

Economic Internationalisation and the Distribution of Income

A Comparison of the Cases of Germany and the U.S.

Dissertation

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List of Abbreviations

ASM	Annual Survey of Manufactures
BDI	Bundesverband der deutschen Industrie e.V.
BEA	Bureau of Economic Analysis
BFA	Bundesanstalt für Arbeit
BLS	Bureau of Labor Statistics
COM	Census of Manufactures
CPI	U.S. Consumer Price Index
CPS	Current Population Survey
DIW	Deutsches Institut für Wirtschaftsforschung
EVS	Einkommens- und Verbrauchsstichprobe
FDI	Foreign Direct Investment
f.o.b	free on border
FSP	Food Stamp Program
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GDR	German Democratic Republic
<i>GL</i> index	Grubel-Lloyd index
GNP	Gross National Product
GSOEP	German Socioeconomic Panel
IAB	Institut für Arbeitsmarkt- und Berufsforschung
IABS	Beschäftigungsstichprobe of the IAB
IISI	International Industrial Statistical Index
IMF	International Monetary Fund
ILO	International Labour Organization
ISI	Industrial Statistical Index
LIS	Luxembourg Income Study
LRD	Longitudinal Research Datafile
M&AS	Mergers and Acquisitions
NAFTA	North American Free Trade Agreement
NBER	National Bureau of Economic Research
NIC	New industrializing countries
NLSY	National Longitudinal Survey of Youth
NTB	Nontariff trade barrier

OECD	Organization for Economic Cooperation and Development
PPI	U.S. aggregate Producer Price Index
PPP	Purchasing power parity
PSID	Michigan Panel Study of Income Dynamics
R&D	Research and Development
SIC	Standard Industrial Classification
SMT	Survey of Manufacturing Technology
TFP	Total Factor Productivity
UN	United Nations
UNIDO	United Nations Industrial Development Organization
USNA	Us National Accounts
WTO	World Trade Organization

Introduction

Economic Internationalisation and the Distribution of Income – Why Compare Germany and the U.S.?

This study is interested in links between economic internationalisation and the distribution of income, comparing the cases of Germany and the U.S. With regard to a thorough comparison of the U.S. and Germany, such analysis requires considering involuntary unemployment with respect to both efficiency effects and distributional effects. Focusing on the functional distribution of income, the comparison of the cases of Germany and the U.S. thus means paying particular attention to differences in labour market characteristics. In at least some of its characteristics the German case represents the European scenario, c.f. Krugman (1995). Therefore, the German case is not only of interest per se but also as an example of what has happened in the main Continental European economies. Starting from the finding of an increasing qualificatory wage gap since the end of the seventies, the debate on the link between economic internationalisation and the distribution of income has tried to analyse, both empirically and theoretically, causes of the rise in wage disparity.

Which economic units should be analysed when formulating distributive hypotheses? In the trade and wages debate the dominant unit is the country. When considering the volume of U.S. trade relative to overall GDP the trade share seems to be rather small. However, this share is expected to essentially affect the U.S. labour income distribution. If the analysis unit of country is given up by disaggregation, complex distributional issues emerge, since the U.S. is heterogenous itself. Locally and regionally different market conditions and institutional settings affect the distribution of labour income. The same applies to Germany. Albeit the German constitution *Grundgesetz* obligates the federal system to create similar living conditions, important regional differences both in level and disparity of incomes can be observed. In this connection, East-West is far from being the only sound and interesting regional category. Again, numerous different market and other conditions affect the level and the disparity of income in the different regions and *Bundesländer*.

So why analyse and compare countries, or more precisely Germany and the U.S.? First, despite national heterogeneity there are characteristics that allow the two types of countries to be distinguished meaningfully in an international sense. Such differences impressively become obvious by calling to mind Esping-Andersen's (1990) classification of welfare states. Preferences as to the scope of the social security system and the role of the government are internationally different. While in Germany a consensus on far-reaching welfare state solutions exists, a comparable system would be refused by the majority of Americans. Among other things, this is due to different concepts of freedom underlying the social consensus on institutional

settings. Furthermore, in general there might exist different preferences as to risk-taking behaviour. What is so interesting in examining the cases of Germany and the U.S. from a comparative point of view are the different perspectives on how to organize society in a world of increasingly open economies. A second and related point is that despite economic and institutional internationalisation national governments are still influential actors.

Finally, as will be shown by reviewing the stylised facts of economic internationalisation in Chapter 1, some important changes have affected highly-developed economies in a similar way. In particular, the role of multinationals has become more and more important. These firms are not only important as foreign direct investors; they also play an important role in innovation. Only if there are supernormal profits, characterising many goods markets both in the U.S. and Germany, will multinational firms invest in R&D. On the other hand, internationalisation strategies depend on technological progress themselves. Standard examples are innovations in transport and communication technologies. Hence technological progress, economic internationalisation and multinational firm growth may not be treated as isolated from one another.

Undoubtedly, this study tries to relate complex issues. Therefore, it is time for an early caveat. In a way, the following analysis will appear disintegrated. However, this necessarily results from the nature of the trade and wages problem itself. Not only very different point of view of how to isolate relevant theoretical hypotheses characterise the debate; large differences in approaches to analyse empirically repercussions between suggested causes of the rising wage gap also contribute to the lack of integration. In addition, up to now a theory that provides a more comprehensive integration of the link between the functional and the personal distribution of income is missing. However, this link gives so much weight to changes in the wage distribution in public debates, since the personal distribution of income is the socio-economic more relevant one. This is as well a shortcoming of this study, whose focus is on the functional distribution of labour income. Yet, to give functional distribution of income issues a broader framework, changes in the personal distribution of income will additionally be taken into consideration.

Apart from the importance of short-term fluctuations in income inequality, significant repercussions between changes in the functional and the personal income distribution can be expected to gain particular socio-economic relevance when income inequality changes significantly in the longer run. In so far, as the process of economic internationalisation is long-term in its nature, the question of appropriate theoretical frameworks has to be addressed. This is the reason why this study will work with real term model approaches: such approaches inherently deal with a long-run perspective.

How this Study Will Proceed

The procedure of this study will be to go step by step from more general thinking about economic internationalisation and income distribution to the details of the

U.S. and the German cases. First of all, this study will identify the relevant phenomena of internationalisation and income distribution on a descriptive level. Considering the distributional issues of the trade and wages puzzle, a group of questions makes relative income categories a subject of discussion: what does an increasing wage gap mean? Does it mean an increase in relative average wages of two or several labour groups that supply different average qualifications? Which inequality and qualification measures are appropriate? Do the methodological decisions inherent in the choice of certain measures allow a correct problem identification? As an implication, the problem of how to find appropriate income and qualification categories raises the problem of rendering these categories operational. Moreover, any review has to address to which concepts income distribution analyses refer. This issue has to be taken particularly seriously, because the purely arbitrary choice of a certain income concept to measure and describe inequality could establish the analysis of irrelevant problems. Therefore, findings by any kind of distributional analysis should be proven as to inequality's sensitivity to the chosen income concept. Only such procedure guarantees the identification of significant problems.

With this in mind, questions as to changes in the distribution of wages and capital incomes, i.e. the functional distribution of income, have to be addressed: which changes in wage structure were found and how important is the qualificatory grouping of wages that made the changes of the functional distribution of labour income such a dramatic topic? Turning our attention to issues of the qualificatory grouping of wages is particularly important because, as will be shown in detail, basic approaches of analysing the wage gap between two qualification groups means forming averages of two subgroups. Hence, not only whether inequality between subgroups changed but also whether inequality within subgroups changed must be analysed.

In a consistent step, relating economic internationalisation and the distribution of income provokes questions of causality: what are the relevant links between the phenomenon of economic internationalisation and the changes in the functional distribution of income? This question is at the core of the trade and wages debate. Relating this central question of causality and all the questions above with respect to income distribution issues on the one hand and issues of economic internationalisation on the other touches upon a large number of economic fields: theory and empirical evidence of the functional and personal income distribution, labour market economics, growth theory, and trade theory, to name some of the main ones. This pluralism of perspectives enhances the impression of a lack of analytical integration. However, the trade and wages debate implies all these questions, not only peripherally but centrally. Because of the topic's outstanding importance both from a socio-economic and a political point of view, such lack of integration has to be borne in order to link at least some of the debate's aspects more comprehensively. This directly leads to this study's aim: even if a deep and comprehensive integration seems to be unrealistic at the moment, a thorough comparison of the trade and wages cases of Germany and the U.S. is able to contribute to a more integrated thinking on economic internationalisation and the distribution of income.

Therefore, the following study is divided in three parts. Part **I** will start from the globalisation debate, in order to distill the important economic aspects of the global-

isation process. These aspects will be subsumed under what will be called economic internationalisation. Not only will the forms of international economic interaction be distinguished, but also the measurement of economic internationalisation will be addressed as a problem. Finally, against the background of changing trade policy paradigms the relevant problems of a debate on economic internationalisation will be outlined. Correspondingly, the subsequent chapter will focus on the field of income distribution. Again, the analysis will start with conceptual issues. Becoming aware of the problems inherent in different income concepts will lead to considerations on income measurement in the context of different categories of qualification as a basis of the disaggregation of labour. Moreover, reassessing different concepts of income and approaches to measure income inequality also requires linking income inequality to the broader concept of economic inequality. Before some concluding remarks will summarise the problems of income distribution analysis as one of the main issues of an integrated trade and wages debate, a data overview will emphasise the advantages and disadvantages of the different data sets used to analyse the case of Germany and the U.S. This is a necessary input to become critically able to understand how income distribution analyses dealing with Germany and the U.S. contributed to the trade and wages debate.

The last chapter of Part **I** aims at setting a benchmark for the theoretical analysis of the interaction of economic internationalisation and wages. Such a benchmark will be given by the neoclassical approach of modelling perfect competitive goods and factor markets. As will be shown, the perfect competition model served as a framework to model repercussions of trade on wages in the U.S. to give the so-called flip-side hypothesis a theoretical basis, that is, increasing wage inequality and increasing involuntary unemployment as the two expected sides of the same coin. This flip-side hypothesis will be introduced in detail against the background of the stylised facts of involuntary unemployment both in Germany and in the U.S. In a word, Part **I** searches for the relevant stylised facts characterising economic internationalisation, appropriate tools for income inequality analysis, and an appropriate theoretical framework to start with when the U.S. case is considered. This thus gives a basis for international comparison as the centre of this study.

Part **II** will concentrate on the U.S. case. First, the changes in inequality both of the functional and the personal distributions of income will be reviewed. To begin with the description of income inequality follows the history of the trade and wages debate. It is one of the particular features of this debate that the initial finding of a substantial change in the distribution of wages later began to motivate theoretical hypothesizing and econometric analysis. Following the original sequence of the trade and wages debate at this point in the study, attention will turn to the classical theorems of trade theory to search for repercussions between factor prices and goods prices and for the 'winner' and 'losers' of economic internationalisation in the form of goods trade. In the face of these theoretical considerations extended by the revision of a reinterpreted Heckscher-Ohlin model, Part **II** will then reassess the empirical evidence on economic internationalisation and wages in the U.S., including outsourcing and multinational activities. Introducing additional restrictions in the form of intersectoral immobility of factors, for example, will give insights into shorter term issues and distributional effects. Moreover, by showing

how Findlay and Kierzkowski (1983) integrated endogenous human capital supply into a Heckscher-Ohlin framework, a basis will be created to draw a line from this way of modified perfect competition approaches to models that integrate rationed unskilled labour to analyse the German case.

Part III will deal with the German case. This part will also start with descriptive income inequality analysis. In order to gain deeper insights into what happened to the income distribution, changes in inequality of the personal distribution of income will be discussed. Now, as the German case is characterised by involuntary unemployment, the benchmark has to be changed not in the sense of introducing further restrictions but by introducing rigidities in the form of factor price rigidities. Such modification of the benchmark allows the cases of Germany and the U.S. to be compared from a theoretical point of view. Moreover, again the role of human capital will be treated in detail by resuming Findlay and Kierzkowski (1983) not only in a general equilibrium framework but in a framework giving up the assumption of perfect competitive labour markets. Part III will conclude with a review of empirical evidence on repercussions of wages and economic internationalisation for the case of Germany.

I

Stylised Facts and Analytical Perspectives

1

Economic Internationalisation

1.1 Globalisation

International economic interaction as a constituent part of social relations has become an important issue in what has been called the globalisation debate. Contrary to Giddens' (1994) farsighted definition of globalisation as an intensification of global social relations, public debates often limit the prospect of globalisation: attention is paid to economic competition that arises from the dynamic development of economies like those of East Asia, even if they have recently suffered from a growth and structure crisis. Further attention is paid to the internationalisation of capital markets and production shifts abroad, where the latter are often put on the agenda by threatening decision-makers who emphasise absolute cost advantages. Globalisation is reduced to economic phenomena and the terms globalisation and economic internationalisation are used synonymously. Here these terms shall be precisely distinguished, because in what follows, the process of economic internationalisation as a part of what Giddens (1994) calls globalisation will be the sole centre of interest.

Quite often public judgement on economic internationalisation is wrapped in metaphors of threat, emphasizing that economic internationalisation minimizes the scope of national politics.¹ The only task left to national politics is strengthening competitiveness, which seems to be unavoidably connected to social hardship, well said by former BDI president Hans-Olaf Henkel (1996, p. 5):

Was ist zu tun . . . , um die Wettbewerbsfähigkeit Europas langfristig zu sichern? . . . Die Frage ist, ob wir jetzt den Versuch wagen, in der Bevölkerung unserer Länder auch für unpopuläre Maßnahmen zu werben. Oder ob wir später einen viel höheren Preis zahlen wollen. Die Idee von einem sozialen Sonderweg Europas ist besonders gefährlich für alle Bemühungen um eine Stärkung unserer Wettbewerbsfähigkeit.

But what does *Wettbewerbsfähigkeit* mean and how does one retain it, if it ever existed in any meaningful sense? Does it mean that wages have to be rendered more flexible by cutting minimum wages or employment protection rights? Does it

¹As to the debate of national political scope in the age of political and economic internationalisation, cf. Beck (1996), Kapstein (1996) and Scharpf (1992).

mean that compensating welfare state transfer systems have to be redimensioned because the government's budget constraint becomes more binding in a world of economic internationalisation? Particularly that society must accept distribution effects due to the process of economic internationalisation has become an influential political opinion. Moreover Henkel (1996) speaks of Europe's *Wettbewerbsfähigkeit* surely meaning the member countries of the European Union. Is such a heterogeneous region like the European Union really the competing aggregate unit? Such debates often lack a sophisticated positive analysis of distribution effects and their normative implications not only for economic and fiscal policy but also for social policy.

Against this background, in Germany the two catchwords *Standort* and *Standortwettbewerb* gained prominence. In a striking way, voices of different political attitude have called for reforms to 'save' the *Standort*. Related arguments have regularly suggested the idea that nations can be seen as competing economic units. Thus, German economists particularly have felt bound to attempt to put forward a theory of *Standortwettbewerb*. Siebert (1996) defines *Standortwettbewerb* as immobile factors in different places, that is labour, entering into competition with each other for the mobile factor, that is capital. In this connection, Findlay (1994) points to the specific meaning of the term *Standort* in the context of economic thinking in the German-speaking world going back to Alfred Weber. With regard to understanding the interaction between economic internationalisation and the scope of national politics, Siebert (1997, p. 13) concludes:

Staaten oder Regierungen stehen also im Standortwettbewerb. Das ist der Wettbewerb der international immobilen Faktoren um die international mobilen Faktoren, um das mobile Kapital und um das mobile technische Wissen. ... Die Exit Option des Faktors Kapital definiert die Opportunitätskosten wirtschaftspolitischer Maßnahmen neu: der Bewegungsspielraum der nationalen Politik wird eingeschränkt.

In a world of economic internationalisation, Siebert (1997) expects increased competition between governments for scarce factors. Against this argument Krugman (1993) and others raised the objection that countries are identified with firms, implying the gains of one country to be an other's loss. However, in the first place a clear-cut definition of gains and losses is missing. In the second place, except for having revealed income losses at the expense of immobile factors and diminishing scope of active policies, no thorough distinction is made between welfare effects and distributional effects between and within economies. This missing distinction is implied by the identification of countries with firms. Naturally, the concept of locational competition is not necessarily misleading. As the Section on international investment decisions by firms will show, regions compete for industrial settlement. It is the specific perspective of the theory of *Standortwettbewerb* on economic internationalisation as outlined above that misguides. Naturally, this is a perspective on international economic competition that is not restricted to the German debate. In this connection Krugman (1993) mockingly speaks of *pop internationalism*.

In search of causality Freeman (1995, p. 15) asks: *Are your wages set in Beijing?* This provocative question is justified by the hypothesis that one production place's absolute cost advantages determine factor prices in other production places.

Obviously, this line of reasoning is also inherent in the above theory of *Standortwettbewerb* which argues that jobs at one *Standort*, like the German one, could only be 'saved' if absolute labour costs were diminished. An important objective of this study dealing with real economic processes lies in a critical investigation of this group of hypotheses from a trade theoretical point of view. Already superficial revision of general equilibrium models of international trade shows the problematic content of this kind of hypothesis: there, relative prices result from simultaneous interaction of exogenous and endogenous variables and are not the outcome of uni-directional causalities.

The boom of globalisation as an inflationary term suggests that the term has clearly been able to cover an unfamiliar economic phenomenon being understood as something completely original. Economic processes classified as globalisation have to be grasped both descriptively and theoretically. For this, trade theoretical approaches are available as an appropriate theoretical framework. A classification of economic phenomena taken as the main features of the process of economic internationalisation subsumed under what has been introduced as the globalisation debate is thus required. When national markets become international

1. international trade in intermediates, final goods and services in the form of
 - (a) inter-industry trade in the form of
 - i. trade among firms and
 - ii. intra-firm trade,
 - (b) intra-industry trade in the form of
 - i. trade among firms and
 - ii. intra-firm trade, and
2. international factor mobility in the form of
 - (a) labour mobility and
 - (b) capital mobility

characterise progressive opening of national markets. However, these characteristics are only an approach used to distinguish national economic interaction from economic interaction in an international sense. Their analysis must be embedded in a framework of hypotheses aiming at the identification of the kind of repercussions between international economic interaction and the distribution of income. The analysis has thus to address how factor prices and quantities are determined in the search for answers to Freeman's (1995) provocative questions: are markets becoming more and more international? Why have national markets become more and more international? Have there been changes in the roles of national institutions like governments or interest groups, e.g. trade unions? Are there changes in effects induced by institutional settings like minimum wage legislation? Or more precisely matching the German case: did the process of economic internationalisation change the action scope of the *Tarifpartner*?

Another important change in institutional settings is the emergence of free trade areas. This seems to have been one important characteristic of economic internationalisation's recent dynamic. Examples are the *European Single Market* and

the *North American Free Trade Agreement* (NAFTA). As will be shown, a main dispute before NAFTA was ratified was whether NAFTA would hurt low-skilled and unskilled American workers. Therefore concepts appropriate for theoretical and empirical analysis of the process of economic internationalisation and its effects on labour markets are necessary. In the following, basic theoretical and empirical concepts that allow structuring of main characteristics of the process of economic internationalisation and of the analysis of its effects will be reviewed. Finally, the question whether economic phenomena subsumed under globalisation actually describe original economic processes from an economic history point of view must be raised. Consequently, starting from Williamson (1996) an economic history perspective on the recent process of economic internationalisation also seems to be indispensable.

1.2 Basic Theoretical and Empirical Concepts

1.2.1 International Trade

Within national frontiers goods, intermediates and services are traded without restrictions in the form of tariff and nontariff trade barriers (NTBs). In this sense one can speak of national markets. International trade in the form of both inter-industry exports and imports is analysed by classical trade theory. In general equilibrium models with perfect competitive goods and factors markets, the binding constraints are relaxed when an economy moves from autarky to free trade: whereas in autarky consumption has to equal production, in free trade the value of goods production has to equal the value of consumption. Thus international trade results in additional degrees of freedom. In the case of a small economy, i.e. where the terms-of-trade are treated parametrically by the economy, international trade always leads to a welfare improvement when moving from autarky to free trade.

In trying to catch what characterises economic internationalisation with regard to the trade in goods and services, the shift from autarky to an equilibrium with some or all goods traded internationally is an irrelevant case, at least for developed countries. The relevant case is the shift from one trade equilibrium to another trade equilibrium characterised by a larger number of internationally traded goods. In the distortion free model world outlined above with a small open economy treating world prices parametrically, the shift from one trade equilibrium to another always leads to a welfare improvement. With the increased number of internationally traded goods further degrees of freedom emerge: the new trade equilibrium only requires the value of production to equal the value of consumption for both the goods already traded and the goods additionally traded. In this sense economic internationalisation means a shift from one trade equilibrium to another. Only in the case of a large country can the shift from one trade equilibrium to another characterised by a larger number of tradable goods accompany a terms-of-trade effect overcompensating the positive welfare effect.

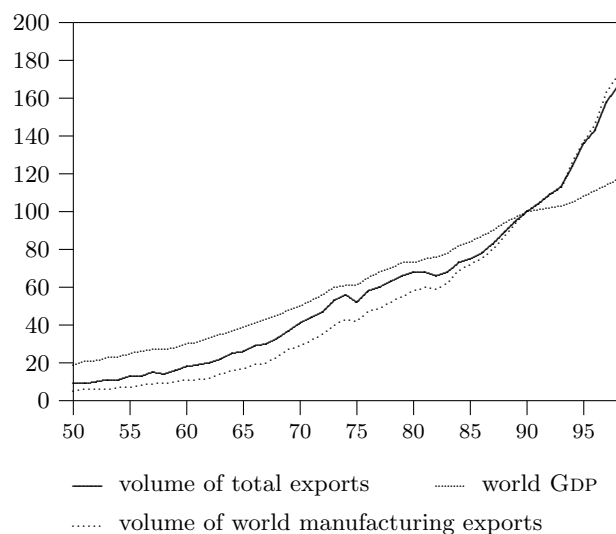
Figure 1.1 gives an impression of the dynamic of changes in international trade by comparing export changes and changes in Gross Domestic Product GDP. Looking

at the second half of the twentieth century world GDP and both total world exports and exported manufactures evaluated f.o.b unambiguously followed a similar trend until the beginning of the eighties. Thenceforth the trends diverged and exports

Figure 1.1

**World Exports, World Manufacturing Exports
and World GDP, 1950 to 1999**

Index, 1990=100



Source: WTO, 2000, p. 27.

began to grow far more than world GDP. In addition, Lewis (1981) emphasises that world trade had already expanded to a great extent in the period between end of World War II and the beginning of the seventies.

Empirical evidence leads to another stylised fact: above all, similar products of the same production stage are traded among highly developed economies. Motor vehicles are an illustrative example. This kind of trade is called intra-industry trade. The Grubel-Lloyd index (*GL* index) serves as an indicator for intra-industry trade's share of total trade. Table 1.1 gives index values for selected countries belonging to the Organization for Economic Cooperation and Development (OECD) in three different years. The high values of the index in 1990 are especially interesting. Meanwhile intra-industry trade has become the bulk of trade between highly developed economies. Obviously, the *GL* index is also an indicator for economic internationalisation because the index gives information about the structural change of world trade. The index, as calculated in Table 1.1, has been criticized because it gives information on the structure of trade in each period of time but, according to Brühlhart (1999), it does not allow conclusions as to the structure of the change in trade flows. This proves to be an important point because economic international-

isation is a dynamic process, going hand in hand with industrial adjustment. The concept of an index measuring intertemporally marginal intra-industry trade was therefore developed.² For the case of the main European economies, the *A* indices by Brühlhart and Elliott (1999) shown in Table 1.1 confirm the prediction of the values of the *GL* index: in general, the *A* values are higher in the third sub-period than in the first sub-period.

Theoretically, the new trade theory deals with intra-industry trade as a main issue. The new trade theory focuses on market forms characterised by imperfect competition: whereas the prevailing assumption in classical trade theory is perfect competition both on goods and factor markets, the new trade theory concentrates on the problem of imperfect goods markets. However, both strands of research more

Table 1.1

Intra-Industry Trade Indices for Selected OECD Countries

	<i>GL</i> Indices			<i>A</i> Indices		
	1970	1980	1990	1979-83	1983-1987	1987-1992
Australia	20.7	21.6	30.5			
Canada	52.1	59.8	60.2			
United States	44.4	46.5	71.8			
Japan	21.4	17.1	32.4			
France	67.3	70.1	77.2	0.28	0.39	0.43
Germany	55.8	56.6	72.2	0.41	0.44	0.36
United Kingdom	53.2	74.4	84.6	0.20	0.43	0.24
EU				0.29	0.37	0.33

Source: OECD, 1996, p. 30, and Brühlhart and Elliott, 1999, p. 111.

or less ignore the problem of labour markets not being cleared by the price mechanism. But strands of research restricting themselves by the assumption of perfect competitive labour markets ignore both welfare losses and distribution effects owing to involuntary unemployment.

Obviously, recent decades have shown increases both in intra-industry and inter-industry trade. There can be no doubt that there has been a new trend during the eighties and nineties. However, looking back in history again shows that this change is in no sense original even if that period was characterised by change differing significantly from the previous decades. Historically, periods showing fast growth of trade are no singular phenomenon. According to Lewis (1981), trade

²The standard *GL* index is $GL = 1 - \frac{|M-X|}{|M+X|}$, where *X* stands for exports and *M* for imports of an industry. The index measuring marginal intra-industry trade between period *t* and *t* - *n* as used by Brühlhart and Elliott (1999) is

$$A = 1 - \frac{|(X_t - X_{t-n}) - (M_t - M_{t-n})|}{|(X_t - X_{t-n}) + (M_t - M_{t-n})|}$$

If the change in trade pattern were purely intra-industry *A* would become unity. By the use of weights both indices can be aggregated over all industries.

grew to a great extent between the mid-nineteenth century and the beginning of the First World War, at least temporarily. That is the reason why the question of what characterises recent growth in international trade in particular should be addressed. Undoubtedly such a special characteristic can be found in the part played by multinationals. As Table 1.2 shows, Mergers and Acquisitions (M&As) increased

Table 1.2

**Worldwide Foreign Direct Investment and
International Production, 1982-1999**

	value at current prices (billion dollars)		annual growth rate (per cent)		
	82	99	86-90	91-95	96-99
FDI inflows	58	865	24.0	20.0	31.9
FDI outflows	37	800	27.6	15.7	27.0
FDI inward stock	594	4772	18.2	9.4	16.2
FDI outward stock	567	4759	20.5	10.7	14.5
Cross-border M&As ^a		720	26.4 ^b	23.3	46.9
Sales of foreign affiliates	2462	13564 ^c	15.8	10.4	11.5
Gross product of foreign affiliates	565	3045 ^d	16.4	7.1	15.3
Total assets of foreign affiliates	1886	17680 ^e	18.0	13.7	16.5
Exports of foreign affiliates	637	3167 ^f	13.2	13.9	12.7
Employment of foreign affiliates (thousands)	17 433	40536 ^g	5.6	5.0	8.3

Source: UNCTAD, 2000, Table I.1, p. 2.

^aData are only available from 1987 onwards.

^b1987-1990 only.

^cBased on the regression of sales against FDI inward stock for 1982 to 1997.

^dBased on the regression of gross product against FDI inward stock for 1982 to 1997.

^eBased on the regression of assets against FDI inward stock for 1982 to 1997.

^fBased on the regression of exports against FDI inward stock for 1982 to 1997.

^gBased on the regression of employment against FDI inward stock for 1982 to 1997.

significantly between 1987 and 1999. The increases in M&As, foreign affiliate employment, gross product and export activities clearly indicate that there must have been a dramatic change in multinational activities. This does not only hold for changes in flows but also for changes in stocks, as indicated by the total assets stock growth of foreign affiliates. Additionally, UNCTAD (2000) provides further evidence for changes in multinational activities with its transnationality index, calculated as the average of three ratios: foreign assets to total assets, foreign sales to

total sales and foreign employment to total employment. Looking at the values of the transnationality index of the largest multinationals during the nineties clearly shows that these firms were already pursuing transnational strategies, which was deepening internationalisation by and large.

Both intra-industry and inter-industry trade cannot only be found among firms which are independent in a property right sense but also within multinational firms, i.e. international intra-firm trade. Internal multinational firm growth from capacity extension, as well as external growth, may imply an increase in international intra-firm trade. However, only few data are available for deeper insights into the development of multinational firms' share of total foreign trade in the form of international intra-firm trade. Data can only be collected by means of firm surveys. Hence, firstly there arises the problem of concept. As will also become obvious in the discussion below of how to distinguish outsourcing concepts, it is hardly possible to decide whether firms are related to each other in the sense of one firm controlling the other by simple criteria like the equity share. Bonturi and Fukasaku (1993) therefore conclude that decisions can be at best made case by case. In addition, because of strategies like tax arbitrage, firms have an incentive to hide the true data. Finally, a problem arises out of transfer pricing within multinationals for reasons such as tax arbitrage, so that the share of intra-firm trade measured by value might be seriously overestimated or underestimated. The data sources thus must inevitably remain incomplete.

At irregular intervals, the U.S. Department of Commerce publishes benchmark surveys on trade between U.S. parents and foreign affiliates, as well as on trade between U.S. affiliates of foreign companies. Bonturi and Fukasaku (1993), who are also the authors of OECD (1993), review these data sets for the eighties and find that for the U.S. about one third of total merchandise imports and about 40 per cent of total merchandise exports are in the form of intra-firm trade. They also review the Japanese case on the basis of data from Japan's Ministry of International Trade and Industry, however, they question data comparability and therefore the value of making more general conclusions.

From a theoretical point of view the analysis of international trade within multinationals raises two further questions: first, the question concerning the market form. Is the emergence of multinationals accompanied by changes in the market form? Second: in which sense do markets for goods and factors exist within multinational firms?

1.2.2 Factor Mobility

From the second half of the nineteenth century until the beginning of the First World War not only international trade increased to a considerable extent. In historical comparison high labour mobility characterised the period as well.³ Dramatic examples are emigration from Ireland and Germany to the U.S. as well as from Eastern Europe to the U.S. International migration, whose economic effects have been the

³By which naturally nothing is said about the social character of the migration decision as an individual economic optimization decision.

topic of a broad political and scientific debate, cf. for a survey Borjas (1994), has also characterised the last decades. For example, in the sixties there was a migration particularly from Turkey and Italy of low-skilled and unskilled workers, known as *Gastarbeiter*, to the former West Germany because labour demand was rationed by domestic labour supply. The discussion on labour market effects due to immigration to the U.S., the majority of immigrants being low-skilled or unskilled workers, serves as an example for the recent past.⁴ If labour and capital are distinguished by their specific characteristics, in case of labour the factor cannot be separated from the person supplying labour. By contrast, in the case of physical and financial capital, owner and factor are not an inseparable unit. This central difference leads back to the locational competition debate introduced in Section 1.1. At the heart of this debate is the suggested exit option of capital in a world of increasing openness

Table 1.3

World Stock of Foreign Direct Investment

	in billion US \$		
	1967	1980	1991
Africa	12.8	29.6	49.9
East Asian Countries	5.1	3.5	256.7
Japan	0.6	3.3	12.3
Australia	4.9	28.1	83.7
European Community	24.8	186.9	714.2
other European Countries	6.6	24.7	93.2
Latin America	18.5	62.3	132.1
Middle East	3.2	4.3	12.3
United States	9.9	83	414.4
Canada	19.2	51.6	113.9

Source: OECD, 1996, p. 33.

and mobility due to changes in markets and institutional settings. The exit option of capital means nothing but sinking costs of foreign direct investment and foreign production as an alternative to domestic investment and production. Labour is seen as less mobile, especially under German labour market conditions and in the German welfare state context.

Obviously, the second form of factor mobility is capital mobility. Different forms of capital mobility can be distinguished: first portfolio investment, i.e. investment in international capital assets, and secondly foreign direct investment. While Table 1.2 shows data for FDI from the eighties to the nineties, data from OECD (1996) go back to the sixties. Even though focusing on only three selected years, Table 1.3

⁴See for example Borjas, Freeman and Katz (1996) and Greenwood, Hunt and Kohli (1997). Immigration means an increase in domestic labour supply. Recently, there have been empirical studies like Bauer (1997), who investigates the effects of immigration on domestic labour incomes in Germany.

outlines tendencies in growth of the worldwide stock of foreign direct investment since the sixties. Above all, the eighties brought a considerable increase in foreign direct investment. Again, drawing a historical comparison shows that in the period before the First World War capital mobility in the form of foreign direct investment also increased. If one looks at multinationals because analysis of their activities is strongly related to the topic of foreign direct investment as will be shown in more detail, certainly for the 19th century and the early 20th century there is no data available comparable to the data on multinational activities in the last decades. But studies that use a broader concept on the basis of case studies like Hagen (1997)⁵, Schröter (1993) or Wilkins (1988), offer clear evidence in favour of increased importance of international firm activities going far beyond trade in goods and intermediates.

Considering multinationals and foreign direct investment leads to the concept of outsourcing. Since the economic literature uses the term international outsourcing in different ways, it is necessary to clarify the concept here. Here, one form of international outsourcing is defined as purchase of goods and services from foreign firms instead of using one's own domestic production. Another kind of outsourcing is purchasing from foreign firms that are part of the domestic firm in a property rights sense. This second form of outsourcing implies foreign direct investment. Three kinds of ownership production are possible: the building up of new plants; the purchase of already-operating foreign plants; a ownership in the form of international equity participation that allows the domestic firm to control the foreign firm's operative business. Apart from importing for own domestic processing, foreign production of intermediate and final goods can also follow alternative targets: import and domestic sale on intermediate and final goods markets respectively; foreign sale; and, export to third countries.

Foreign direct investment can be both complementary and substitutive to domestic investment. Therefore, foreign direct investment can imply an international shift of domestic production stages, a feature reminiscent of the populist absolute costs advantage argument in favour of production shifts. In the case of vertical international diversification, this means an international shift of production stages either forward or backward from production at home. In the case of horizontal diversification, to shift production abroad means that some parts of production of the same production stage remain at home. In consequence, if outsourcing accompanies production that remains within the firm, the strategy of internalization implies foreign direct investment. Therefore, international outsourcing and foreign direct investment are closely linked to the concept of the multinational firm: multinational firms pursue outsourcing and national firms turn into multinational firms by foreign direct investment. Outsourcing becomes synonymous with the multinational firm, if the economic activity abroad is related to the domestic firm by the plants abroad being operated either as subsidiaries or through arm's length relationships. In addition, alternative strategies to the strategy of internalization exist. Examples include the

⁵In her comprehensive study of German foreign direct investment in the United Kingdom, Hagen (1997), however, shows that investment in selling companies dominated, even if direct foreign investment in production facilities was increasing in the period of interest. In the UK, the total German foreign direct investment was expropriated during the First World War.

international licensing of production and the international cooperation of firms. In the case of only minor capital links between firms cooperating internationally, one can also speak of alliances. As a matter of principle, a firm must always decide whether production should remain inside the firm or licensing other firms is more efficient if the internationalisation of production is taken into account.

1.2.3 Technological Progress and Multinational Firms

The analysis of the circumstances of the emergence and expansion of multinational firms provides evidence as to factors being both condition and consequence of economic internationalisation. The emergence and growth of multinational firms is determined by several economic and technological factors:

1. Market interaction: multinational firms often act on markets characterised by imperfect competition. An important approach in explaining the emergence of multinational firms is increasing returns to scale in models that assume monopolistic competition.
2. Reduction of transaction costs by solving problems within the firm. This topic refers to the fundamental economic decision problem of market versus hierarchy.
3. Technological progress, which
 - (a) enables the progressive slicing up of the value chain. Both slicing up the value chain and the reduction of tariff and nontariff trade barriers are sufficient conditions for the emergence of supertrading economies trading multiple of their national product. From Krugman's (1995) point of view the emergence of such supertrading economies turns out to be an important characteristic of recent economic internationalisation.
 - (b) reduces communication costs and transport charges.
 - (c) supplies technological knowledge that can be used as a common input in different international product places. At the same time, multinational firms transfer technology internationally, resulting in technological spillover effects in the sense of positive externalities.

Technological spillover effects from the activities of multinational firms are part of a far-reaching development: Nelson and Wright (1992) show that technologies gain more and more international character, whereas historically technology and the nation state were closely linked.

In the sense of changing input coefficients either neutrally or factor-biased, technological progress is a dynamic phenomenon inducing the slicing up of the value chain. In the context of the search for causes and conditions of economic internationalisation, the reduction of transport charges and communication costs due to technological innovations has been widely used to explain the acceleration of the slicing up of the value chain. A prominent example is Harris (1993). In this connection the dramatic changes in computer technology seem to be a significant factor. Many studies, such as DiNardo and Pischke (1996) or Krueger (1993) for example, deal with the direct and indirect effects of technological progress on the demand for

human capital and on relative wages earned by low-skilled and high-skilled workers. In this connection, the indirect effects on labour demand and relative factor prices can be distinguished from the direct effects. Multinational firms provide an example of what drives thinking about the interaction of direct and indirect effects caused by technological progress: whereas technological progress determines the emergence and growth of multinational firms, multinational emergence and growth leads to indirect effects on labour demand and the relative factor prices of different labour skills. Multinational firms and technological progress are inseparably linked by both direct and indirect repercussions between technological progress on the one hand, and prices and quantities on the other.

But is there empirical evidence to show to what extent decreasing transportation costs have contributed to the increasing international trade in goods and intermediates as a constituent part of the process of economic internationalisation as defined in Section 1.1? Recently Baier and Bergstrand (2001) provide new answers to the puzzle, albeit restricted to international trade in final goods. Building on the gravity approach they allow for transportation costs, tariff barriers and market power due to firm size, in contrast to this approach's basic variants. Their result is clear cut: the dominant reason for the increase in international trade seems to have been real GDP growth. Baier and Bergstrand (2001, p. 23), examining the causes of the growth in final goods trade among a group of sixteen OECD countries from 1958-60 and 1986-1988, find that *approximately 67-69% of this growth could be explained by real GDP growth, 23-26% by tariff-rate reductions and preferential trade agreements, 8-9% by transport-cost declines, and virtually none by real GDP convergence.* That is, less than one tenth of total growth is explained by decreasing transportation costs. In the following Section the analysis will turn more comprehensively to the political economy background of trade liberalisation, resulting in the removal of tariff and nontariff trade barriers. Naturally, an implied issue will be the problem of measuring the degree of trade liberalisation by means of intertemporal tariff and nontariff trade barriers analysis.

The importance of technological progress as a driving force of the change in relative factor prices since the mid-seventies has also been attributed to its dynamics, compared to earlier historical periods. The vast majority of contributions to the so-called wage gap debate, which will be subject of Part II, identified technological progress as the main reason for the increasing inequality of wages in the U.S. since the second half of the seventies. However, periods of dynamic technological innovation can be observed time and again. Goldin and Katz (1996), for example, point to dynamic technological progress in the period between around 1910 and the end of the thirties, which was characterised by the far-reaching electrification of both industry and private households, cf. Nelson and Wright (1992).

Empirically, Goldin and Katz (1996) find complementarity between human capital and physical capital increasing the most in the century's second decade and in the period between 1979 and 1989. Complementarity of these production factors is interpreted as evidence of intensifying technological progress, so that evidence is provided for exceptional dynamic technological progress during the eighties, when this decade is compared to those before. Wright (1997) questions whether a com-

parison backed up by research based on the present state of knowledge is already possible. The often applied total factor productivity (TFP)⁶, for example, has been criticized as being an inadequate measure for technological change, because technological progress can lead to changes of input-output relations that do not allow the driving technological changes to be revealed.

1.2.4 Economic Policy Paradigms

Changes in economic policy paradigms also might have contributed to the dynamics of economic internationalisation. Particularly in developing economies with obvious comparative cost advantages in products intensive in low-skilled and unskilled labour, changes in economic policy paradigms can be observed. While during the fifties and the sixties import substitution strategies were dominant, these were later replaced by free trade and export competition as the leading model. For example, Prebisch (1959) and Singer (1950) developed arguments in favour of former protectionist trade policies. In this context, one of the most prominent arguments was the so-called infant industry argument: industries just in emergence should be protected against foreign competition until having reached competitiveness.

Naturally, from an economic point of view changes in economic policy paradigms are not only exogenous in their nature. Rodrik (1992) tried to explain the observable opening up of developing economies by the severe macroeconomic and structural crisis in the late seventies and early eighties. Distributive costs were only slightly weighted because of the crisis' severity as to solvency, budget and unemployment, to mention at least some of the important problems. Thereby a policy of economic opening was enabled. Conflict-generating distributive effects that had previously hindered free trade policy, now hindered any turning back of economic and trade policy. This development raises the important question of which kind of interrelationship characterises the market process on the one hand, and economic policy on the other: in what way does the market process effect changes in economic policy and vice versa? Undoubtedly there were significant changes in the institutional and the economic policy framework of factor price determination.

Such considerations require empirical evidence as a basis, in particular with respect to changes in economic openness. There are many approaches both to measure openness and to relate economic and trade policy parameters to the degree of openness. The attempt to find unambiguous empirical evidence for economic as well as trade policy that aims at increasing international competitiveness pursued by decision-makers in both developing countries and the newly industrialized countries (NIC), however, leaves many unanswered questions. Pritchett (1996) summarizes the results of different measurement concepts of economic openness and examines whether they reveal logical consistence. The first two measures in Table 1.4 try to quantify changes in economic policy paradigms. By contrast, measures [5] and [6] are the attempt to transform the description of economic internationalisation in Subsection 1.2.1 into theoretically well-founded measurement concepts.

⁶The negative sum of changes of input coefficients weighted by factors shares serves as a measure for the change of TFP. This measure is based on the total differential of zero profit conditions.

Measurement concept [1] infers economic policy aiming at internationalisation in the sense of import competition from a relatively low number of nontariff trade barriers. Measurement concept [2] completes [1] by additionally including the level of average tariffs. Values of these two measures are consistently correlated. Yet, according to Pritchett (1996), for values of the other measures there is no logical consistent correlation. Trying to find measurement concepts that describe changes in trade policy strategies both quantitatively and qualitatively obviously raises severe problems: first, measures are often based on intuitive *ad hoc* reasoning. These measures lack theoretical foundation. Exceptions are measures [5] and [6] in Table 1.4 or the trade restrictiveness index by Neary and Anderson (1994). The latter

Table 1.4

Measures of Openness

Measure	Concept
[1] NTB frequency	Fraction of imports subject to NTBs
[2] Average tariffs	Data on tariff levels and on the frequency of NTBs; computation of average total import charges
[3] Structure adjusted trade intensity	Trade flows adjusted by structural characteristics like level of per capita GDP, transport costs or factor endowment characteristics; measure is the residual from a trade intensity regression indicating the amount of intensity difference to a country with similar characteristics
[4] Price distortion	Construction of a PPP exchange rate by price comparison data to make GDP internationally comparable; PPP exchange rate is divided by official exchange rates to create a comparable index of price levels; assuming that higher tariffs result in higher prices this index adjusted for the level of GDP can be interpreted as an outward-orientation index
[5] Leamer's openness index	Reference is a modified Heckscher-Ohlin-Vanek ^a model of trade flows; measure is the sum of deviations of the predicted from the actual level of net exports across all commodities
[6] Leamer's trade distortion indices	Construction of three different intervention indices by the residuals of an estimated Heckscher-Ohlin-Vanek model; the indices differ by weights chosen for residuals

Source: Pritchett, 1996, pp. 312.

^aThe Heckscher-Ohlin-Vanek Model analyses the factor content of trade. If the supply of a factor exceeds its domestic consumption, the home country is called rich in this factor. As a consequence the home country exports this factor indirectly.

builds on the welfare economic analysis of tariff and nontariff trade barriers. Second: measurement results expected to record the degree of trade policy liberalization in the sense of a reduction in tariff and nontariff trade barriers are either inconsistently or not at all correlated with the results of those measures that are supposed to describe to which extent international trade has grown.

In principle, this must not weaken the finding that economic policy and trade policy of most developing countries and NICs are now obliged to changed principles.

Though what has to be taken into consideration is these principles' sometimes neglected different nature, when analysed in detail. This means that from policies being sceptical of free trade one cannot easily conclude to a protectionist economic and trade policy. A prominent example is the case of South Korea in the eighties: neither size nor structure of economic internationalisation have been solely driven by a rush development towards an undistorted international market exchange of intermediates, final goods and services. Dornbusch (1992, p. 72) rightly concludes: *But even with great heroism, it is at best possible to create subjective, qualitative indices for individual countries.*

Another indicator, in a sense also qualitative, for economic internationalisation or, at least, deeper international economic cooperation and coordination, is institutional developments. Exemplary institutional results of such international opening of national economies are the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO). Nevertheless, Finger (1991) emphasises that while industrialized countries were making huge progress towards trade liberalization under GATT, developing countries were for a long time allowed to maintain protection of their domestic markets. At the same time, efforts of regional economic integration processes could be observed: free trade areas like NAFTA or the single European market have come into being. On the one hand, one can identify the economic policy and trade policy objective of free world trade in goods and services and unconstrained factor mobility. On the other, this liberalization takes place with a strong regional orientation, where tariff and nontariff trade barriers restrict consumers and firms in countries without membership in the free trade area. An impressive example of this is the protection of the agrarian markets of the European Union. The European Union is also an example of the ambivalence of the reduction of barriers to factor mobility: while the objective of reducing barriers to mobility is pursued inside the European Union, institutional arrangements with regard to the frontiers of the European Union are largely supposed to prevent illegal migration from third countries, cf. settlements of the *Schengen* treaty.

1.3 Problems

The attempt to identify determinants of economic internationalisation showed that building hypotheses has to take into consideration a large number of interrelations and repercussions. The following findings can be taken as a basis for further analysis:

1. Relative to GDP during the past decades international trade and foreign direct investment grew by a positive trend. When drawing a historical comparison, growth can be supposed to have been above average.
2. In this period, the importance of multinational activities compared with their share of total world trade seems to have been considerable. With regard to within-multinational trade as a share of total international trade, the number of one third has gained prominence. However, the lack of data does not really allow such a conclusion and the search for the actual extent of multinational activities and their importance needs further data collection and

analysis. Nevertheless, intuition, anecdotal evidence and case studies suggest that multinationals play an important role both in the structure and in the volume of international trade. In addition, long run historical comparison offered sophisticated arguments in favour of this role. As outlined above the case is different for empirical evidence on FDI where data are available. In summary, the growing importance of multinationals as to international division of labour, international fragmentation of production and different forms of international trade can be stated as a stylised fact for further theoretical reasoning.

3. Technological progress is of growing importance:
 - (a) The character of technology is becoming more and more international.
 - (b) Economic internationalisation is characterised by the growing international division of labour, i.e. the slicing up of the value chain.
 - (c) On the one hand, multinational activities are accelerating international technology transfer. On the other, slicing up of the value chain gives rise to the emergence and growth of multinationals.
4. International reduction of tariff and nontariff trade barriers accompanies the emergence of regional free trade areas partly establishing new tariff and nontariff trade barriers to trade in goods and services with third countries as well as interregional mobility barriers.

Which distributive effects in highly developed economies are related to economic internationalisation as characterised above? Even if the shift from one trade equilibrium to another yields a welfare gain unanswered questions with regard to the distribution of income remain. Of course, in an undistorted economy problems of allocation and distribution can be separated analytically, expressed by the two theorems of welfare economics. Even if efficient in the sense of the first theorem, the market outcome can be unjust from a distributive justice point of view. Moving from one trade equilibrium to another, some factor incomes are rising while others are falling. If for the case of a multihousehold economy the questionable assumption of lump sum transfers, i.e. the assumption of 'winners' compensating 'losers' without causing further distortions, is abandoned, distribution conflicts emerge. Thus, the distribution of ownership of production factors becomes essential. Yet, in reality transfers rarely are lump sum transfers. In any case, in a world of second best, i.e., an economy for example characterised by labour market distortions or goods market oligopolies, allocative and distributive effects can no longer be separated analytically. Taking into account what has been called in the literature the European scenario of open economies, whose labour markets are suffering from involuntary unemployment, the analysis of effects caused by economic internationalisation may not be restricted to questions of efficiency.

Obviously, the normative puzzle is quite complex. In summary, three normative dimensions can be distinguished. First of all, there is the efficiency norm inherent in the first theorem of welfare economics which is widely accepted by economists. Indisputably, there might be enormous efficiency gains from international economic interaction, even if the economic and institutional reality hardly fits the first best

world of the first theorem. Second, despite welfare gains from economic internationalisation, an income distribution from the market process not accepted by society might result. In contrast to the efficiency norm of the first theorem of welfare economics, no consensus exists as to distributive norms.

Whatever normative perspective on distributional issues is chosen, a positive analysis of what drives the change in relative incomes is always required. And, more closely to the characteristics of the German case, not only is an analysis of the change in relative income positions important but also of what changes unemployment, leading to the third dimension of the normative implications of changing employment and unemployment. At this point, it should be mentioned that apart from efficiency norms in the debate on economic internationalisation, not only distribution norms matter: labour norms have also become a subject, for example, so that the broad debate on international labour standards is not surprising. However, these topics are beyond the scope of this analysis.

After a short introduction to the conceptual problems inherent in income distribution analysis, measurement problems, especially with regard to international comparison, will be examined. Then, income inequality and economic inequality will be related to each other. In order to become conscious of the problems of empirical income distribution analysis as well as income inequality comparison, selected aspects of important income data sets for Germany and the U.S. that are usually used in such analysis, shall be discussed. The following step will be to introduce the theoretical perspective on income distribution analysis as well as the explanations of income inequality and changes in income inequality respectively. Finally, the comparative perspective chosen requires special attention to be paid to the Flip-Side hypothesis. This hypothesis tries to capture the different effects of economic internationalisation on U.S. labour markets and those of the main Continental Western European economies, in particular Germany.

Searching for distributive effects calls for a survey of income inequality in the U.S. and Germany: thus Parts **II** and **III** will not only examine in detail the change in the functional distribution of labour incomes, but also the personal distribution of income. There, special attention will be paid to the link between the functional and the personal income distribution: intuitive reasoning suggests that in liberal welfare states, a category going back to the classification of welfare states by Esping-Andersen (1990), increasing inequality of the functional distribution of labour incomes, *ceteris paribus*, results in a corresponding change in the personal distribution of income. This question was also raised, for example, by Hanratty and Blank (1992) in the context of the wage gap debate, which will be subject of Part **II**, focusing on the U.S. case. Several reasons motivate this procedure: first, the wage gap debate exemplifies theoretical as well as empirical efforts to identify distributive effects of economic internationalisation in highly developed economies. Second, this debate shows important theoretical controversies arising from the analysis of potential causes that underlie distributive effects. Third, the development in the U.S. serves as a benchmark for the search for distributive effects due to economic internationalisation in economies whose labour markets exhibit different structural characteristics and who experienced persisting unemployment during the

last decades, thus leading to the German case discussed in Part **III**. Therefore, going beyond income inequality description, both parts will contain reviews of the literature examining empirically whether economic internationalization contributed significantly to distributive outcomes in Germany and the U.S., thereby building bridges to draw a theoretical line of reasoning that allows understanding the important theoretical differences of how to analyse the two cases.

Income Distribution Analysis

2.1 The Concept of Income and Income Distribution Typologies

Debates on concepts of income have a long tradition. But the core of any reasoning on a changing distribution of income in an open economy must address which income type is meant. Four arguments can be put forward in favour of conceptual considerations: first, only precise insights into the problem of how to define income allow descriptive and econometric contributions to be evaluated. Thus, the following conceptual considerations will serve as an input to the comparison of the changes in income inequality in the U.S. and Germany. Second: to understand why the analysis of economic internationalisation and the distribution of income is disintegrated to a large extent can be clarified by shedding light on the complexity of the phenomenon income as well as on the typology of income distributions. Additionally, there is a third good reason: the sense in which the link of income inequality and economic inequality is important for understanding the normative dimension of the wage gap debate can only be understood by a precise conceptual framework. Fourth, stylised models to explain changes in income distribution, to which the analysis will come back in Parts [II](#) and [III](#), construct few homogenous income categories.

In order to interpret and evaluate such models' problem focus, a conceptual basis is necessary. When trade between countries richly endowed with different types of skilled labour and countries poorly endowed with labour skills is analysed, another classification problem arises: this kind of analysis requires building international comparable homogenous skill categories. In this connection, Wood (1994) points to the important and obvious difference in average skill and capital intensity of economic output between low-skilled labour once a highly industrialised economy is focused and once a country of a lower industrial development stage is focused. Finally, a remark concerning the personal distribution of income: the rather comprehensive exposition of the problem of weighting household members according to needs, when household incomes are to be compared, aims at becoming aware of the principal problems and difficulties of how to integrate personal income distribution topics into the debate on income distribution and economic internationalisation.

Fundamentally, a distinction can be made between market and nonmarket income. Market income comprises income from employed labour supply and capital. Apart from factor income earned by capital and labour, market income includes income from entrepreneurial activity. Nonmarket income consists of private and public transfers. Transfers can either be monetary or real. An example of real transfers is the Food Stamp Program (FSP) in the U.S. Because a large share of households in highly developed economies does not earn market incomes, the inclusion of transfer incomes is important for description and analysis of the overall household income distribution. The largest of these groups is pensioners.

An obvious problem arises from the definition of the income types the concept of income should cover: whereas a narrow concept of income can easily be restricted to monetary income, a broader concept has to take into consideration both monetary income and income that cannot be directly measured in monetary units. In this connection, Simons (1938) introduces the concept of comprehensive income. Consequently, a broad concept of income has to include income from labour and capital, private and public transfers, and income that is earned from owner-occupied real estate or long living consumption goods. Fringe benefits belong to those elements of a broader income concept that are difficult to measure. Hauser und Wagner (1997) emphasise that for lack of information fringe benefits often have to be excluded from labour income analysis.

Utility that arises out of leisure interpreted as consumption also eludes direct measurement and is often totally ignored. Probably one important reason for this is that *little is made of the notion that leisure is a consumer good and therefore a component of income* (Arrow, 1994, p. 344).¹ Besides, the quantification of this kind of income is faced by almost insurmountable difficulties. A broader concept of income can also include income from unpaid labour in the sense of labour not being rewarded on markets. An important example is labour input necessary to run private households. This kind of income could be evaluated by its opportunity costs in the form of net income from the supply of similar services in the labour market, i.e. monetary income less disutility of labour. Furthermore, one has to decide whether special payments, for example, Christmas bonuses, nonrecurring payments or success dependent payments, ought to be taken into consideration proportionately. This problem is related to the problem of whether to use point data or averages by year.

Often the debate on household welfare recurring to period incomes implicitly assumes period incomes to determine the demand for goods and services as the binding income constraint with goods and service quantities as arguments of the utility function. As the permanent income hypothesis offers an alternative economic rationale, to assume period incomes to be the binding constraint raises a basic controversy: there, expected income cumulated over lifetime discounted to its present value is suggested to be the behaviour determining constraint. With this in mind, the intertemporal core of the permanent income concept becomes clear. In contrast to period incomes, permanent income cannot be directly measured. As a remedy,

¹See also Becker's (1965) full income concept that includes labour income as well as income from leisure.

consumption expenditure serves as an appropriate approximation. The underlying hypothesis postulates that consumption expenditure is less liable to transitory income fluctuations.

Van der Gaag and Smolensky (1982) point to the importance of inequality in a further element of household consumption: households consume different amounts of public goods. In consequence, when developing an income concept demand for public goods as a component of total household consumption, approximating permanent income should be taken into consideration as well. Unlike consumption of private goods, monetary evaluation of public goods seems to be difficult: first, government provides public goods because of market failure so markets and market prices do not exist. And second, even if the problem of monetary evaluation can be solved the problem of how to ascribe public goods consumption to households remains.

Income is liable to taxes and social security contributions. The concepts of primary and secondary income distinguish between market income and income after taxes, transfers and social security contributions due to institutional intervention. While the former comprises total market income, the latter stands for secondary income. Secondary income corresponds to disposable income. Disposable income is defined as income freely disposable for private demand for goods and services. The distinction between primary and secondary income should be understood as a descriptive concept and should be used analytically only with proviso. Primary and secondary income are mutually conditional, outlined by simple causal reasoning: for instance, taxes and social security contributions induce distortions. Gottschalk and Smeeding (1997) thus conclude to behavioral adjustments: by endogenous labour supply decisions taxes and social security contributions affect the distribution of market income, i.e. primary income. In a static model the two distributions' determination has to be considered simultaneously and may not be understood as one distribution determined by the other distribution. Even though taxes and transfers are lump sum parametrically treated by agents and thus allocatively neutral, they change the individual opportunity set and, in this way, material freedom, cf. Lindbeck (1988).

Related to the distinction of different types of income, studies of income distribution issues distinguish between the functional and the personal distribution of income. For example, Ramser (1987) follows this structure. The functional distribution of income distinguishes income by distinguishing different forms of capital and different labour skills. While from a microeconomic point of view the factor prices wage and interest rate are the relevant distributional variables, from a macroeconomic point of view these are wage bill and profits. The personal distribution of income distinguishes incomes earned persons and households respectively. The distributional variable is earned total income, which can consist of different functional incomes. Therefore, it is also referred to as the cross-sectional functional income distribution. Bedau (1990) finds that the household income distribution is now often labelled by the term 'personal income distribution' because people typically live and economize together. The sole analysis of the distribution of income among persons thus does not make sense. In favour of this it can be argued first, that certain goods consumed by a household are public goods within the household. An

example would be to secure doors and windows of a family apartment. Second, economies of scale arise out of investment in consumer durables by multi-person households. Besides, economies of scale possibly not only arise with an increasing number of household members but also with increasing income. And third, rents arise from goods complementarity.

Household members can additionally be characterised by different needs. Inequality in household incomes due to different needs, different composition and different household size is considered by the use equivalence scales.² Becker und Hauser (1995), for example, derive their equivalence scale from the *Regelsatzproportionen* of the *Bundessozialhilfegesetz*. Van der Gaag and Smolensky (1982) develop equivalence scales from an extended system of linear demand functions. Hence, an equivalence scale related to the consumption costs of a benchmark household can be derived by the cost functions dual to the system of demand functions. Because of this theoretically well-founded procedure *ad hoc* assumptions can be abandoned. However, Van der Gaag and Smolensky (1982, p. 22) emphasise: *This ... does not imply that our equivalence scale is the 'correct' one in any absolute sense*. As the 'true' equivalence scale does not exist, in the end the choice of a certain equivalence scale remains a pragmatic decision. Advantages and disadvantages of methodological considerations underlying equivalence scales have to be weighed. This especially applies to international comparisons, cf. Hagenaaers, de Vos and Zaidi (1995), and thus to this study's perspective. Whether the same equivalence scale should be applied to different countries in order to render income distributions comparable despite country-specific household consumption patterns is discussed by Giles et al. (1998). Finally, a remark on the intertemporal application of equivalence scales: normally, in empirical studies equivalence scales are applied to the whole period of investigation for which income data are to be analysed. However, because of relative price changes and socio-structural changes within societies, equivalence scales should be dynamically adapted.

A further critical feature that must also be kept in mind for what follows concerns sensitivity analysis: measured inequality should be examined as to its sensitivity when different equivalence scales are applied, as done for example by Burkhauser, Smeeding and Merz (1996). The idea of equivalence scales providing a good approximation to individual welfare if household size and household composition are known goes back to Engel. Engel found that compared to richer households, poorer households spent a larger share of total expenditure on food. This observation was also confirmed for larger households compared to households of only a few persons. Engel concluded that food's share of total expenditure can be applied as an indirect welfare indicator. Therefore, comparison of money incomes of households revealing the same expenditure share for food implies a certain equivalence scale, as explained

²Let y^h be household's net income, n the number of persons living together in a household, and b_i a weight dependent on the needs of person i according to a prejudged equivalence scale. Then one gets as equivalence income of person i :

$$y_i^e = \frac{y^h}{\sum_{i=1}^n b_i}.$$

by Deaton and Muellbauer (1980). In this connection Danziger and Taussig (1979) point to the necessary condition of adapting distribution units in order to equally weight each person's income if income serves as a welfare measure that builds on the concept of an individualistic welfare function.

As to equivalence scales, one should mention a further important feature: an income unit received by a poor household is not equivalent to an income unit received by a rich household. Because of the latter's higher income and wealth, higher creditworthiness results from another income unit, *ceteris paribus*. Once again, this example shows the complexity of inequality that often has to be radically narrowed in order to make selected problems tractable, especially in theoretical treatments.

Equivalence scales establish the comparability of household incomes, but not of single personal incomes. The concept of equivalence scales does not allow conclusions with regard to the within-household income distribution because equivalence scales construct, in a certain sense, a within-household income distribution, even if this construction is more deeply founded by needs or goods demand, in order to make total household incomes comparable. Households are treated allocatively and distributively as a 'black box'. Renunciation of a within-household income distribution analysis is a serious shortcoming because a change in the within-household income distribution is allocatively nonneutral: for example labour supply decisions of household members could depend on the within-household income distribution. In addition, not only are labour supply decisions endogenous, but also household size. When exogenous equivalence scales are applied thus a conflict would appear. Finally, the use of equivalence scales necessitates complete income pooling, implying the neglect of both withholding and hiding of income by household members. Consequently, arguments in favour of summarizing incomes according to appropriate household definitions and arguments dealing with the problem of within-household income distribution have to be weighed.

In what follows, personal income distribution will mean the distribution of household and family incomes. Therefore, greater importance is attached to the above arguments where operational problems and problems of data play an important part in this decision.

2.2 Measuring Inequality Descriptively

Empirical income distribution analysis has to solve two main problems: first, the level of incomes has to be measured to derive distribution as well as density functions. This requires a precisely defined income concept. The application of the chosen income definition then provides the unit of measurement. Second, empirical inquiry of the distribution of income requires measures that describe the distribution's characteristic properties as to inequality. In the following section selected important deterministic inequality measurement concepts shall be reviewed. Their comprehensive presentation is motivated by two reasons first, as will be shown in the two subsequent chapters, in the wage gap debate's context these measurement concepts have often been applied to disclose changes in income inequality. Second, and more important, their deeper understanding discloses problems arising from

distance concepts. Any wage gap is nothing but a distance concept to search for important economic structural changes. In addition, thinking about the decomposition of some of the introduced measures will realize the importance of inequality analysis, not only among groups but also within groups. However, deterministic measures are only one possibility to analyse income inequality. An alternative, to which this section will return later, is offered by econometric studies estimating earnings functions.

Locations are an often used class of descriptive measures. The first important location is average income, which is calculated as arithmetic means from the parent population of incomes. A second important location is modus standing for the income of largest frequency.³ Thus, for example the transition of the unimodal density function of incomes to a bimodal one at the beginning of the eighties in the UK strengthened the hypothesis of income distribution polarization with an implied diminishing middle class, cf. Jenkins (1995). The income beyond which lie the incomes of fifty per cent of all distributional units is called the median income.⁴ In the case of a symmetrical income distribution, median income equals average income. The median income is also a parameter of location with median income as the most important of the group of quantiles.

Apart from median income percentiles of the lower and the upper range of an income distribution are often analysed. By means of quantiles incomes earned by persons or households can be compared in the sense of distance. To relate average income in the 90th percentile to average incomes in the 50th and 10th percentile, for example, allows changes in relative income distances of the upper range of an income distribution relative to the middle and lower range to be analysed. Even if the choice of percentiles for income distance description and analysis remains somewhat arbitrary, sensitivity analysis can provide insights in to whether chosen distances are fairly robust with respect to the degree of measured inequality.

This method of inequality measurement by income distances exhibits the advantage of robustness to outliers. As will become obvious in what follows, many studies dealing with income inequality in the U.S. and Germany infer changes in the degree of inequality of an income distribution from the change in distances of average income in selected quantiles. This distance measure of dispersion can be expressed as relative as well as absolute distance. However, both kind of distances ignore all the properties of an income distribution between the chosen quantiles and are restricted to the analysis of either relative or absolute distance. Therefore, quantile distances do not allow statements on how inequality is characterised over the whole spectrum of an income distribution.

Naturally, relative and absolute distances can also be formed for two groups of incomes distinguished by the qualification of income recipients: hence, the wage gap between skilled and low-skilled labour in the concept's true sense can either be expressed by a size wage gap measured by the distance in nominal or real monetary

³A distribution is called bimodal if the density function's first derivatives twice equal zero and the corresponding second derivatives become negative.

⁴In empirical poverty research that naturally deals with the lower tail of the income distribution, median income serves as an important benchmark for the definition of relative poverty measures.

units or by a relative wage gap. The relative wage gap g can also be written in logarithms:

$$\ln g = \ln w_s - \ln w_u. \quad (2.1)$$

That is: inequality analysis by means of two different income subgroups necessitates deciding how and by which characteristics the two distributions are to be compared. Theoretical approaches contributing to the trade and wages debate to analyse the conditions underlying qualificatory wage gaps often start from reducing stylised facts to few or even two subgroups of average incomes where incomes are distinguished by skill. Hence, to return to the wage gap in (2.1), w_s would stand for the average income of skilled workers and w_u would stand for the average income of low-skilled workers.

Income distributions are often segmented by the income shares of population subgroups. The procedure is to structure income distribution units, for example by quintils, and to calculate each quintil's cumulated proportional share of total income. This kind of structuring cannot be compared with socio-structural categorizing for which class and strata theories developed by sociology serve as an example. A general problem arises due to statements on the degree of polarization of an income distribution, which can be derived neither from shares nor from scalar measures such as quantile distances. This is shown by Wolfson (1997) by means of a mean-preserving redistribution that transforms an equal distribution into a bimodal one. Depending on which income recipient units' share of total income is chosen to define a 'middle' income group, this group's share of total income either increases or decreases. That is, consistent conclusions concerning the development of the 'middle' income group's income share critically depend on the chosen segmentation.

Nevertheless, despite these objections an intertemporal and international comparison of quantile distances provides preliminary evidence of possibly important relative distance changes within an income distribution by a simple statistical measure. Besides, in contrast to summary measures, both percentile distances and the share segmentation of an income distribution give insights into the disaggregated income distribution. Another basic and often applied dispersion measure with an inherent distance concept is the coefficient of variation, which builds upon the simple variance. Standardization of the variance by means of the average income guarantees independence from the income scale. Income scale independence means that despite all incomes doubling the inequality measure's value would remain unchanged, for example. According to the consensus of the standard literature this turns out to be an important property that ought to be satisfied by any inequality measure. The normative focus of this kind of inequality measurement thus lies on an inequality concept evaluating relative income positions.

Hence, income dispersion would only change if different incomes changed by different factors. For the simple qualificatory wage gap in (2.1) a stable degree of inequality follows when both average incomes would increase by the same factor. However this property's normative implications also raise critical questions. For example, if values of income inequality measures satisfying this property are compared internationally, inequality would be measured irrespective of absolute income levels. Consequently measured income inequality in a country where wages in the

lower range of the income distribution hardly allow subsistence level could be equal to inequality in a country where the same position in the income distribution allows adequate participation in socio-economic life. However, one could argue that such problems do not concern a German-U.S. comparison of income inequality. Since both countries are at a similar development stage.

Additionally, an inequality measure should satisfy the weak principle of transfers: two incomes differ by $\delta \geq 0$. Assume income that amounts to less than $\frac{1}{2}\delta$ is transferred from higher to lower income. Then, an inequality measure would satisfy the weak principle of transfers if the measure showed a decrease in inequality for each income and each transfer δ . A strong principle of transfers can also be formulated: income is transferred from a higher to a lower income. The strong principle of transfers would be satisfied if the change in inequality depended solely on the change in distance between incomes independent of the incomes having been chosen. A fourth condition is that the principle of population is satisfied if the value of an inequality measure does not depend on the underlying population size.

Finally, the principle of decomposability claims an inequality measure to be decomposable into the contribution of within-group inequality and between-group inequality to total inequality. If an inequality measure is exhaustively decomposable into only two terms, it is called decomposable in a strong sense. Since stylised facts as a basis for theoretical analysis of the economic internationalisation and income distribution link build on few skill subgroups, the decomposability property becomes particularly interesting. In general, decomposition into between-subgroup and within-subgroup income inequality provides additional structural insights into subgroup income inequality and its contribution to overall inequality.

The principles outlined above represent a minimum standard that inequality measures should meet. Despite deficits and strong normative implications they guarantee meaningful properties as to reaction to changing income distances. All deterministic inequality measures reviewed in this section satisfy at least the weak principle of transfers and are independent of income scale and population size. The inequality measures introduced so far can also be called descriptive inequality measures. The Gini coefficient, whose definition can be found in Appendix A.1, also belongs to the class of descriptive inequality measures. By assigning a unit of measurement to Lorenz curves, the Gini coefficient as a summary measure allows statements on the degree of inequality of the underlying Lorenz curve.

As the Lorenz curve depicts cumulated proportional income shares against cumulated shares of income recipients, cumulation establishes a direct link to the share segmentation of income distributions discussed above. As Ramser (1987) emphasises, the Gini coefficient acts as a *tie breaker* that allows the derivation of an inequality ranking even if two Lorenz curves were crossing. The Gini coefficient is criticized in different ways: as an index number, it rests on questionable cardinal assumptions. Furthermore, like other descriptive measures, the Gini coefficient considers value judgements only implicitly. In this connection Atkinson (1970) shows that summary measures such as the Gini coefficient or the coefficient of variation postulate certain assumptions as to the shape of the implied social welfare function.

A way out of questionable cardinal assumptions offers Lorenz dominance analysis,

a procedure that aims at ordinal comparison of inequality. Dominance analysis represents a middle course in trying to find appropriate income inequality measures. Atkinson (1992) describes the field of conflict where this middle course is placed: on the one hand, there is the possibility of choosing a certain measure and a certain equivalence scale accompanied by the attempt to convince the public of their plausibility. On the other hand, the researcher can disclose her difficulties in choosing an appropriate inequality measure and an appropriate equivalence scale. Naturally, the latter rules out definitive conclusions. Appendix A.2 outlines the concept of dominance analysis and the fundamentals of Lorenz dominance analysis. There, the link between dominance analysis and the concept of social welfare functions that allows explicit integration of value judgments is also clarified, cf. Bishop and Formby (1994). Integration of social welfare functions in both inequality description and analysis goes back to Atkinson (1970), who introduced the concept of social welfare functions into the measurement of inequality aiming at the explicit disclosure of value judgements. Atkinson (1970), whose inequality measurement concept is explained in detail in Appendix A.3, constructs an inequality measure that explicitly considers the inequality aversion of the person who measures. Determined by a chosen degree of inequality aversion, the Atkinson measure reacts sensitively to changes in either the lower, middle or upper ranges of an income distribution by varying intensity, due to implied different degrees of the welfare functions' concavity, thus giving different weights to income changes in the lower, middle and upper ranges. The sensitivity of and inequality measure is thus defined as the property of showing the intensity of changes in the underlying income distribution.

An inequality measure that also integrates value judgments explicitly is offered by the Theil measure, which belongs to the class of generalized entropy measures, cf. Appendix A.4 following Cowell (1995). Again, the sensitivity implied by the measurer's preferences to changes in different ranges of an income distribution enters the measurement concept. In addition, the Theil measure has a second advantage: its simple exhaustive decomposability of total inequality into within-subgroup and between-subgroup inequality. In other words the the class of generalized entropy measures meets decomposability in the strong sense.

Unlike measures belonging to the class of generalized entropy measures, sensitivity does not explicitly enter the Gini coefficient which reacts most sensitively to changes in the middle range of an income distribution. Obviously, the sensitivity of an inequality measure critically depends on its immanent value judgments. If value judgments were explicitly considered, the sensitivity of an inequality measure could be examined in the dependence on the degree of inequality aversion of those who measure.

As to decomposability, Deutsch and Silber (1999) recapitulate that the Gini coefficient exhibits the often criticized disadvantage of not being decomposable in the strong sense. Yet the simple Gini coefficient does not violate all required decomposition properties. The problem of Gini decomposition, rather, is the lack of interpretation of that additive component neither describing within-subgroup inequality nor between-subgroup inequality. Pyatt (1976) shows how to decompose the Gini coefficient in three income inequality components add up to an income

distribution's overall Gini coefficient: the first two components are disparity due to between-subgroup and due to within-subgroup inequality. The third component he isolates measures income disparity due to the overlapping of subgroup income distributions. This third additive term can be interpreted as an interaction term of the subgroup income distributions relating characteristics of subgroup inequalities to each other. For further details see Appendix A.1.

Not only could the decomposition of the Gini coefficient into three additive components based on distinction of income recipient subgroups be shown but a second type of decomposition procedure is also possible. Application of a wide income definition shows the many facets of household income. The simple Gini coefficient elucidates either the degree of inequality due to a single income source or the degree of inequality inherent in the distribution of aggregated incomes. Therefore, the breakdown of the contribution of each income component relative to the change of overall income inequality is not possible. That is the reason why Lerman and Yitzhaki (1985) decompose the simple Gini coefficient in a different way, cf. Appendix A.1. Their multiplicative decomposition results in a component that is each income component's share of total income. A second component measures whether changes in respective shares increase or decrease overall inequality. Finally, the Gini coefficients of the single income components enter the decomposition. Such decomposition's advantage lies in identifying to which extent the change in inequality in each income source contributes to either the decrease or increase in overall income inequality, *ceteris paribus*. In consequence, the measurer can identify, for example, whether the change of transfer income or changes of the functional income distribution are linked to changes of the personal income distribution. When measuring income inequality, interaction of the functional and personal income distribution is thus approximated descriptively. This kind of decomposition concept elucidates the socio-economic dimension of the link between the functional and personal distribution of income from a descriptive point of view. In the trade and wages debate this link has often been neglected. Yet it is precisely this link that gives changes in the functional distribution of income its socio-economic and political relevance.

Albeit the above introduction of descriptive measures was restricted to those measures that will be essential for the following analysis, fundamental problems as to income and income inequality measurement inherent in the debate on income inequality on the one hand and the process of economic internationalisation on the other hand should have become obvious:

1. Analytical capacity of descriptive measures is strongly limited. Measures that explicitly contain value judgments in the form of a coefficient representing inequality aversion of the one who measures disclose the normative dimension of inequality measurement and the problem of distributional justice respectively. On the one hand, this type of measure provides information on preferences of those who have decided to apply a certain inequality measure. On the other, this type of inequality measures enables sensitivity analyses.
2. By techniques of statistical decomposition, empirical analysis can gather more sophisticated descriptions of the change in the distribution of income and the change of its inherent degree of inequality. In addition, structural insights are

gained by the decomposition of aggregated income changes into components.

3. Statistical decompositions offer structural insights, but it must be kept in mind that pure statistical decompositions do not permit conclusions as to causalities or repercussions.
4. Naturally, the question of which incomes should actually be measured and analysed raises a crucial point. The analysis of different income concepts showed that this question remains a key issue. First, the concept of income underlying studies dealing with income distribution topics, and the income data under consideration must be examined. Second, the specific characteristics of the chosen inequality measures must also be examined.
5. The descriptive measures introduced so far suffer from significant shortcoming in that they do not allow one to distinguish whether changes in inequality are due to changes in market forces or to changes in individual characteristics. In this sense they are purely descriptive. Only econometric analyses solve this problem. The debate will come back to this point.

This study deals with links between the process of economic internationalisation and the distribution of income in highly developed countries by comparing the cases of Germany and the U.S. Focusing on an economy's income distribution addresses two important aspects of economic inequality: first, the distribution of property rights as to production factors and their evaluation by markets. With regard to the production factor labour, this study is interested in the evaluation of different labour qualities by the market mechanism. And considering taxes sheds light on the household's set of demand. Because consumption expenditures approximate permanent income, it stands to reason to take studies into consideration that analyse household inequality in consumption expenditures as a benchmark for income inequality analysis.

Income inequality analysis remains incomplete without looking at changes in employment. For example, if a certain labour skill's share in total employment were decreasing, this could mean a decreasing share of this labour quality in total factor reward without any changes of average income within this qualification category, *ceteris paribus*. Reasons for this can be found in increasing involuntary unemployment of that factor, skill-upgrading or retirement. This objection does not only concern quantile analysis, but as well measures that describe the inequality degree of cumulated income components like the simple Gini coefficient, for example.

2.3 Inequality of Incomes and Economic Inequality

Income inequality and economic inequality have to be distinguished precisely. Income inequality represents just one possible dimension of economic inequality. For example, empirical poverty research expands the definition of economic poverty to include the dimensions of employment, education and residence, cf. Hanesch et al. (1995). On principle, as aspects of inequality these kinds of categories are equally important for the analysis of economic inequality of persons and households.

The dimensions of economic inequality are closely linked to one another. Thus,

increasing economic inequality in the labour market because of labour supply rationing is mainly manifested in the monetary income dimension, despite a wide-ranging social security system: *ceteris paribus*, involuntary unemployment has a negative effect on household income by the household receiving lower unemployment benefits as a labour income substitute. In the case of long-term unemployment, households are threatened by further income losses because of even lower social security contributions such as subsidiary income support. Naturally, the difference between cause and effect must be precisely distinguished analytically. Descriptive evidence of the termination of unemployment benefits does not necessarily mean that the cause of the worsening relative income position has been found. Research must aim at identifying labour demand, labour supply or institutional settings that might be responsible for long-lasting unemployment spells.

Moreover, changes in the distribution of one aspect of socio-economic inequality can give rise to changes in the distribution of other dimensions of socio-economic inequality: the search for structural causes of persisting involuntary unemployment in the major continental European economies hypothesized and empirically confirmed that long-term unemployment implies devaluation of qualification.⁵ Unemployment causes changes in the distribution of the economic characteristic qualification, being significantly correlated with the level of income. Despite social security systems, unemployment implies distributional effects affecting several dimensions of economic inequality. Changes in the dimensions of economic inequality therefore cause both directly and indirectly, changes in the income inequality dimension. As will become obvious by the review of the wage gap debate, inequality in the qualification dimension is an example of essential empirical and theoretical importance.

The dimension of security serves as another interesting example. Different normative attitudes regarding compensation systems in the U.S. and Germany imply different evaluations of income risk. Schwarze (1996) analyses the effects of income security on individual welfare. Different economic characteristics reappear in possibilities to smooth out individual factor income and household income respectively. If labour suppliers faced heavily fluctuating labour demand resulting in income insecurity, those who are risk-averse would have to bear welfare losses. Such labour demand fluctuations could be due to the dynamic process of economic internationalisation, for example. In consequence, because of risk aversion, income-smoothing welfare state compensation systems would induce welfare gains that have to be weighed against welfare losses caused by distortion-inducing compensation systems. Besides, the case of income risk again elucidates the links between different dimensions of economic inequality.

As already stated, increasing inequality in U.S. labour incomes has resulted in a

⁵When unemployment has increased because of a change in an independent variable and will fall back to its original trend not before having adjusted only gradually, unemployment is denoted as persistent unemployment. In this case, unemployment, formally, is not only a function of the independent variables but also a function of its historical level. There is unemployment hysteresis if unemployment is not coming back to its original level when the exogenous shock has dropped, which is nothing else but a special case of persistent unemployment. For an overview of the empirical evidence in favour of persisting unemployment in Europe and its causes, cf. Blanchard and Summers (1988) or Kösters und Belke (1992).

substantial debate among economists. Sen (1997) points out that this increasing income inequality is being broadly and fundamentally accepted in U.S. society. Although this does not mean that deprived groups might disagree with this consensus. In this connection a controversial debate has risen on the possible economic reasons of, in international comparison, high U.S. criminality, cf. Freeman (1996). This consensus is obvious and has normative power, even if numerous critical voices have emphasised that the increasing inequality of labour incomes could be interpreted as the costs of the U.S. social and economic model, cf. Halimi (1997). Only recently a public debate on a rise in legal minimum wages has emerged. Access to this debate's empirical as well as theoretical aspects is, for example, provided by Whitman (1996). There is also a debate on the problem of the working poor, cf. Levitan, Gallo and Shapiro (1993), O'Connor and Smeeding (1993) as well as Phelps (1994). Following Sen (1997), by contrast, in the main continental European economies, France and Germany, not only is unemployment persisting but the social acceptance of unemployment.

Sen's (1997) hypothesis implies that increasing divergence of labour incomes would hardly have been accepted in countries like Germany. As a stylised fact, until now no comparable income inequality to that in the U.S. could have been observed in Germany. But the distributional effects accruing from unemployment, especially concerning the high share of long-term unemployment, has not yet been sufficiently examined. Thus the issue of whether income inequality actually has remained largely unchanged since the end of the seventies remains unresolved. This problem is closely linked to questions raised by the flip-side hypothesis, so called by Freeman (1995) and others, or two-sides-of-the-same-coin hypothesis, so put by Fitzenberger (1999a) and others. The analysis will return to these problems in Parts II and III.

2.4 Income Data and the Analysis of the Labour Income Distribution

Which data sets serve as a basis for income inequality comparisons of the U.S. and Germany? Data collection offers two different kinds of income data: cross-section data and longitudinal data. For the case of Germany, the *Beschäftigungsstichprobe* of the *Institut für Arbeitsmarkt- und Berufsforschung* (IABS) contains extensive cross-section data for dependent employees responsible for social insurance contributions. The IABS distinguishes six different qualification categories: *Ungelernte*, *Facharbeiter*, *nur Abitur*, *Abitur und Lehre*, *Fachhochschule* degree, and university degree.

Cross-section data of the IABS exhibit several problems. First, they are right censored at the social security threshold. Whereas just a negligible two per cent of unskilled workers are affected by censoring, for high-skilled labour, that is university or *Fachhochschule* degree, more than two-thirds of all cases are right-censored, so that not even the median can be calculated, cf. Möller (1999). Second, working hours are not documented. Only the information part-time/full-time employment is given. Third, coding of fringe benefits and the remuneration definition were

changed over time. Thus, fringe benefits cannot be distinguished from other income components without great effort. In order to take structural breaks into account, adjustment procedures have to be applied, cf. Möller (1999) and Fitzenberger (1999a). Finally, no data on self-employed income, unpaid family workers, civil servants and low-paid employees are collected. Even if at least 80 per cent of Germany's important sectors like manufacturing, insurance and the health system are covered, so that IABS is quite representative, possible distortions due to a too low degree of data acquisition should not be ignored.

The Einkommens- und Verbrauchsstichprobe (EVS) is an income and consumption survey by the *Statistische Bundesamt* providing further cross-section data for Germany. In the EVS personal incomes collected monthly are aggregated to annual data. Like IABS, part-time workers cannot be distinguished from full-time workers and households with a foreign head of household are excluded. Employment periods are available only for 1983 and 1988. The EVS is topcoded and bottom-coded because only social security employment data are collected. Furthermore, it was stated that the EVS is not suitable for analysing income distribution topics, cf. Fachinger und Flaig (1995). Since participation in the EVS is voluntary, middle-class households are overrepresented. Finally, the EVS does not contain any information on human capital.

For the U.S., extensive cross section-data are included in the *Current Population Survey* (CPS). Among other information the CPS contains data for age, education, industries, employment and different kinds of income. In contrast to cross section-data, panel data not only collect income data of persons or households from a random sample according to selected characteristic features, but also pursue the changes in variables assigned to micro units, over time. Panel data are repeated observations on the same set of cross-section units. This is important because changes in characteristics like education and work experience imply mobility within the distribution of income. Pure cross-section data do not take into consideration whether data characterised by a certain feature in period t are still those characterised by the same feature in period $t - 1$. Inequality measurement should consider this change: the duration of time a statistical unit belongs to a certain quantile of an income distribution gives insights into the time structure and into the inequality persistence. Unlike cross-section data, panel data permit answers to the question of over which period persons or households remain within a certain income quantile. A problem inherent in panel data is leaving and entering. Since panel data not only observe changes in personal or household incomes, but also changes in personal or household characteristics, the characteristics of those who enter and leave must be taken into consideration when long-term aspects of panel data are to be utilized.

The German Socioeconomic Panel (GSOEP) has collected extensive longitudinal data on different functional and personal income variables for Germany since the beginning of the eighties. Income data are collected in a comprehensive way. For the U.S., equivalent data are surveyed by the Michigan Panel Study of Income Dynamics (PSID). Since the GSOEP collects data on the micro unit household, it offers an alternative basis for the inquiry into the personal and functional income inequality responding to objections to use of cross-section data in income inequality studies.

Yet, there are also disadvantages: answers are given voluntarily by respondents, and problems such as rounding or underestimation of the true income arise. By contrast, IABS data rest on the legal obligation of employers to disclose income data for social security purposes.

The GSOEP data have also become part of the *Luxembourg Income Study* (LIS). This study builds on nationally collected data with the aim of comparability as an adapted basis for comparative studies: *One major task faced by LIS was to aggregate (or to disaggregate) country-specific income elements into internationally consistent income categories* (Smeeding and Schmaus, 1990, p. 8). The LIS structures national data on the basis of statistical guidelines proposed by the United Nations, cf. United Nations (1999). Among other things, data are classified by income sources. The categories classifying personal income recipient units are households consisting of related as well as unrelated persons and families connected by relationship, marriage or adoption living and economizing together. These categories largely correspond to those organizing national data, with only small deviations. Generally, data on institutionalized persons, for example prisoners and persons in nursing homes, as well as homeless persons are not covered by the surveys. Studies of the lower tail of the income distribution thus have to be tested for systematic distortions due to their data base. In this connection, despite possibilities for statistical correction a fundamental issue arises, especially in the case of data collected on the basis of voluntariness: bottom-coding and top-coding lead to an insufficient description of very high and very low incomes. Schäfer (1995) emphasises that both top-coding and bottom-coding represent a problem inherent in the GSOEP revealed by the comparison of average incomes based on the GSOEP and average incomes calculated on the IABS data.

Apart from appropriate data, the analysis of labour income requires dimensions to distinguish characteristics of income recipient units. From a macroeconomic point of view the whole wages and salaries and the whole capital income constitute the two functional elements of the aggregated national income of an economy. These components again can be functionally disaggregated. The instant in time related distinction of appropriately defined households on the basis of production factor property leads to the personal distribution of incomes by assigning disaggregated functional incomes. Whilst for such cross-section analysis the distribution of production factors property is given by assumption, longitudinal analysis allows to the consideration of changes of production factors property.

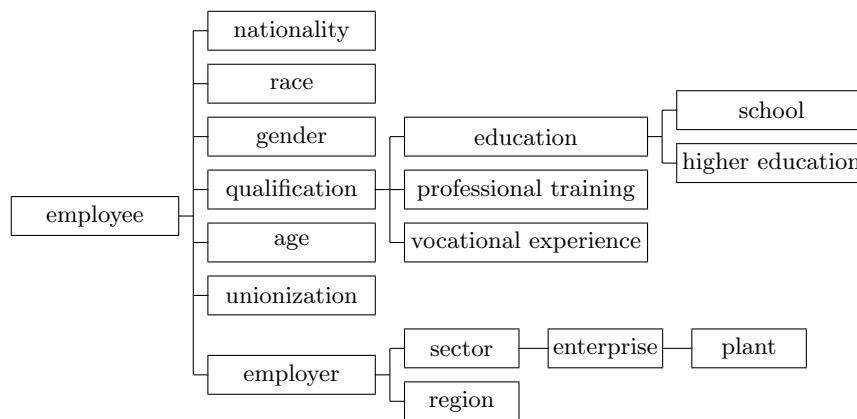
Functionally disaggregated wages and salaries are inseparably linked to the persons who earn these incomes. As persons often earn further functional incomes apart from labour incomes such as income from capital ownership, this obviously means disaggregation of the functional macroeconomic income distribution ending up in the functional microeconomic distribution of incomes. Once again it should be emphasised that within the scope of this inquiry the personal distribution of income and the household income distribution are treated synonymously.

The degrees of equality and inequality respectively inherent in the labour income distribution firstly can be measured without any grouping of those earning incomes. In consequence, disparity measures like the Gini coefficient or the coefficient of vari-

ation can be calculated for the whole of the ungrouped labour incomes. Second, labour incomes can be grouped by meaningful characteristics. Then, two forms of disparity can be analysed: on the one hand disparity of incomes between appropriately defined subgroups, and on the other, disparity within these subgroups. In order to distinguish labour incomes descriptively, Figure 2.1 offers a classification concept of the main characteristics. Characteristics can be both distinguished and combined as research design requires, with regard to underlying objectives and hypotheses. In particular labour market economics empirically analyses whether and

Figure 2.1

Dimensions to Classify Labour Income



to what extent the distribution of labour income changes along such characteristics. At the same time, labour market economics raises both empirically and theoretically the question of whether and to what extent differences in characteristics explain the level of incomes and labour income disparity.

Earnings functions have become established as a methodological tool to search for those characteristics classified in Figure 2.1 that are supposed to determine both the level of incomes and income disparity.⁶ Compared to pure descriptive and deterministic measures, income disparity measurement earnings functions additionally exhibit the advantage of providing a tool for identifying whether and to what extent changes in the characteristics of observation units explain observed changes. When the role of qualification in wage level and disparity determination is analysed, earnings functions allow controlling for factors like age or industry, for example. In a way, it can be tested for causality.

The dominant approach is to apply least square estimation procedures. With this

⁶The fundamental formulation widely used in human capital models reads

$$\ln y = \varphi(s, x) + u.$$

While y denotes income, φ is that function with the best fit as to data on education s and vocational experience x . u is the normally distributed residual with zero expectation and represents all variables that cannot be observed. See, for example, Willis (1986).

approach distances and distance changes of the mean log wage or a more comprehensively defined mean log labour income of different worker groups distinguished by skill can be measured. In addition, often within-subgroup wage inequality is explored by the variance of log wages. However, this procedure is only appropriate for uncensored data. If data are censored like the IABS data set, which is essentially topcoded due to the social security threshold, typically the Tobit approach is applied. Again, different contributions estimate quantile time trends, where the choice of appropriate quantiles avoids the problem of coding with results being robust to outliers.

Alternatively, the quantile estimation approach combines important properties of the approaches outlined in the preceding paragraph. The idea is to analyse certain quantiles of an income distribution for the overall income distribution and the distribution of income for different skill groups. As comprehensively explained by Fitzenberger (1999b), there is an analogy between the least square regressions and quantile regressions: while the least square approach shows how regressor variables have an effect on the conditional mean of the dependent variable, the quantile estimation approach clarifies the influence of regressor variables on the chosen conditional quantile of the dependent variable. Moreover, studying different quantiles of a subgroup income distribution allows not only the derivation of evidence as to within-subgroup inequality, but also the derivation of more detailed evidence into distance changes between different ranges of income distributions distinguished by skill. Therefore, this approach allows testing for complex hypotheses about changes in income inequality considering age, cohort and skill.

Hence, biases and the overlooking of structural changes in the distribution of skill characteristics can be avoided. In a word, what can be avoided is attributing changes in income inequality to market forces as an implication of technological progress and economic internationalisation, when the true reasons lie in the interaction of age, cohort and skill selection and composition effects. Earnings functions find an important theoretical basis in human capital theory. In many studies empirical earnings functions that build on human capital theory show the outstanding importance of qualification and vocational experience in explaining the distribution and the level of incomes. As well in the analysis of trade, wages and involuntary unemployment, qualification is the main grouping category. This grouping problem is at the core of any distribution analysis and fundamentally influences the research design, cf. Champernowne and Cowell (1998). Parts II and III, which deal with the cases of the U.S. and Germany respectively, will illustrate why the qualification category became so prominent in comparisons of the two economic scenarios in a world characterised by economic internationalisation and technological progress. Principally, the formulation of alternative hypotheses with regard to the link between income and the income recipient units' characteristics is a prerequisite of any thorough analysis of income disparities. Only in this way can a well-founded empirical evaluation of the meaning of any qualification wage gap be achieved.

Analysis of qualification wage gaps raises serious problems about how to render qualification operational. As will be shown in what follows, in order to relate empirical analysis and theory theoretical studies often distinguish between only two different

labour skills. Both Parts II and III will provide insights into relevant theoretical concepts that themselves induce wage categorizations that require the distinction of only a few labour qualifications in order to build theoretical hypotheses. Naturally, such procedures are accompanied by considerable aggregation difficulties. In numerous studies that try to test theoretical models for empirical evidence, qualification is distinguished by its type of occupation with blue collar and white collar workers as the classification categories. While occupation in production and production-like occupations are subsumed under blue-collar, white-collar stands for all remaining employees. For the U.S., for example the Annual Survey of Manufactures (ASM) renders this division operational. There, production work is distinguished from all other occupations.

When looking at various labour income data, immediately the fact that both categories subsume skill-requiring occupations as well as low-skilled occupations attracts attention. While subsuming the demanding operation of computer-controlled production machines under blue-collar makes sense, for example, classification of simple office occupations as white-collar does not satisfy defined criteria. Consequently, Leamer (1994) concludes that this classification was only partly suitable for skill distinction. An alternative approach is offered by definitions that do not build directly on occupations but on sophisticated characteristics of labour supply like the ones shown in Figure 2.1.

In this study, skill classification plays an important part in two respects: first, problems of defining qualification underlie the empirical analysis of the labour income distribution's qualification structure. Second, empirical analysis of repercussions between economic internationalisation and the distribution of labour income needs input coefficients of the economy's various production and service sectors. Hence, qualification must be rendered operational. The systematization in Figure 2.1 of course shows that contributions distinguishing labour inputs in production and services by a few educational characteristics instead of the categories blue-collar and white-collar exclude other dimensions like vocational experience or age. Findings by means of a certain skill classification thus have to be tested for robustness to variations of the chosen skill categories. In addition, unobserved qualification characteristics have to be expected to a great extent, so that a big question mark must be put behind any concept of qualification measurement clearly showing the necessity of a thorough sensitivity analysis, cf. Dickens' comment on Gottschalk and Moffitt (1994).

2.5 Problems

The methodological and theoretical complexity of both the choice of an appropriate income concept and the measurement of income necessitates a detailed analysis of those influential studies that found an increase in U.S. wage inequality. Results building on period income data have to be discussed as to robustness to the use of a dynamic concept of income that distinguishes between permanent and transitory income components. Whether the increased qualification wage gap remains a temporary deviation from a secular trend or constitutes itself a secular trend is of great

importance for a deeper theoretical understanding of the causes and repercussions of an increase in the disparity of the functional distribution of labour income. This also applies to the debate on trade policy, economic policy, and social policy concepts to meet challenges by distributional effects due to the process of economic internationalisation. Furthermore, a revision of empirical changes in the personal distribution of income will be integrated to approach descriptively repercussions between the functional and the personal income distribution. In Chapter 3, first a benchmark model for a theoretical analysis of repercussions between trade and wages will be revisited. This model will not only provide a framework to organize thinking about the U.S. case but also a starting point for the analysis of the German case in Part III, considering imperfect labour markets.

3

Frameworks

3.1 Theoretical Approaches to Explain the Distribution of Income

Following Rothschild (1993), theories of the distribution of factor incomes can be subdivided to

1. income distribution theories, and
2. theories that contribute to the explanation of what is causing changes in the distribution of factor incomes by their comparative statics or dynamics.

The first type of theory tries to explain the right-skewness of a stylised empirical income distribution by the distribution of person-specific characteristics such as different abilities. On the other hand, human capital approaches model investment decisions in individual labour skills in order to explain the distribution of labour incomes. Rothschild (1993) considers such theories as genuine theories of distribution. However, self-contained theories to explain the distribution of income do not exist. Moreover, most theories concentrate on the explanation of the functional distribution of incomes, i.e., the distribution of factor incomes, although the search for an explanation of determinants of the personal income distribution is an important objective of the analysis of the functional income distribution. In this connection, one of the most important categories underlying the analysis of the personal income distribution makes the distinction between labour income and capital income. Atkinson (1997, p. 298) critically summarizes the actual state of research:

the relationship of the factor distribution with the personal distribution of income is typically not spelled out. Statements about the division of national income between wages and profits do not tell us directly what determines the share of the top 20% or the bottom 20% of income recipients. The factor distribution is certainly part of the story, but it is only part, and the other links in the chain need to receive attention.

To model the link between the functional and the personal distribution of incomes requires numerous complex market and nonmarket repercussions as well as institutional settings to be taken into consideration.

Household factor endowments are of special importance if one seeks to analyse the distributional effects of a changed functional distribution of income on the personal income distribution. If several household members supply different labour skills, the change of all labour incomes would determine the change of total household income. What has to be considered are changes in factor incomes possibly leading to changes in factor supply by changes in factor income or changes in employment if household members' labour supply decisions are endogenous, with employment and factor income of other household members as explaining variables. However, households do not only receive labour income but also income earned by physical and portfolio capital, which is, as a stylised fact, more unequally distributed over all households than labour income. The neglect of changes in capital rules out a satisfying and exhausting analysis of repercussions between the functional income distribution on the one hand and the personal income distribution on the other.

Numerous trade theoretical models belong to those theories contributing to the explanation of changes in the distribution of income by their comparative statics and dynamics respectively. Certainly, most of these theories do not give priority to the search for the determinants of changes in the distribution of income. But often these approaches allow conclusions with respect to direction as well as extent of income inequality changes. For example, the well-known Heckscher-Ohlin model, which offers an explanation of why and under which conditions countries can gain from opening up to international trade, predicts the direction of changes of the functional income distribution application of the Stolper-Samuelson theorem. The Stolper-Samuelson theorem identifies factors that 'gain' and factors that 'lose' implied by changes in relative goods prices when moving from autarky to free trade or from one trade equilibrium to another.

The marginal productivity theory of distribution is taking over an important function in trade theoretical models. Again, this can be illustrated by means of the standard Heckscher-Ohlin model with two factors, two goods, and two countries under the assumption of perfect symmetric countries except in terms of their factor endowment: relative factor and goods prices in free trade equilibrium result from simultaneous interaction of factor endowments, preferences and technologies. Linear-homogeneous technologies ensure complete functional income sharing to labour and capital rewarded by their marginal products.¹ National product is exhausted. However, only in the case of perfect competitive factor markets are factors rewarded by their marginal product. The theoretical inquiry of the wage gap debate also raises the issue of the empirically relevant market form and, thus, the issue of the market type reward of different labour skills.

Trade models largely neglect the problem of how to model repercussions between the functional and the personal income distribution. Models with the underlying assumption of exogenous factor endowments, the dominant procedure in neoclassical trade theory, require assumptions as to the distribution of property rights of fac-

¹Note that application of the marginal productivity theory of distribution is not restricted to linear-homogeneous technologies calling to mind models that distinguish between national and international economies of scale. Ethier (1982) shows conditions under which the results of the theorems of the factor endowment theory still hold if national and international economies of scale are allowed to interact.

tors when multi-household economies are modelled. In general equilibrium models with different labour skills, the assumption of exogenous factor endowments is very restrictive. An important problem to be solved is the endogenization of labour supply. Endogenizing the qualification structure of labour supply aims at reconciling of labour market approaches with both human capital theory approaches and international trade theories. Such a perspective is offered by Findlay and Kierzkowski's (1983) endogenization of labour supply an approach to which the debate will come back in Chapter 6.

The effect of significant changes in the functional distribution of income on the personal distribution of income is of eminent political-economy relevance. In public debates, income and disposable income are generally regarded as one appropriate approximation to an empirical index of household welfare. For example, one of Ross Perot's main topics during his 1992 presidential campaign was a polemic debate over the effects of NAFTA on the U.S. distribution of wages. In order to sum up the employment loss and deteriorating income position of low-skilled American workers as a severe and undesired consequence of the establishment NAFTA, Perot used the metaphor of a *giant sucking sound as if a monster devoured employment*, cf. Lawrence and Slaughter (1993). A further example is the debate which has been intensifying since the mid-nineties on minimum wages as an effective redistributive policy option, cf. for example Freeman (1996). A final example is the German debate on the *Entsenderichtlinie* concerning domestic workers belonging to lower *Lohngruppen* of the building sector who are supposed to compete with migrating foreign workers, cf. Peter (1998). The labour income of these *Lohngruppen* is much more important for their total household income relative to other income sources compared to other ranges of the personal income distribution. These income sources potentially smooth out fluctuations in wages.² Obviously, such debates shed light on potential political implications of worsening positions of low-skilled and unskilled workers' incomes with qualification significantly correlated with income as a rule.

Such debates contain, either explicitly or implicitly, value judgments about whether the income distribution resulting from the market mechanism is fair or not. Value judgements are also inherent in the widely accepted Pareto-criterion covered by the first theorem of welfare economics, cf. Hagel (1993). The first theorem of welfare economics states that in a market economy under perfect competition in all goods and factor markets a Pareto-efficient allocation can always be achieved, i.e., a market solution where no one can be made better off without someone else getting worse. While the first theorem of welfare economics deals with the efficiency problem, the second theorem focuses on distribution issues: for appropriate distributions of factor endowments all Pareto-efficient allocations are Walras-equilibria. Classical trade theory shows that for a non-deteriorated economy movement from autarky to free trade and, under the small country assumption, movement from any one trade equilibrium to another always means a net welfare gain even if there are many households. However, the latter only holds if the 'winners' compensate the 'losers' by means of allocatively neutral lump sum transfers. This result raises two main issues: First, in reality 'loser'-compensating lump sum transfers are rather

²For Germany, see Schäfer (1995). This stylised fact was also empirically confirmed for the case of the United Kingdom in the eighties by Johnson and Webb (1993).

unlikely. Therefore, distributional analyses gain far-reaching importance. Besides, even if 'winners' compensate 'losers', compensation by means of lump sum transfers always concerns the individual's or household's material freedom. Second, if market distortions exist one has to raise anew the issue of interaction between welfare effects and distributional effects. Analytical distinction between efficiency and distribution as in the case of a perfect competitive market economy can not be maintained any longer.

For this study, a summary so far suggests both a positive theoretical and an empirical analysis of repercussions between the process of economic internationalisation and the distribution of income. The benchmark case will be an undistorted market economy. To this end, an appropriate framework shall be revisited in the following section.

3.2 A Framework for an Internationally Comparative Trade and Wages Debate

3.2.1 Whose Time Has Come?

Analysis of distributional effects induced by economic internationalisation needs a trade theoretical basis. There are two main reasons: first, only a debate on trade theoretical approaches is able to elucidate whether there is really a problem related relevance of these theories. As will be shown, reasoning that builds on mechanisms like that of the simple Heckscher-Ohlin model and on the logic of a simple two-by-two model world with the two aggregated production factors skilled and unskilled labour does not suffice.

Second, general equilibrium approaches provided by trade theory have comparative advantages compared to partial equilibrium approaches because they consider spill-over effects between markets. From this point of view, falling back on trade theoretical approaches in order to give empirical analysis of what caused the increase in the qualification wage gap a framework seems to be straightforward. However, as literature revision will show, partial equilibrium approaches have dominated. Albeit the process of economic internationalisation is a complex phenomenon that makes high demands on theory, half a decade ago Krugman concluded for the analysis of trade between highly developed economies and fast developing economies:

There is a way to think systematically about the effects of growing world trade: it is called general-equilibrium trade theory. Indeed, the hot current topic of NIE trade in manufactures is almost tailor-made for analysis using the techniques developed decades ago by Jagdish Bhagwati, T. N. Srinivasan, Ron Jones, and their students. These are textbook models whose time has come. (Krugman, 1995, pp. 361-362)

Such a procedure also provides the necessary framework for the reconciliation of general equilibrium trade theory with labour market models and human capital theory, cf. the preceding section. According to these premises the next steps will serve to summarize the necessary theoretical basis. However, recapitulation of the perfect competitive model with zero profits of firms in equilibrium will also reveal

deficits. Thinking about multinationals and wages requires an incentive model to explain why firms shift production abroad. Furthermore, and directly linked to the multinational topic thinking about technological progress, economic internationalisation and wages requires identifying incentives for firms to invest in R&D. Consequently imperfect competition on product markets has to be integrated. And paraphrasing Krugman's (1995) dictum: a perspective whose time has come as well.

Third, the comparative perspective requires a framework that allows the consideration of not only crucial characteristics of the U.S. case but also crucial characteristics of the German case. Moreover, the German case is in so far representative as it partially matches stylised facts characterising other Western European economies like France or Spain. The perfect competitive labour market case thus provides a concept for thinking about the increasing qualification wage gap in the U.S. as well as a benchmark for analysing characteristics of the German case, in particular factor price rigidities.

The wage gap debate has been primarily interested in the functional distribution of income. An essential motivation of the wage gap debate and its implied public debate has been relatively and absolutely sinking real incomes of households mainly supplying low-skilled and unskilled labour, though relatively and absolutely decreasing real wages do not necessarily mean an increase in household income disparity and personal income disparity respectively. Supporting arguments can be found for example by disaggregating household labour supply decisions as exemplified in Section 2.1. Hence, repercussions between changes in the functional distribution of income and changes in the household income distribution represent an independent problem whose analysis should have its own place.

In what immediately follows two assumption will restrict the debate to the functional distribution of income in a perfect competitive economy: goods demand and factor supply will be modelled by a representative household. Personal income distribution topics will thus be postponed.

3.2.2 Starting from the Neoclassical Paradigm

Firms

The framework for subsequent analysis and comparison will be a perfect competitive general equilibrium. The strength of this class of models lies in their structural insights. Complex repercussions can be modelled. Let

$$\mathbf{w} = [w_i] \quad \text{with } i = 1, \dots, m$$

be the vector of factor prices and let

$$\mathbf{v} = [v_i] \quad \text{with } i = 1, \dots, m$$

be the vector of factor quantities. Let

$$\mathbf{p} = [p_j] \quad \text{with } j = 1, \dots, n$$

be the vector of goods prices and

$$\mathbf{x} = [x_j] \quad \text{with } j = 1, \dots, n$$

the vector of goods quantities.³ The quasi-concave production functions

$$x_j = f^{x_j}(v_{ij}) \quad \text{with } i = 1, \dots, m \quad (3.1)$$

are constant returns to scale with decreasing marginal productivity in each factor. Hence, the corresponding second-order derivatives become negative. Firms behave on both factor markets and goods markets as price takers. Under the assumption of exogenous factor supplies and parametric goods prices the economy's production side can be modelled by the national product or revenue function

$$R(\mathbf{p}, \mathbf{v}) \equiv \max_{\mathbf{x}} \{\mathbf{p}\mathbf{x} \mid g(\mathbf{x}, \mathbf{v}) \leq 0\} = \mathbf{p}f^{\mathbf{x}}(\mathbf{v}) \quad (3.2)$$

with the function $g(\mathbf{x}, \mathbf{v})$ describing technologies in (3.1). The disadvantage of this concept is the neglect of variable factor supplies. A remedy of this shortcoming is the aggregated profit function concept:

$$\pi(\mathbf{p}, \mathbf{w}) \equiv \max_{\mathbf{x}, \mathbf{v}} \{\mathbf{p}\mathbf{x} - \mathbf{w}\mathbf{v} \mid g(\mathbf{x}, \mathbf{v}) \leq 0\}. \quad (3.3)$$

Like the national product function the profit function in (3.3) is an optimal value function, both of them characterised by derivation properties according to the Envelope theorem. Consequently, one gets goods supply and factor demand functions

$$\frac{\partial \pi}{\partial p_j} = x_j^s(\mathbf{p}, \mathbf{v}) \quad \text{and} \quad \frac{\partial \pi}{\partial w_i} = -v_i^d(\mathbf{p}, \mathbf{w}) \quad (3.4)$$

by Hotelling's Lemma under the assumption of $m \geq n$. Because of the assumption of linear homogeneous technologies the input coefficient matrix can be derived by means of factor demand functions. In the constant returns to scale case input coefficients are a sole function of factor prices:

$$\frac{\frac{\partial \pi_j}{\partial w_i}}{x_j} = \frac{v_{ij}^d}{x_j} = a_{ij}(\mathbf{w}). \quad (3.5)$$

Hence, the input coefficient matrix becomes:

$$A = [a_{ij}(\mathbf{w})] \quad \text{with } i = 1, \dots, m \quad \text{and} \quad j = 1, \dots, n. \quad (3.6)$$

A further possibility to derive the input coefficient matrix is offered by the symmetric concept of the cost function. The problem of cost minimization dual to profit maximization can be written as follows:

$$C(\mathbf{x}, \mathbf{w}) \equiv \min_{\mathbf{v}} \{\mathbf{w}\mathbf{v} \mid g(\mathbf{x}, \mathbf{v}) \leq 0\}. \quad (3.7)$$

This optimal value function again shows derivation properties in accordance with the Envelope theorem. Accordingly, factor demand functions can be derived by the cost function as well:

$$\frac{\partial C}{\partial w_i} = -v_i^d(\mathbf{x}, \mathbf{w}). \quad (3.8)$$

³Let the price vectors be line vectors and let the quantity vectors be column vectors.

Due to the the assumption of linear homogeneous production functions the cost function can be alternatively formulated as

$$C(\mathbf{x}, \mathbf{w}) = c(\mathbf{w})\mathbf{x}. \quad (3.9)$$

Finally, input coefficients result from the cost function's derivation properties:

$$\frac{\partial c_j}{\partial w_i} = \frac{\partial C_j}{\partial w_i} = \frac{v_{ij}^d}{x_j} = a_{ij}(\mathbf{w}). \quad (3.10)$$

Households

The representative household can also be modelled by an optimization problem. The household tries to reach a given utility level by expenditures that are as low as possible. First, constant labour supply is assumed. Under the assumption of identical households with homothetic preferences, the representative household's expenditure function becomes

$$e(\mathbf{p}, \mathbf{u}) \equiv \min_{\mathbf{x}} \{ \mathbf{p}\mathbf{x} \mid U(\mathbf{x}) \geq u \}. \quad (3.11)$$

While $U(x)$ stands for a concave utility function satisfying standard assumptions, u represents a certain utility level. Like the national product function, profit function and cost function the expenditure function $e(\mathbf{p}, \mathbf{u})$ is an optimal value function with derivation properties according to Shepard's Lemma. Therefore, goods demands can be determined by derivation of the expenditure function with respect to goods prices:

$$\frac{\partial e}{\partial p_j} = x_j^d(\mathbf{p}, u). \quad (3.12)$$

The optimization approach dual to expenditure minimization is utility maximization under the budget constraint.

At this point, it should be emphasised that the analysis of the personal income distribution in the sense defined in Chapter 2 trivially requires a meaningful distinction of households. If the personal distribution of income is to be analysed, assumptions on household factor ownership distribution are necessary. The concept of expenditure functions allows such modelling of a multi-household economy. Now, each household h minimizes its consumption expenditure under the constraint of a given individual utility level:

$$e^h(\mathbf{p}, \mathbf{u}^h) \equiv \min_{\mathbf{x}} \{ \mathbf{p}\mathbf{x} \mid U^h(\mathbf{x}) \geq u^h \} \quad \text{with } h = 1, \dots, z. \quad (3.13)$$

For every single household the corresponding goods demands can easily be derived:

$$\frac{\partial e^h}{\partial p_j} = x_j^{dh}(\mathbf{p}, u^h). \quad (3.14)$$

Up to now, price inelastic factor supplies have been assumed. Yet, the concept of expenditure functions also allows variable factor supplies. If labour supply is

variable with factor prices as arguments, changes in relative factor prices lead to endogenous changes in factor supply. The modified minimization approach then reads

$$e(\mathbf{p}, \mathbf{w}, u) \equiv \min_{\mathbf{x}, \mathbf{v}} \{ \mathbf{p}\mathbf{x} - \mathbf{w}\mathbf{v} \mid U(\mathbf{x}, \mathbf{v}^f - \mathbf{v}) \geq u \}, \quad (3.15)$$

where superscript f denotes fixed factors. Consumption possibilities decrease by variable factor income because supplied working hours diminish disposable leisure time. From the variable expenditure function in equation (3.15) both goods demand and labour supply can be derived by means of the Envelope properties:

$$\frac{\partial e}{\partial w_i} = -v_i^s(\mathbf{p}, \mathbf{w}, u). \quad (3.16)$$

Naturally, the expenditure function with endogenous labour supply can be written for the case of a multi-household economy as well:

$$e^h(\mathbf{p}, \mathbf{w}, u^h) \equiv \min_{\mathbf{x}, \mathbf{v}} \{ \mathbf{p}\mathbf{x} - \mathbf{w}\mathbf{v} \mid U^h(\mathbf{x}, (\mathbf{v}^f - \mathbf{v})) \geq u^h \}. \quad (3.17)$$

These functions' derivatives with respect to factor prices provide factor supplies:

$$\frac{\partial e}{\partial w_i} = -v_{ih}^s(\mathbf{p}, \mathbf{w}, u^h). \quad (3.18)$$

The functions $e(\mathbf{p}, \mathbf{w}, u)$ and $e^h(\mathbf{p}, \mathbf{w}, u^h)$ respectively are also denominated transfer functions, i.e. $T(\mathbf{p}, \mathbf{w}, u)$ and $T^h(\mathbf{p}, \mathbf{w}, u^h)$. Transfer functions show the minimal transfer income necessary for the household to finance a certain utility level at given goods and factor prices. The transfer function can thus be either positive or negative. If the transfer function describes household behaviour solely on perfect competitive markets, it becomes zero.

Production Side Equilibrium

In the above sections, the well-known duality method for modelling optimal firm behaviour as well as optimal household behaviour was not only exposed for the case of fixed factor supplies but also for the case of endogenous labour supply. However, for the moment fixed factor supplies are assumed. On the production side modelling an undistorted equilibrium requires firms to maximize profits according to (3.3). Firms realize their optimal supply schemes with satisfied zero profit conditions as an implication:

$$A^t \mathbf{w}^t \geq \mathbf{p}^t \quad (3.19)$$

where superscript t stands for the transposed. For a simultaneous supply side equilibrium factor market equilibrium conditions

$$A\mathbf{x} \leq \mathbf{v} \quad (3.20)$$

must also be satisfied. If the number of factors equals or exceeds the number of goods, i.e. $m \geq n$, the supply side can separately be solved for given goods prices because of n equations determining m relative factor prices. In this connection one

speaks of the separation property of prices. Obviously this holds for a small open economy that faces parametric world market prices by assumption. If the separation property holds,

$$x_j = x_j(\mathbf{p}, \mathbf{v}) \quad (3.21)$$

by implication, and

$$w_i = w_i(\mathbf{p}, \mathbf{v}). \quad (3.22)$$

While equation (3.21) means goods supplies being a function of goods prices and factor endowments, equation (3.22) gives a dependence of fundamental importance: if the separation property holds, factor prices are solely determined by goods prices and factor endowments. If factor endowments are given, goods prices determine the functional distribution of income. For a small open economy, it follows that even if factors cannot be traded internationally, world market prices determine the domestic functional income distribution. Hence, in a sense the small open economy gives up its sovereignty over the domestic functional income distribution. This loss of a degree of freedom must be kept in mind when efficiency and welfare aspects due to the process of economic internationalisation are analysed. Finally, it has to be emphasised that the functions in (3.22) exist whatever the number of goods and factors and do not depend on the exclusion of factor intensity reversals.

Therefore, one important transmission mechanism that contributes to the theoretical structuring of the wage gap debate exists in the form of the functional relationship between goods prices and factor prices. Changes in goods prices would mean changes in the qualification wage gap. World market goods prices determine the domestic functional distribution of labour income and thus relative labour income distances.

In order to model effects on the production side, either substitutive or complementary relationship of the factors has to be described. For this the cost function concept to model firms is useful, because the matrix of partial Allen-Uzawa substitution elasticities can be written by means of the cost function concept as follows, cf. Kohli (1991):

$$[\epsilon_{ii}] = \left[\begin{array}{c} \frac{\partial^2 c_j(\mathbf{w})}{\partial w_i \partial w_i} \\ \frac{\partial c_i}{\partial c_i} \end{array} \right] \quad (3.23)$$

with the own-substitution elasticities on the principal diagonal. However, the partial Allen-Uzawa substitution elasticity has been object of criticism. Blackorby and Russell (1989) showed that the Allen-Uzawa elasticity of substitution is no measure of the isoquant curvature.

Nevertheless, total differentiation of the zero profit conditions (3.19) and the factor market equilibrium conditions (3.20) enables the links between changes in the endogenous variable goods quantities and factor prices as well as the exogenous variables goods prices and factor endowments to be written as follows:

$$\left[\begin{array}{cc} S & A \\ A^t & 0 \end{array} \right] \left[\begin{array}{c} d\mathbf{w} \\ d\mathbf{x} \end{array} \right] = \left[\begin{array}{c} d\mathbf{v} \\ d\mathbf{p} \end{array} \right], \quad (3.24)$$

where S represents the matrix of the factors' substitution properties, shown in detail

in Appendix B.1. Equation system (3.24) can be rewritten in relative changes, i.e.,

$$\begin{bmatrix} E & B \\ F & 0 \end{bmatrix} \begin{bmatrix} d\hat{\mathbf{w}} \\ d\hat{\mathbf{x}} \end{bmatrix} = \begin{bmatrix} d\hat{\mathbf{v}} \\ d\hat{\mathbf{p}} \end{bmatrix}. \quad (3.25)$$

Matrix S can be transformed into matrix E by multiplying S by the matrix of Allen-Uzawa substitution elasticities according to (3.23). The system matrix in (3.25) represents the inverse matrix of

$$\begin{bmatrix} H & B \\ F & 0 \end{bmatrix}, \quad (3.26)$$

where H is the matrix of the inverse demand functions' quantity elasticities matrix, i.e.,

$$[\eta_{ii}] \equiv \left[\frac{\partial \ln w_i}{\partial \ln a_{ij}} \right], \quad (3.27)$$

multiplied by the substitution matrix S . The inverse factor demand function can be directly derived from the social production function in (3.2). Hence, an equation system results that shows the structure of factor price dependence:

$$\begin{bmatrix} H & B \\ F & 0 \end{bmatrix} \begin{bmatrix} \hat{\mathbf{v}} \\ \hat{\mathbf{p}} \end{bmatrix} = \begin{bmatrix} \hat{\mathbf{w}} \\ \hat{\mathbf{x}} \end{bmatrix}. \quad (3.28)$$

Hereinafter a symmetric system will be the focus of attention. This means $m = n$ or the number of goods equaling the number of factors. Under the assumption of a small open economy the factor prices can be determined solely by means of zero profit conditions because these are an equation system with n equations in n variables. Since in equilibrium the factor market equilibrium conditions (3.4) have to be satisfied,

$$\mathbf{w}\mathbf{v} = \mathbf{w}\mathbf{A}\mathbf{x} = \mathbf{p}\mathbf{x}. \quad (3.29)$$

Total differentiation shows

$$\begin{aligned} \mathbf{p}d\mathbf{x} &= \mathbf{w}d\mathbf{v} \\ \mathbf{x}d\mathbf{p} &= \mathbf{v}d\mathbf{w}. \end{aligned} \quad (3.30)$$

The first equation in (3.30) follows from (3.24) considering zero profit conditions (3.19). In equilibrium the latter are satisfied because linear homogeneous cost functions ensure $\mathbf{w}^t S = 0$. The second equation in (3.30) follows from the first equation and the total differential of (3.29).

By means of the social revenue function, the matrix of the Stolper-Samuelson effects can now be derived. Because of (3.30) the total differential of the national product function is

$$dR = \mathbf{p}d\mathbf{x} + \mathbf{x}d\mathbf{p} = \mathbf{w}d\mathbf{v} + \mathbf{x}d\mathbf{p} \quad (3.31)$$

taking equations (3.21) and (3.22) into consideration. Hence,

$$R_{\mathbf{v}} \equiv \frac{\partial R}{\partial \mathbf{v}} = \mathbf{w} \quad \text{and} \quad R_{\mathbf{p}} \equiv \frac{\partial R}{\partial \mathbf{p}} = \mathbf{x}. \quad (3.32)$$

According to the Envelope theorem the partial derivatives of the social product function with respect to goods prices and factor quantities provide goods supplies and factor prices. The derivatives of the factor quantities being functions of goods quantities and factor prices as well the derivatives of the goods prices being functions of the factor prices form the Hessian matrix of the social product function:

$$\begin{bmatrix} R_{vv} & R_{vp} \\ R_{pv} & R_{xp} \end{bmatrix} = \begin{bmatrix} \frac{\partial \mathbf{w}}{\partial \mathbf{v}} & \frac{\partial \mathbf{w}}{\partial \mathbf{p}} \\ \frac{\partial \mathbf{x}}{\partial \mathbf{v}} & \frac{\partial \mathbf{x}}{\partial \mathbf{p}} \end{bmatrix}. \quad (3.33)$$

Because of Young's theorem

$$[R_{vp}]^t = \left[\frac{\partial \mathbf{w}}{\partial \mathbf{p}} \right]^t = \left[\frac{\partial \mathbf{x}}{\partial \mathbf{v}} \right] = [R_{pv}]. \quad (3.34)$$

In the symmetric case the Stolper-Samuelson-matrix $[R_{vp}]^t$ can be transformed into the Rybczynski matrix $[R_{pv}]$ and vice versa.

The Stolper-Samuelson matrix formalises the well-known Stolper-Samuelson effects that analyse changes of factor prices due to goods price changes with factor endowments remaining unchanged. By contrast the Rybczynski matrix provides the change in outputs due to changes in factor endowments with product prices unchanged. However, if the new factor endowment does not lie inside the diversification cone, production specialization results.

Yet can these theoretical concepts contribute to a deeper understanding of the interaction of economic internationalisation and the distribution of income? This issue will be at the heart of Chapter 5.

3.3 Inequality versus Unemployment – the Flip-Side Hypothesis

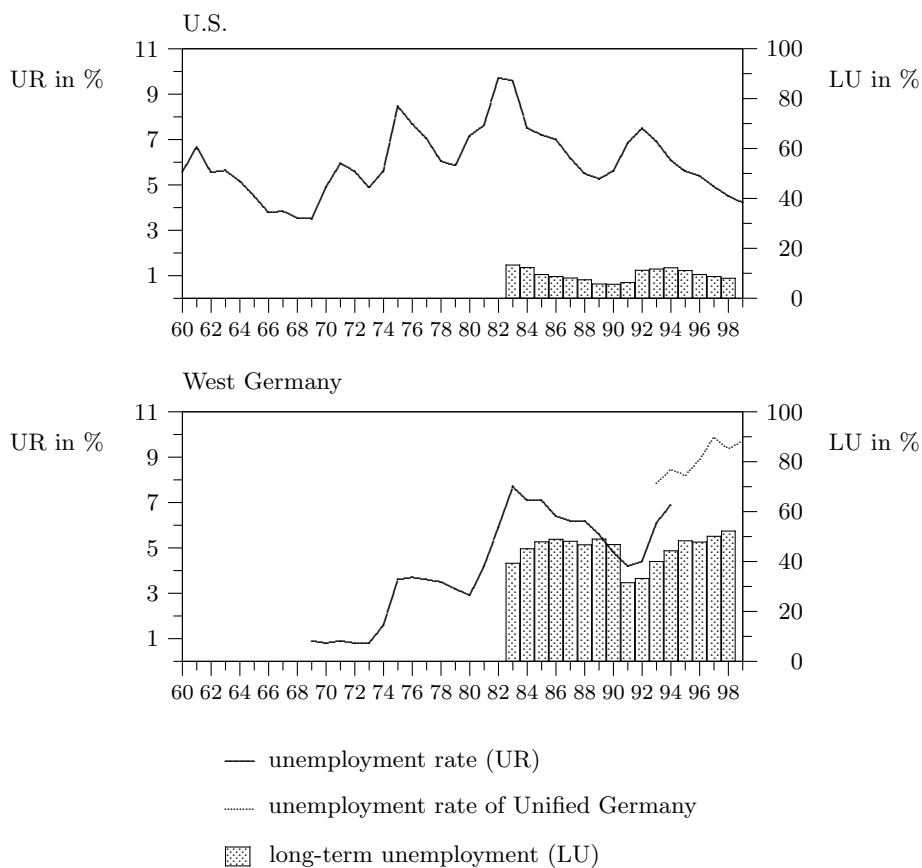
The majority of empirical studies that examine the increasing wage gap in the U.S. during the eighties derive their testing approach from the assumption of perfect competitive labour markets. Looking at the time series of standardized U.S. unemployment rates in Figure 3.1 shows an increase in involuntary unemployment at the beginning of the eighties. During the rest of the decade, however, unemployment dropped again to the level of the beginning of the seventies. Additional consideration of unemployment rates in the nineties suggests unemployment was not the dominant long-run social and economic policy problem of U.S. society over the last decades. In the last decades, unemployment rates moved around an average, fluctuating cyclically, so that no secular appears. This finding could justify a widespread and strong assumption of price-cleared labour markets to be an adequate working hypothesis for analysing U.S. labour markets from a long-term perspective.

The low share of long-term unemployment defined as involuntary unemployment that lasts longer than twelve months without a break in total unemployment supports the presumption of the labour market price mechanism leading to the long-run equation of supply and demand. The situation in Germany appears different. There, as Figure 3.1 shows, unemployment has been increasing by a secular trend since the beginning of the seventies. In other words, involuntary unemployment has

persisted impressively, as shown by the standardized unemployment rates in Figure 3.1. In addition, the share of long-term unemployment in total unemployment has been considerably larger than the U.S. share. Certainly, with respect to calculated long-term unemployment shares in total unemployment, OECD (volumes b) states that only large differences were significant because of problems in the data

Figure 3.1

**Unemployment Rates and Long-Term Unemployment
– Comparison of Germany and the U.S.**



Source: OECD, volumes a, and OECD, volumes b.

base. Still, comparing Germany and the U.S. shows significant and stable differences in the long run. Finally, analysis of the duration structure of German involuntary unemployment also shows that low-skilled and unskilled workers have been disproportionately affected. Generally speaking, except for the case of the United Kingdom, the German experience is representative for the labour market development in the main western European economies.

The scenario outlined above motivated the flip-side hypothesis: while under U.S.

conditions either technological progress or the process of economic internationalisation might have caused the increased disparity of the functional distribution of labour incomes, under the conditions of the main Western European economies the same factors might be responsible for the increase in involuntary low-skilled and unskilled labour unemployment. Thus, a wage gap debate that takes international comparison seriously requires the integration of non-price cleared labour markets into theoretical analysis. Involuntary unemployment has to be analysed both theoretically and empirically with respect to distributional effects, that are in a world of second best inseparably linked to welfare effects, since increasing as well as decreasing involuntary unemployment implies changes in the functional distribution of labour incomes. However, up to now there has been no generally accepted benchmark model or framework to analyse involuntary unemployment. By contrast, Section 3.2 offered the widely accepted neoclassical production side orientated framework to build general grounds for economic analyses of the trade and wages issue under perfect competition on labour and goods markets. Analysis of the German case in Part III will focus on this problem.

3.4 Problems

In the time of Ricardo and Mill, the personal income distribution was mainly determined by the functional distribution of income because, as a stylised, fact households supplied either capital or labour. That is surely one important reason why the functional distribution of income was focused on for so long. Only in the fifties, did studies like Champernowne (1953) first begin to recognize the necessity of self-contained theoretical approaches to explain the personal income distribution not only by disclosing what determines the functional distribution of income. To ask for changes in the personal distribution of income concentrates on the distribution of production factor ownership. Of course, not only the personal distribution of portfolio capital and real capital ownership is of interest, but also the distribution of human capital.

Even if the change in relative goods prices due to the movement from one trade equilibrium to another induces a widening wage gap, only a comprehensive personal income concept clarifies the actual repercussions on the distribution of household incomes: in the U.S. for example, households in the lower range of the personal income distribution receive considerable real transfers. Though perhaps not explicitly intended, parts of these transfers could have compensated households having lost by changes in relative wages induced by distributional effects of economic internationalisation. Thus, the 'winners' would have partly compensated the 'losers', by which gains from economic internationalisation would have been redistributed.

Without any compensation mechanism, the distribution of factor ownership determines whether factors 'gain' or 'lose'. In highly developed economies most workers are insured against involuntary unemployment by social security systems, but in international comparison these systems differ to a great extent in structure and scale. Finally, the distribution of factor ownership is endogenous. This also applies to human capital: the qualification structure of labour supply is endogenous. At-

tention will be turned to this problem in the context of theoretical considerations in Part II and Part III.

Choosing a historical perspective, Williamson (1998, p. 61) points to the deficits the analysis of repercussions between the process of economic internationalisation and the distribution of income in the 'golden age' suffered from: *The modern debate over inequality has a fixation on wages, but since land and landed interests were far more important to late 19th century inequality trends, we need to add them to our distribution inquiry.* The almost exclusive concentration on repercussions of economic internationalisation and the distribution of wages narrows the analytical perspective in recent debates as well: while analysis of income distribution changes during the second half of the nineteenth century seem to neglect land ownership, now the debate mainly focuses on wages neglecting the role of physical capital and portfolio capital.

Studies like Fortin and Lemieux (1997), Freeman (1991), Gottschalk and Joyce (1998) or Lee (1999) focus on institutional causes and conditions of the increasing inequality of the functional distribution of labour income. In this context, the changing role and diminishing power of trade unions has become an important topic. Gosling and Machin (1995), for example, examine the hypothesis whether the decreasing number of trade unions accompanied by a decrease in trade union membership caused increased labour income disparity. Yet, the majority of empirical studies trying to contribute to the analysis of causes of the increased U.S. labour income inequality concentrate on economic internationalisation and technological progress. In principal, two different classes of hypotheses must be distinguished:

1. hypotheses that focus on country-specific causes presumed to determine changes in the distribution of income. Examples are changes in institutional settings, but also demographic changes inducing country-specific labour supply changes.
2. The second class of hypothesis focuses on causes affecting economies in a similar way. An example relevant to this study are changes in labour demand due to changes in inter-industry trade structures.

Nevertheless, there are important links between the two classes of hypotheses. The flip-side hypothesis showed that even if there were similar effects on economies induced by economic internationalisation, this does not imply the same distributive effects, since it suggests that changes in labour demand either lead to increased labour income disparity under U.S. conditions or to increased involuntary unemployment in Western Continental European economies like Germany, in particular at the expense of low-skilled and unskilled workers. The flip-side hypothesis links both classes of hypotheses insofar that there might be forces at work affecting highly developed countries in a similar way, but against the background of uneven institutional settings outcome might be quite different. This particularly applies to U.S.-German labour market comparisons.

In a word, the two classes of hypotheses do not necessarily exclude each other. For example, trade union power could be restrained as a result of diminished bargaining power in a more and more open economy. Repercussions between economic internationalisation and technological progress raise another issue of causality. It should

be kept in mind that firms, as modelled by the neoclassical framework revisited in Subsection 3.2.2, earn zero profits in equilibrium without any incentive to invest in R&D. Obviously modelling technological progress requires firms in another type of goods market, for example monopolistic competition. Yet, the bulk of studies treats economic internationalisation and technological progress as competing explanations. This line of reasoning contradicts intuition, which suggests that both direct and indirect effects of technological progress have to be taken into consideration: while low-skilled labour biased technological progress shifts low-skilled labour demand inwards, there are also indirect effects due to technological progress, *ceteris paribus*. The change in the qualification structure of labour demand implies changes in relative goods and factor prices. Consequently, in the case of a large open economy, relative world market goods prices change as well. Furthermore, technological innovations cause outsourcing, because international production becomes more and more profitable by technological progress. Technological progress is a necessary condition of further slicing up of the value chain. On the other hand, the process of economic internationalisation creates incentives for efficiency-enhancing innovations because of more competition.

Obviously, one of the main issues is the way international production and technological progress interact. This problem will be taken up again. First, the following chapters of Part III will discuss distributional changes in the U.S. particularly during the eighties and those factors suggested as causes of the changes in the functional distribution of labour incomes.

II

The Case of the U.S.

Three Decades of Increasing Income Inequality

4.1 The Increasing Wage Inequality in the U.S.

Table 4.1 reviews selected empirical studies making both the change in the overall distribution of wages and the change in the distribution of incomes earned by different labour skills a subject of discussion. The main and common result of these studies is an increase in wage inequality among different labour skills, at least since the mid-seventies. In order to avoid confirming the hypothesis of an increasing qualification wage gap only by an arbitrary choice of qualification characteristics, the studies all analyse labour income disparities according to the categories education and vocational experience.

As discussed in Section 2.4, fundamental problems are raised by the choice of appropriate income data for the analysis of changes in income inequality. This problem is taken up by Juhn, Murphy and Pierce (1993). Despite obvious differences, comparison of hourly and weekly wages confirms the finding of increasing overall labour income inequality since the mid-seventies. Furthermore, the researcher has to decide whether to analyse cross-section data or longitudinal data. The majority of studies examines cross-section data. Therefore, Burkhauser, Holtz-Eakin and Rhody (1997), as well as Gottschalk and Moffitt (1994), point out that to cross-section do data not distinguish between permanent and transitory, i.e. temporary, changes of income inequality when dynamic changes of income inequality are to be analysed, because in contrast to panel data, cross-section data do not observe workers' employment biographies.

Nevertheless, if cross-section data were applied for other reasons neither cohort analysis solves this problem on principle. Gottschalk and Moffitt (1994) try to circumvent this problem by formulating permanent income as the average income over a certain period. Average income is interpreted as a permanent component of total income. Formally, the authors write the decomposition of individual real yearly logarithmic income y_{it} into a permanent and a transitory component as follows:

Table 4.1

Labour Income Inequality in the U.S.

Study	Data	Measures	Findings
Coleman (1993)	Data for 1940 to 1980 from the decennial census; CPS data for the eighties	Estimation of earnings equations controlling for schooling; aggregation of observations into year-educational level-experience group cells within each race-sex group; for each of these cells the average of weekly earnings is computed; the log of this variable is regressed on different schooling and experience variables	Movements of the earnings differential between high school and college graduates are similar across race and sex groups without any downward trend; increase of the college premium for most workers in the eighties
Davis and Haltiwanger (1991)	LRD wage data on manufacturing plants	Coefficient of variation of wage levels; standard deviation of log wages; standard deviation of residuals from log wage regression	Since the mid-seventies significant increase both in overall wage inequality and in inequality within experience-education-gender groups
Gottschalk and Moffitt (1994)	PSID data; male head of households aged 20-59 in any year between 1970 and 1988 with positive wage and salary earnings	Computation of permanent and transitory components by subdivision of the data into two nine-year periods	Both transitory and permanent fluctuations in earnings seem to have been significant; white males in all age and education groups experienced an increase in transitory earnings fluctuations
Juhn, Murphy and Pierce (1993)	CPS data from survey years 1964 to 1990; 1969 decennial census; both refer to earnings and weeks of full-time workers aged 18 to 65	Overall wage distribution: relative percentile changes and changes in log relative wages by percentiles; between-group and within-group changes in wage inequality by percentiles; decomposition of the skill premia due to observable and unobservable dimensions of skill by a simple wage equation where residuals represent the unobservables	Overall wage distribution: inequality has increased substantially in all parts of the wage distribution; rise in wage inequality is mainly due to rising returns to skill; 70s: increase in wage inequality within education and experience categories and no significant rise in returns to skill across these categories; 80s: rise in returns to both observed and unobserved skill
Pierce and Welch (1994)	CPS data for 1963 to 1990	Location statistics	General trend of increasing disparity of incomes distinguished by skill; trend is characterized by a variety of underlying changes of relative wages
Ryscavage and Henle (1990)	CPS data; BLS data; examination period is 1968 to 1988; focus on full-time year-round earners	Both Gini coefficients and cumulated quintiles are analysed for earners distinguished by race, gender, industry and occupation; percentile analysis; cross-sectional data for different years are compared	Compared to earlier decades, during the eighties earnings inequality accelerated among male and female full-time, year-round workers and increased among workers distinguished by the categories race, industry and occupation

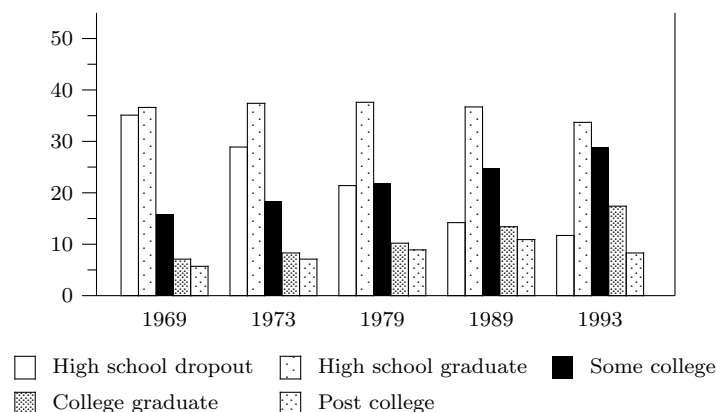
$$y_{it} = \mu_i + \nu_{it}, \quad (4.1)$$

where i stands for labour income and t for time. While the first term on the right-hand side stands for permanent income as average income not varying over time, the second term on the right-hand side represents the transitory income component. The variance of income consists of the variance of both the transitory and the permanent income component. The findings by Gottschalk and Moffit (1994) are presented in Table 4.1.

Buchinsky and Hunt (1999) emphasise that wage mobility possibly counteracts increasing cross-section income inequality. Therefore, whether such wage dynamics were working against the increase in cross-section wage inequality during the eighties unambiguously ascertained by various summary measures becomes an important hypothesis to be tested. For the eighties, the authors analyse longitudinal data stemming from the *National Longitudinal Survey of Youth* (NLSY). Albeit one should be aware of the constraints inherent in this data set, Buchinsky and Hunt (1999) get

Figure 4.1

**Proportional Share of Different Educational Levels in
Per Cent of Total U.S. Employment**



Source: Cline, 1997, p. 28.

the interesting result of a significant fall in wage mobility. This could hint at less overall income mobility in the labour market, aggravating the increase in measured cross-section wage inequality instead of reducing it by stronger dynamics within and between income subgroups.

Burkhauser, Holtz-Eakin and Rhody (1997) confirm this result, making use of panel data for the same period. The authors apply U.S. PSID data and GSOEP data. Their findings rely on the analysis of incomes of male workers aged 25 to 55. This limitation on the data is justified by the different temporal structure of education and retirement in Germany and the U.S. For the U.S., these longitudinal data

confirm the finding of an increasing inequality in labour incomes accompanied by falling income mobility. By contrast, for Germany comparable changes in wage inequality cannot be found. Further evidence is provided in favour of this result by Burkhauser and Poupore (1997), who also calculate the extent to which both the permanent and transitory income components contribute to income inequality in Germany and in the U.S.

The search for an answer to the question of whether observed changes in labour income inequality are transitory or permanent is important because of two reasons: first, as to the evaluation of their long-term implications, and second, as to the debate on economic and social policy strategies. Therefore, Coleman (1993) analyses census and CPS data looking at a long-term trend of changes in the college earnings premium, starting in the forties. In order to test the results' sensitivity to the choice of the college premium measure, as benchmarks both the high school earnings premium and the graduate school earnings premium are analysed. Estimation of the high school earnings premium for the groups distinguished by income recipient unit characteristics confirms findings derived for the college premium, which did not show any secular trend. Its main characteristic was merely periodical fluctuations.

Is the development ascertained since the mid-seventies only a temporary fluctuation or the beginning of a secular trend accompanied by an obvious long-term change in the qualification structure of employment as indicated by Figure 4.1? Nevertheless, even if this were a periodical fluctuation it was significant and straightforward over more than a decade. It thus motivates the search for deeper insights into what was driving this development and into distributional effects due to this significant change.

4.2 From the Analysis of Labour Incomes to the Personal Distribution of Income

Empirical labour income distribution analysis means a focus on the functional microeconomic income distribution. In contrast, the analysis of the empirical distribution of household or family incomes allows the discussion of personal income distribution topics. Following and extending Levy (1995), the development of both the functional and personal U.S. income distribution can be divided according to the following periods:

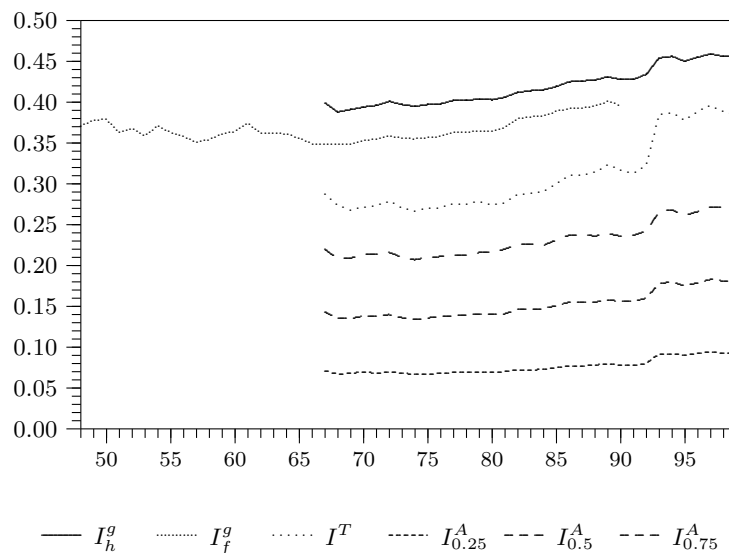
- | | |
|-----------|---|
| 1947-1967 | Rapid growth of labour incomes and decreasing inequality in both wages and family incomes. |
| 1967-1973 | Further income growth and decreasing wage inequality. Increasing household income inequality. |
| 1973-1979 | Diminishing growth of incomes ending up in stagnancy accompanied by a slight increase in wage inequality and a moderate increase in household income inequality. |
| 1980-1989 | Repeated stagnancy of average incomes with a significant increase in wage inequality mainly at the expense of low-skilled and unskilled workers. Significant increase in the inequality of household incomes. |

1990-1999 Continuing trend of increasing income inequality, now as well at the expense of higher labour qualifications, especially elder high-skilled workers. Further significant increase in household income inequality.

Looking at the Gini coefficients of family incomes¹ since the end of the forties and at Gini coefficients of household incomes since the end of the sixties in Figure 4.2 discloses the changes' trends: while income inequality fell with a clear-cut trend from the end of the forties until the end of the sixties, this trend reversed itself not later

Figure 4.2

Summary Measures of Inequality for U.S. Household and Family Incomes, 1948 to 1999^a



Source: Nelson, 1994, and U.S. Census Bureau.

^aGini coefficients for family incomes reprinted in Nelson, 1994, pp. 39. All other summary measures from U.S. Census Bureau, Current Population Reports, Series P60-204.

than at the beginning of the seventies. Therefore, Karoly (1993) speaks of an U-turn of the inequality inherent in family incomes. However, intertemporal comparison of Gini coefficients and the attempt to identify trends offers only limited insight into the changes in the degree of income inequality. The Gini measure exhibits only low sensitivity to changes in inequality both at the top and at the bottom of an income distribution.² Furthermore, the Gini measure does not disclose the income

¹Data on appropriately defined household incomes for the calculation of Gini coefficients are not available before 1967. Family incomes differ from household incomes by the inclusion of incomes earned by single-person households and households where non-related persons are living together. Nelson (1994) uses CPS data.

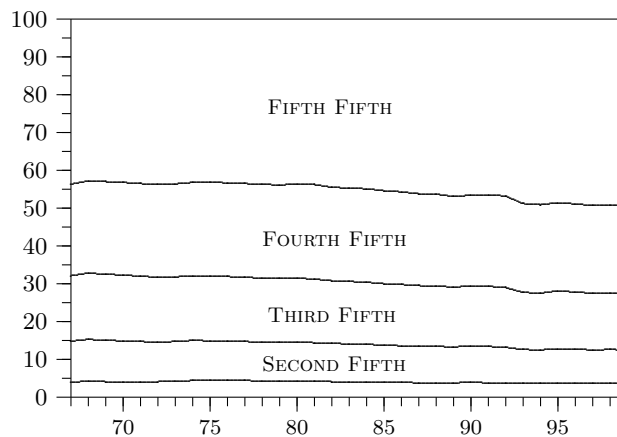
²As shown in Section 2.2, the simple Gini coefficient suffers from the deficit of only considering overall inequality and neglecting between-subgroup and within-subgroup inequality. Apart from

distribution ranges whose changes determine either an increase or a decrease in the degree of overall income inequality. Therefore, Figure 4.2 offers additional summary measures of inequality. All additional summary measures, i.e., the Theil measure and Atkinson measures for different sensitivity coefficients, show the same trend. The interesting point is that the Atkinson measure with highest sensitivity in the lower range of the income distribution, i.e. the highest sensitivity coefficient, does not only reach the highest values but seems to also exhibit the steepest trend towards increased inequality. This strengthens the presumption that important changes in inequality particularly happened in the lower range of the income distribution where the households mainly supplying low-skilled and unskilled labour can be found.

Section 2.2 showed how to structure income distributions descriptively by means of quantile analysis. For example, income distribution could be segmented by quintils. However, application of quantiles to measure inequality has raised severe objections.

Figure 4.3

Household Income Shares by Quintiles for the U.S., 1967 to 1999^a



Source: U.S. Census Bureau.

^aQuintile shares from U.S. Census Bureau, Current Population Reports, Series P60-204.

Nevertheless, working descriptively with quantiles is widespread, because preliminary insights into the structure of an income distribution as well as preliminary hints to changes in sound income distances are offered. Figure 4.3 offers such insights into trends in changes of the U.S. personal income distribution. Like the summary measures of inequality in Figure 4.2, the changes in cumulated household

decomposition of the simple Gini coefficient, a so-called location statistics provides a further possibility for taking the overlapping of subgroup income distributions into consideration. Location statistics makes use of the probability that an randomly chosen income from an income distribution is higher than that one chosen from another income distribution. Cf. Pierce and Welch (1994), whose findings are presented in Table 4.1.

incomes by quintil confirm the suggested trend as well: while the lower quintils up to the middle fifth were losing in the last three decades, the upper two quintils were gaining. If changes in the top five percent's share were additionally taken into consideration this impression increases. Comparing somewhat arbitrarily average shares of this part of the income distribution for the seventies, eighties and nineties shows an increase from 16.3 percent in the seventies to 17 per cent in the eighties to 20.5 percent in the nineties. In a word, there must have been a trend towards increased inequality favouring higher income households. This also means changed income distances, since changes in shares imply changes in distances. If a group's share increased with another group's share decreasing, the income distance between

Table 4.2

**Percentage Change of U.S. Family Incomes in
Real Absolute Percentiles, 1967 to 1987**

	Family Income Percentile									
	Families					Families and Unrelated Individuals				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
67-73	21.9	12.4	17.3	20.6	21.8	24.5	11.9	13.4	18.3	19.4
73-79	-1.2	0.2	3.4	5.0	6.2	0.3	-2.1	-4.0	1.4	2.9
79-87	-8.7	-1.4	2.4	7.7	10.1	-6.4	-2.6	1.3	4.7	8.6

Source: Karoly, 1993, p. 32.

the two groups would increase. At this point it should be mentioned that nothing at all is said about income mobility. It is straightforward that in a dynamic economic context some households would have gained while others would have lost, but unlikely that only low and middle income households' positions worsened. Whereas formerly higher income households may have moved to the lower range of the income distribution, the position of some lower and middle income households may have improved, now finding themselves in the upper range of the income distribution.

As well, Karoly (1993) examines average income changes in selected family income percentiles. Interestingly her division into periods partly covers the above sequence following Levy (1995). Unlike the period 1967 to 1973 when incomes of the two percentiles belonging to the lower tail of the income distribution were still increasing, in the periods 1973 to 1979 and 1979 to 1987 incomes were either stagnating or even decreasing, as shown in Table 4.2. Once again these findings suggest a trend towards more inequality. In order to test this result for robustness Karoly (1993) analyses the same income percentiles on the basis of an extended family definition finding the main trends confirmed.

An increase of family income inequality for the period from the end of the seventies to the beginning of the eighties was also found by Bishop, Formby and Smith (1991) who use the CPS data set, although the degree of inequality stabilized in 1986, the end of the period under consideration. From a methodological point of view the authors apply a more sophisticated inequality measurement concept by

means of Lorenz dominance analysis, compared to the studies introduced so far. This concept offers important advantages when income distributions are compared intertemporally, cf. Section 2.2.

To illustrate the change in relative income positions, Karoly (1993) analyses an adapted family income which is the quotient of absolute family income deflated into 1967 prices and the official 1967 poverty threshold. That is, Karoly (1993) investigates family income measured relative to a sound poverty threshold. For the eighties, the change of this constructed income shows serious deterioration in the income situation of families at the bottom of the income distribution relative to the official poverty threshold. The finding of increased family income poverty in the eighties motivated Blank (1991), Blank and Card (1994) and Cutler and Katz (1991) to examine whether this increase was induced by increasing wage inequality, mainly driven by the deteriorating position of low-skilled and unskilled workers. In particular, Blank (1991) finds strong evidence in favour of this hypothesis.

This more specific hypothesis regarding how changes in the functional distribution of income and changes in the personal distribution of income at the lower tail of the income distribution may interact was put more generally: can the changes in the functional distribution of labour income in the eighties be made responsible for the increase in overall inequality of the personal distribution of income? In this connection, it should be kept in mind that labour income is still the most important component of the majority of family incomes. But increasing inequality in labour incomes does not necessarily imply a corresponding change in family income inequality, i.e., the personal income distribution. Disaggregation of household income showed that the labour supply of one household member could increase due to the decrease in labour income earned by another household member, for example. With regard to total household income, endogenous labour supply decisions within households possibly offset effects resulting from the decrease in factor prices or from the decrease in employment of certain labour skills. Consequently, despite changes in the functional distribution of labour incomes, household income inequality might be rather stable because such effects offset the decrease of functional labour incomes. Though Juhn and Murphy (1997) find no evidence for such endogenous labour supply effects within households of couples at the lower tail of the income distribution by analysing CPS data of married couples for the period 1967 to 1991, there is still a lack of broader evidence as to the relevance of such effects.

Irrespective of whether there was a causal link between decreasing male earnings and the one hand and female labour supply decisions on the other, Cancian, Danziger and Gottschalk (1993) find that inequality in incomes of married couples increased and would have increased even more without opposite effects due to female labour market participation and female labour incomes. The authors analyse the change in inequality of female and male earnings from 1968 to 1988 and find support not only for a strong increase in male earnings inequality, but also for an increase in the inequality of family incomes for all demographic groups considered. Comparison of cross-sectional data of the changes in both labour market participation and female incomes for married couples shows changes having partly compensated increasing inequality in household incomes due to decreasing male incomes. An overview of the

data, procedure and results of Cancian, Danziger and Gottschalk (1993) is presented in Table 4.3.

Descriptively, inequality measures decomposable with respect to income sources provide information on changes of inequality of single income components underlying the changes of overall income inequality. However, the Gini coefficients shown in Figure 4.2 do not provide any evidence as to the contribution of different income sources to changes in inequality. Therefore, Karoly and Burtless (1995) decompose the standard Gini coefficient following the method developed by Lerman and

Table 4.3

The Development of Family Incomes in the U.S.

Study	Cancian, Danziger and Gottschalk (1993)	Karoly (1993)
Data	CPS income data for 1968, 1978 and 1988; persons aged 18 to 64 divided into three demographic groups: married persons, heads of household and other adults	CPS data 1964 to 1990; analysed income recipient units: families, families with children, unrelated individuals and all individuals
Measures	Coefficients of variation and Gini coefficients; analysis of labour income's fraction of men and women in six different income groups; change of labour market participation of women related to their spouses' income position; distance of married couples' incomes from the official poverty threshold	Gini coefficients; changes in percentile ratios; change in percentiles relative to median income; change of absolute income class shares; variance of logarithm of income
Findings	Income inequality between all families distinguished by the demographic categories gender, race and ethnicity increased	Since the mid-seventies increase in the dispersion in both the lower and upper tails of the distribution of family incomes

Yitzhaki (1985), cf. Section 2.2. Then, with a further step this decomposition is transformed, so that intertemporal changes of the Gini coefficient can be analysed. The Gini coefficients calculated by Karoly and Burtless (1995) not only differ by decomposition from those calculated by the Census Bureau, they also differ by data grouping. First, the authors sketch a more complex household structure when per-capita incomes are determined: not only are economies of scale within households taken into consideration by the application of equivalence scales, but families are defined as a household subgroup. Second, their analysis concentrates on families with at least one working member aged 25 to 64. For the eighties, the authors find that increasing inequality of incomes earned by male workers was the driving force behind the increase in household income inequality. This result is robust to the integration of family incomes where heads of household are either older than 64 or younger than 25 and thus not supposed to be part of the economically active population. Hence, for the U.S. in the eighties the importance of changes in the functional distribution of income with regard to changes in the personal income distribution is once again confirmed.

Undoubtedly, the change in the functional distribution of labour income discloses why inequality of the personal income distribution in the U.S. increased during the eighties. Or, as Cancian, Danziger and Gottschalk (1993, p. 317) put it: *The largest single factor contributing to the increased inequality in family income was the rising inequality of husbands' earnings.* This conclusion is also confirmed by Karoly's (1993) analysis of family incomes and their composition, as well as labour incomes distinguished by demographic characteristics since the end of the sixties. Furthermore, additional evidence is provided by those studies cited above, which deal with changes in the lower range of the income distribution and, in particular, with increasing poverty during the eighties. Consistent with these findings, Gottschalk and Smeeding (1997, p. 641) summarize: *At this point there is a wide consensus in the research community that an important driving force behind the increase in family income inequality in the United States was the increased dispersion of earnings.* Or in terms of distributional analysis: empirically, an unambiguous and significant relationship between the change in functional income distribution and the personal income distribution has been found.

The trend towards increasing inequality of the personal income distribution observed for at least one decade beginning in the early seventies points to another important aspect: the decrease in inequality of the personal distribution of income from the end of World War II up to the end of the sixties seemed to confirm Kuznets' (1955) hypothesis of an U-shaped change in inequality over the structural transformation process undergone by highly developed economies. However, Kuznets (1955) had only fragmentary and insufficient data for hypothesis testing. He did not try to prove his hypothesis empirically, neither did he formulate a consistent theoretical model: *The paper is perhaps 5 per cent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking. ... The ... excuse is that the subject is central to much of economic analysis and thinking* (Kuznets, 1955, p. 26).³ Nevertheless, his hypothesis has become an influential working concept on structural change and income distribution.

Taking the Kuznets hypothesis as a starting point, Nielsen and Alderson (1997) analyse U.S. income data from 1970 to 1990, the period whose astonishing changes in income disparity stimulated the wage gap debate. For this period, the authors do not find evidence in favour of structural industrial change having contributed to a decrease in income inequality offsetting the increase in inequality by otherwise caused demand shifts or supply shocks. On balance, from the authors' point of view other factors seem to have been the driving force towards increasing income inequality. As international trade induces sectoral change, cf. for example the basic Heckscher-Ohlin model, one could therefore speculate by indirect conclusion that this is a piece of evidence against international trade as a driving force behind changes in income inequality. Hence, against the background of the trade and wages literature, in following sections the point at issue shall be whether and to what extent the process of economic internationalisation has contributed to increasing inequality of labour incomes distinguished by different labour skills.

³Since then, there were many attempts to empirically prove the Kuznets hypothesis. An empirical study using German historical income data is Dumke (1991).

4.3 Economic Context

The evidence provided by income distribution analysis discussed so far can be summarized in two main findings:

1. During the eighties, there was a clear trend towards increased labour income inequality.
2. The increasing labour income disparity occurred between different labour skills.

These two stylised facts reflect the motivation of a broad academic debate on possible conditions and causes underlying this income inequality trend. In this connection, both theoretical and empirical contributions developed hypotheses which can be classified according to the following categories:

1. shifts in labour demand due to
 - (a) low-skilled and unskilled labour biased technological progress,
 - (b) the process of economic internationalisation,
2. shifts in labour supply, and
3. institutional changes.

Hypotheses falling in the first and second category are interested in changes in the qualification structure of labour demand and labour supply. Hypotheses falling in the third category focus on changes in trade union influence, cf. Freeman (1992), changes in minimum wage legislation, or changes in transfer systems.

Studies from a labour economics point of view mainly apply partial equilibrium approaches. They concentrate on shifts in labour demand and labour supply. Furthermore, on the labour demand side two different groups of hypotheses are competing: first, a labour demand shift due to low-skilled and unskilled labour intensive import competition replacing domestic production. In perfect competitive partial equilibrium this labour demand shift implies a decrease in wages earned by low-skilled and unskilled workers, *ceteris paribus*. The second group of hypotheses expects low-skilled and unskilled labour biased technological progress to shift labour demand. Once again, in perfect competitive partial equilibrium, this implies a shift in labour demand thus decreasing wages of low-skilled and unskilled workers.

On the supply side, economic, demographic and sociological causes of labour supply shifts were analysed. Examples of such causes are labour market entry of high birth-rate cohorts, skill upgrading and graduates or increasing female labour market participation. For the seventies, there is strong evidence in favour of such factors having shifted labour supply. During that decade, a significant change in the qualification structure of graduates towards higher qualifications was taking place, concisely summarized by Levy and Murnane (1992) and for which Baldwin and Cain (1997) find further evidence. A consequence of this increased relative supply of skilled labour was a decrease in the skill premium, i.e., an effect in relative prices opposite to the one pushing the trade and wages debate. Amongst other things, it was this supply shift that suggested careful analysis of whether a positive shift of low-skilled and unskilled labour supply caused the increase in the skill premium

in the eighties. However, evidence for such a positive shift was not found. On the contrary: while supplies of low-skilled and unskilled labour were either stagnating or even decreasing, the supply of high-skilled labour increased comparable to the seventies. The data used by Harrigan (1998), who distinguishes qualification by the highest secondary school qualifications and university degrees, underline these findings.

Partial equilibrium contributions to the trade and wages issue taking a labour economics point of view treat international trade exogenously. By and large this is also the case for technological progress. International trade and technological progress are not explained by the models themselves. By contrast, a small number of studies build upon general equilibrium models when empirically analysing repercussions between economic internationalisation on the one hand and the change in the functional distribution of labour income on the other. Following the tradition of the classical trade theory with perfect competitive goods and factor markets, international trade is analysed as an endogenous phenomenon. If all relevant markets exist in the sense of the law of the one impersonal price, these models explain incentives for international goods trade, and the trade structure as well as repercussions between international trade and national factor rewards by the transmission mechanism of factor price dependence, and thus potential causes of the increasing qualification wages gap. Furthermore, this kind of analysis takes income effects into consideration.

However, in these models technological progress is usually assumed to be exogenous as well. One reason may be the static nature of these models. Technological change is only modelled as exogenous technological shocks. But endogenizing technological change offers important insights into repercussions between technological progress on the one hand and relative factor prices of different labour skills on the other. There have recently been promising approaches to integrate the dynamic nature of technological change within the trade and wages debate, an example being the model by Dinopoulos and Segerstrom (1999). Another important reason is the lack of incentives for firms to invest in R&D in the perfect competitive model. There, with zero profits in equilibrium, the number of firms is indeterminate so that firms do not exist in the sense of supernormal profit possibilities. A remedy is to introduce imperfect competition when modelling firms.

At first sight, the introduced classification of suggested causes of the increasing qualification wage gap during the eighties in the U.S. neglects repercussions between technological progress and the process of economic internationalisation, too. Nevertheless, this kind of interdependence seems to be essential. This becomes obvious in several respects: looking at the discussion on causes underlying increasing openness of goods and factor markets showed that apart from political economy and welfare economic approaches, technological change in transportation and communication seems to have been an important force driving the process of economic internationalisation. International trade induced R&D effects on less developed economies serve as an additional example of repercussions between the process of economic internationalisation and technological progress. Coe, Helpman and Hoffmaister (1997) analyse spillover-effects among 22 industrialized countries and 77

developing countries. They find significant empirical evidence in favour of R&D spillover-effects in the period from 1971 to 1990. Therefore, in the subsequent section methodological differences inherent in selected approaches to analyse causes and conditions of the increase in income disparity of different labour skills will be at the centre of interest.

But how to organize such a complex debate? Originally, the trade and wages debate was motivated by the astonishing empirical income distribution facts of the seventies and the eighties. The debate could thus be organized by first providing the evidence and then the contributions of theory explaining income distribution changes in a world of economic internationalisation and dynamic technological change, or vice versa. In order to link the relevant aspects of theory and empirical evidence more exactly, the strategy chosen will try to integrate both perspectives on the basis of the benchmark considerations in Section 4.1. Moreover, this procedure will render missing links more obvious.

5

Classical Theorems – Insights in Trade and Wages Issues?

5.1 The Inter-Industry Trade and Wages Logic of the Stolper-Samuelson Theorem

Section 4.1 showed a model framework with perfect competitive factor and goods markets. As implied by perfect competition, all production factors were always fully employed. Neither skilled nor unskilled labour suffered from involuntary unemployment. Price signals ensured factor market equilibriums. Looking at the long run performance of U.S. labour markets this assumptions seems to be a reasonable approximation, cf. Section 3.3. The Stolper-Samuelson framework outlined in Subsection 3.2.2 serves as one of the main benchmarks of the trade and wages debate, at least from a trade theoretical point of view. In order to become able to classify and to evaluate empirical contributions, application of the Stolper-Samuelson link to the trade and wages puzzle shall be analysed in detail. At the core of the Stolper-Samuelson effects is factor price dependence. Relative goods price changes are expected to induce changes of the functional distribution of labour incomes.

The strongest distributional implications are made by the basic version of the Stolper-Samuelson theorem. This versions restricts the model economy not only to the symmetric case of an equal number of goods and factor markets but even to two goods and two factor markets. Naturally, for an analysis framework to be applied to the trade and wages link, this means an economy with two factors – skilled and unskilled labour – and two goods markets. Moreover, one goods production has to be more skill-intensive compared to the other. Such a two-by-two model has to aggregate two labour qualities to represent two average skills. In this case the Stolper-Samuelson matrix and the Rybczynski matrix become

$$\begin{aligned} \begin{bmatrix} \frac{\partial w_1}{\partial p_1} & \frac{\partial w_2}{\partial p_1} \\ \frac{\partial w_1}{\partial p_2} & \frac{\partial w_2}{\partial p_2} \end{bmatrix} &= \begin{bmatrix} Y_{v_1 p_1} & Y_{v_2 p_1} \\ Y_{v_1 p_2} & Y_{v_1 p_2} \end{bmatrix} \\ &= \begin{bmatrix} Y_{p_1 v_1} & Y_{p_1 v_2} \\ Y_{p_2 v_1} & Y_{p_2 v_2} \end{bmatrix} = \begin{bmatrix} \frac{\partial x_1}{\partial v_1} & \frac{\partial x_1}{\partial v_2} \\ \frac{\partial x_2}{\partial v_1} & \frac{\partial x_2}{\partial v_2} \end{bmatrix}. \end{aligned} \quad (5.1)$$

Let v_1 denote skilled labour earning w_1 and let v_2 denote unskilled labour earning w_2 . Let good x_1 be the skilled labour-intensive good and let good x_2 be the unskilled labour-intensive good. Furthermore, let the U.S. as a highly industrialized country be abundant in human capital. Hence, the U.S. has a comparative advantage in good x_1 . Following this logic the trading partner is assumed to be abundant in unskilled labour.

Calling the main structural characteristics of the process of economic internationalisation to mind, the preceding scenario means a focus on repercussions between inter-industry trade implied by relative goods price changes and the functional distribution of labour income. Consequently, in the resulting trade pattern, the U.S. exports skilled labour-intensive good x_1 and imports unskilled labour intensive good x_2 , i.e., the focus is on trade between North and South.

For the U.S., the trade equilibrium would imply an increase in relative goods price x_1 . For this case Jones (1965) shows that

$$\hat{w}_1 > \hat{p}_1 > \hat{p}_2 > \hat{w}_2. \quad (5.2)$$

This is the magnification effect.¹ If the price of the unskilled labour intensive good x_2 decreases due to moving to a new trade equilibrium, the scarce factor of unskilled labour unambiguously loses. The functional distribution of income shifts in favour of skilled labour and the qualification wage gap increases.

In addition, the signs of the Stolper-Samuelson matrix, i.e.,

$$\begin{bmatrix} \frac{\partial w_1}{\partial p_1} & \frac{\partial w_2}{\partial p_1} \\ \frac{\partial w_1}{\partial p_2} & \frac{\partial w_2}{\partial p_2} \end{bmatrix} = \begin{bmatrix} + & - \\ - & + \end{bmatrix}, \quad (5.3)$$

show that while v_1 gains absolutely, unskilled labour v_2 loses absolutely when the price of x_2 decreases with a relative price increase of x_1 .² Empirical testing of the causes underlying the increased qualification wage gap building on this approach thus requires relative price increases of skilled labour-intensive goods. As will be explained in Section 5.2 this question has become the object of a controversial empirical debate.

By aggregating two goods and two factors the model has severe aggregation problems. It reduces the wage gap analysis to the distance between two average incomes representing two income groups distinguished by skill. The problems that arise out of such classification attempts were explained in Section 2.4. Moreover, stylised facts covering the changes in the U.S. labour income distribution not only revealed an increasing wage gap among skilled, low-skilled and unskilled labour respectively, but also significant changes in the degree of inequality within qualification subgroups, cf. Table 4.1. These changes are neglected if average incomes of two aggregated labour qualifications are formed to analyse changes in the income distance between the two groups. A remedy would be to integrate modelling of subgroup income distributions leading to Borsook (1987), whose approach will be introduced later.

¹The hat denotes the growth rate, i.e. $\hat{w}_i = \frac{dw_i}{w_i}$. Appendix B.3 gives a standard proof of the magnification effect.

²See Appendix B.2. This version of the Stolper-Samuelson theorem is also called the strong one. See Deardorff (1993).

Finally, a note concerning terminology: in the following sections when two production factors are modelled, skilled and unskilled labour are meant. However, because using two factors means forming labour income averages of two labour subgroups in the focused highly developed economies, the average of the less-skilled workers terminologically would be better approximated by low-skilled labour. In addition, in highly industrialized countries there is a clear secular trend towards a decreasing share of workers lacking any formal qualification, as shown, for the case of Germany by Tessaring (1994).

Positive analysis of links between changes in relative goods prices and changes in relative factor prices by means of the Stolper-Samuelson theorem relies on assumptions that have to be taken seriously with respect to problem orientation. Above all, the economy under consideration must always be diversified. As to distribution analysis, another problem with the procedure is the assumption of a representative household. The simplest and frequently proposed solution is a multihousehold economy with each household possessing one of the production factors. In the two-by-two model with two different labour skills, this means each factor labour is assigned to a household. Calling to mind North-South inter-industry trade and its expected distributional effects, the household owning unskilled labour would lose, whereas the household owning skilled labour would gain. This result is independent of the households' consumption patterns. Clearly, this line of reasoning often found in the literature is nothing else but the simple translation of the functional distribution of income into the personal distribution of income.

5.2 Inter-Industry Trade and Endogenous Changes in Labour Supply – Endowment Considerations

Unlike the Stolper-Samuelson matrix that deals with changes in goods prices, the Rybczynski matrix in (3.34) allows changes in endowments to be analysed. Such changes can be due to both exogenous and endogenous factor supply changes. In the trade and wages context, endogenous labour supply decisions can be expected from relative factor prices changes. As will be shown, in Findlay and Kierzkowski (1983), the underlying idea is that changes in terms of trade induce incentives to accumulate human capital, thereby changing the economy's long-run human capital endowment. By analogy with the Stolper-Samuelson chain in (5.2),

$$\hat{x}_1 > \hat{v}_1 > \hat{v}_2 > \hat{x}_2 \quad (5.4)$$

can be derived. If the endowment with one factor increased, *ceteris paribus*, its increase would be smaller than the growth of goods production that is intensive in this factor. Additionally it will exceed the other goods production change. The economic idea is, that with the new endowment still lying inside the diversification cone and therefore unchanged factor prices, sectoral reallocation of factors has to ensure zero profit conditions to hold, and factor market equilibrium conditions to be satisfied. For the two-by-two case in the case of the Rybczynski effect, a strong

relationship also holds, cf. Rybczynski (1955):

$$\begin{bmatrix} \frac{\partial x_1}{\partial v_1} & \frac{\partial x_1}{\partial v_2} \\ \frac{\partial x_2}{\partial v_1} & \frac{\partial x_2}{\partial v_2} \end{bmatrix} = \begin{bmatrix} + & - \\ - & + \end{bmatrix}. \quad (5.5)$$

That is, if the endowment with human capital increases caused by an endogenous labour supply effect, goods production x_1 intensive in this factor goes up. By contrast, unskilled labour intensive production x_2 clearly decreases. For the trade and wages scenario this finding means strong predictions with respect to structural change, provided that there are endogenous human capital supply effects.

5.3 Trade, Wages and the Gains from Trade

The above discussion on Stolper-Samuelson effects and the above factor endowment considerations concentrated interest on the positive analysis of repercussions between international goods trade and the functional labour income distribution in highly developed countries thus giving a benchmark for a positive analysis of the trade and wages link. In order to find empirical evidence of whether international trade really contributed to the increasing inequality in the functional distribution of labour income, this benchmark suggests testing for signs of the link between relative goods prices and relative factor prices. Yet, there are many problems inherent in the measurement of relative goods prices. In comparison, measurement problems inherent in the factor content of trade approach competing with direct linking of relative goods price changes and relative factor price changes do not seem so severe. This alternative approach establishing a direct link between the factor content of trade and relative wages will be discussed in detail in Section 6.2.

The factor content of trade approach to search empirically for the causes of changing relative factor prices was theoretically founded by Deardorff and Staiger (1988), for example. However a main shortcoming of the Deardorff and Staiger (1988) contribution, a study taken as a basis by many authors, is the neglect of welfare economic issues. To neglect welfare economics issues in the debate on trade and wages, means to neglect one of the most essential elements constituting the explosive force of the trade and wages puzzle. From an economics point of view, the debate on distributional effects can not be meaningfully developed if welfare implications of trade are ignored. It is well known that the first best equilibrium outlined in Subsection 3.2.2 implies a welfare optimum in autarky. Starting from such an autarky equilibrium, trade theory gives strong arguments in favour of economic opening by proving that under certain conditions welfare gains emerge from international trade. If there were unwanted distributional effects due to economic internationalisation from a certain normative point of view, welfare effects would have to be taken into consideration before paying attention to the question of redistributive policies.

A small open economy characterised by perfect competitive goods and factor markets opening up in the sense of moving to an equilibrium with an increased number of goods tradable serves as a benchmark for the gains from trade analysis. In an original trade equilibrium goods demand has always to equal goods supply for all

nontradeable goods, i.e.,

$$x_j^d = x_j^s \quad \text{and} \quad \sum_{h=1}^z x_j^{dh} = x_j^s \quad \text{for } j = 1, \dots, n - r \quad (5.6)$$

in the case of a multihousehold economy respectively. Clearly, goods $j = n - r + 1, \dots, n$ have been the tradable goods in the original equilibrium. Trade leads to further degrees of freedom, so that the value of demand equals the value of supply for each good additionally tradable. For the example of another tradable good in the new trade equilibrium, restriction (5.6) is relaxed. Hence

$$p_j x_j^d = p_j x_j^s \quad \text{and} \quad p_j \sum_{h=1}^z x_j^{dh} = p_j x_j^s \quad \text{for } j = n - r - 1, \dots, n \quad (5.7)$$

for a multihousehold economy. This additional degree of freedom induces a welfare gain.

In a world with perfect competitive goods and factor markets, moving from autarky to free trade as well as moving from one trade equilibrium to another, leads to welfare gains due to an increased number of tradable goods, in the case of a small open economy. It is just such a shift from one trade equilibrium to another that would indicate the comparative static intuition of a deepening internationalisation of final goods markets as part of the process of economic internationalisation. Only if the assumption of a small open economy is given up, the terms-of-trade effect might offset welfare gains stemming from the larger degrees of freedom when moving from one trade equilibrium to another.

The message of the argument outlined above is that the trade and wages debate may not only deal with the analysis of effects of economic internationalisation on the functional distribution of income but also with welfare effects. To consider both kind of effects is critical to arguing about compensation mechanisms in favour of those who might have lost from deeper international economic integration in a regional as well as in a global sense. Finally, in a world of second-best, the analysis of welfare effects and distributional effects cannot be treated separately any longer.

In principal, from a welfare economics point of view a trade and wages analysis must consist of two elements: distributional analysis as well as welfare analysis. With respect to both distributional and welfare effects due to international economic interaction, a trade and wages debate has to consider different types of international trade, for classification cf. Subsection 1.2.1. These types of economic interaction have to be described and their conditions be clarified. Thus, a comparative trade and wages analysis focusing Germany and the U.S. must at least take the following issues into consideration:

1. The two countries trade with the rest of the world. Assume the rest of the world to comprise only less-developed countries. Compared to those, in some important respects Germany and the U.S. are similar. Examples are technology, labour force composition and overall factor endowment. Theories of factor abundance have tried to explain why countries with different factor endowments trade with each other. However, similarity in the sense of

factor abundance naturally does not mean that inter-industry trade affects Germany and the U.S. the same way. This is the idea underlying the flip-side hypothesis, cf. Section 3.3. Hence, different distributional effects due to international trade requires the identification of relevant differences between the U.S. and Germany. An immediately striking characteristic is differences in labour market institutions. Furthermore, differences include the educational system especially the German vocational school system and differences in public transfer and social security systems, cf. Esping-Andersen's (1990) classification of welfare states outlined in Section 1.3.

2. Germany and the U.S. trade with each other. This trade is mainly intra-industry. Explanation approaches have to go beyond factor abundance considerations, albeit differences in factor endowment due to different systems of general educational and vocational training systems can not be neglected.

5.4 Reinterpreting the Heckscher-Ohlin Model

As emphasised in Section 1.1 increasing competition from countries abundant in low-skilled and unskilled labour represents a main part of the globalisation debate's folklore. Because the Heckscher-Ohlin model deals with inter-industry trade due to factor endowment differences and because it provides strong predictions as to distributional effects induced by two countries opening to trade, this model also played a prominent part in theoretically founding the trade and wages debate. As will be shown later parts of the empirical debate rests on this model's logic.

In order to explain this model's popularity and to explain why this model is of only limited use to the trade and wages debate, its most important features shall be reviewed. As parts of the Heckscher-Ohlin model, the factor price equalization theorem and application of the Stolper-Samuelson theorem describe the relevant repercussions between international trade in final goods and the functional distribution of income. First, international goods trade leads to international equalization of the functional distributions of income. Second, the national functional distributions of income will change according to the prediction of the Stolper-Samuelson theorem in its two-by-two version. However, these results rely on rather restrictive assumptions.

In the model's original notation, physical capital and labour were assumed to be perfect symmetric production factors supplied and demanded on perfect competitive factor markets. Consequently, the focus was on the functional distribution of income. In order to theoretically found the empirical analysis of the trade and wages link, many studies simply renamed the two production factors as skilled and unskilled labour, so that both labour factors would always be fully employed with the factor supply completely price inelastic. Furthermore, whereas factors are assumed to be perfect mobile and perfect substitutes within countries, internationally factors are immobile.

The assumption of only two production factors is not the only restrictive assumption behind the Heckscher-Ohlin model and its results. In the standard model two

countries produce only two goods by means of two factors. With production technologies internationally identical and constant returns to scale, all goods markets exhibit perfect competition. Applied to the trade and wages puzzle, while one goods production is intensive in skilled labour the other goods production must be intensive in unskilled labour. The representative households' internationally identical preferences are of the homothetic type.³

By assumption, the only distinction between the two trading countries are different factor endowments. With respect to the analysis of the causes underlying the increased qualificatory wage gap the assumption of the U.S. as a highly developed country abundant in human capital and the less-developed rest of the world abundant in low-skilled and unskilled labour is straightforward. Hence, compared to the less developed rest of the world, the U.S. produces more of the skilled labour intensive good in autarky. Because of a comparative advantage in this good being reflected in a lower relative goods price the U.S. would thus export the skill intensive good. By contrast the unskilled labour intensive goods would be imported accompanied by an increase in the skilled labour intensive export goods price. This holds under the assumption of both countries continuing to be diversified and under the exclusion of factor intensity reversals. Formally, in the long run equilibrium the two countries produce inside the same diversification cone. Therefore, factor price equalization in the sense of equalization of the functional distribution of incomes necessarily results. By the Stolper-Samuelson theorem, both the factor that loses and the factor that gains can be identified: whereas the domestic price of skilled labour rises, unskilled labour not only loses relatively but also absolutely, thus providing an explanation for the increasing wage gap in the U.S., cf. Section 5.1.

With respect to the Heckscher-Ohlin model's power to explain the increasing U.S. qualificatory wage gap, empirically unskilled labour intensive goods prices should have risen. Once again Stolper-Samuelson effects are of special importance, which are relevant in a much more general framework than the Heckscher-Ohlin model. Whether there are clear-cut empirical findings on relative goods price changes in the U.S. during the period of interest has to be postponed to the following chapter. Furthermore, if the Heckscher-Ohlin model is taken seriously another empirical implication would be increasing relative prices of low-skilled and unskilled labour in the rest of the world. Apart from measurement problems and lack of evidence, at this point the questionable nature of assuming international homogeneous production factors gains significance. Or differently put: different labour qualities in countries at different development stages are far from identical. This point sheds light on the importance of internationally different human capital production functions in the context of the trade and wages debate.

Theoretically, the two-by-two Heckscher-Ohlin model with its two production factors interpreted as two different labour skills undoubtedly provides a straightforward explanation of the increasing qualificatory wage gap. The model's welfare economics implications also show that despite gains from trade, losers only would be made bet-

³Note that homothetic preferences are not a necessary condition but a sufficient condition for Heckscher-Ohlin results.

ter off, and thus be compensated, if welfare gains were redistributed. Without such redistribution, free trade possibly generates undesirable distributional effects.

In summary, both the structure and assumptions of the Heckscher-Ohlin model raise several important issues concerning its explanatory contribution to the trade and wages puzzle:

1. The two-by-two Heckscher-Ohlin model works with two homogenous and symmetric arbitrarily denominated production factors that exhibit perfect mobility between sectors. Furthermore, the long run orientation of the model becomes obvious because, at least in the shorter run, sector-specific physical capital and human capital is a realistic assumption.
2. The assumption of only two aggregated production factors restricts the analysis to the functional distribution of labour incomes. Combining production-side determination of the functional distribution of labour income and goods demand derived from utility maximization by a representative household characterised by homothetic preferences the analysis completely neglects personal distribution of income issues. In any case, in a model with only two factors there is no meaningful distinction of households except for two households endowed with different labour skills, a distinction undoubtedly ignoring stylized facts. A further essential problem is the neglect of inequality within the two aggregated groups of labour. Empirically such changes seem to have been of undeniable importance, cf. Section 4.1.
3. In comparison to the concept of factor price dependence, the concept of factor price equalization is a very special concept relying on restrictive assumptions. Albeit some empirical evidence in favour of factor price convergence has been found, factor price equalization has been widely contradicted by the majority of empirical studies, cf. Leamer (1995). Yet, as Leamer (1995) emphasises, this must not mean giving up the empirical search for factor price equalization, since it is a benchmark model that perhaps allows unsatisfied assumptions preventing factor price equalisation to be identified.
4. Only in the case of two goods and two factors does the Stolper-Samuelson theorem hold in its strong version, and consequently so do its results concerning repercussions between international trade and the change in the functional distribution of income.
5. The Heckscher-Ohlin explanation approach solely focuses on inter-industry trade, which is a perfect substitute for factor mobility. Even if inter-industry trade covers those features of the process of economic internationalisation that bring interaction between highly developed countries and developing as well as emerging market economies into focus, important differences in technology between these countries are completely ignored by assuming globally identical and available production technologies.

The last point is of special importance for another reason: Chapter 1 distilled the stylised fact that growth in intra-industry trade between economies of similar sectoral structures and similar development stages has particularly characterised the recent process of economic internationalisation.

Despite all justified criticism, the Heckscher-Ohlin model's prominence as a working horse model to analyse the trade and wages topic can be understood by this model framework not only providing clear-cut results as to distributional and welfare changes in the trading countries but also offering a structural model of two countries' economic interaction. Calling to mind the classification system of international trade in Section 1.1 as well as the stylised empirical facts presented in Subsection 1.2.1, the following can be concluded: to give the trade and wages debate a more thorough analytical basis, models should depict interaction and repercussions between at least two different types of countries. For the case of two similar economies like the U.S. and Germany that move from one trade equilibrium to another when trade relations are intensified, a model that focuses on intra-industry trade would be indispensable. By contrast, against the background of stylised facts trade between highly developed countries and less developed countries is mainly covered by inter-industry trade. Furthermore, it is this scenario that grasps the provocative features of the locational competition debate introduced in Chapter 1.

5.5 On How to Justify the Application of Two Factors Models to the Trade and Wages Problem

Continuing this line of reasoning leads to multi-country models. An exhaustive model of the trade and wages problem would have to cover not only the types of economic interaction explained above but to integrate them into a model of the global economy. In consequence, such a model would have to model at least three types of countries, not only depicting intra-industry trade as well as interindustry trade between differently endowed economies, but also different labour market scenarios with factor price rigidities in the German economy type. And to return to another important feature of the process of economic internationalisation: such a model would have to trace out how foreign direct investment works. Obviously, this would be an exercise of dramatic complexity.

Before empirical issues will be discussed, the analysis will return to attempts that have tried to justify complexity reduction by reinterpreting factors in the two factors model in the sense of two different labour skills. Like other authors, Krugman (1995) applies the methodology by Stolper and Samuelson as well as Rybczynski to an economy with the two production factors of skilled and unskilled labour. Physical capital is ignored. Krugman (1995) justifies his approach by means of an empirical argument: in the U.S. the wage bill seems to have been roughly constant during the seventies and the eighties. For Cline (1997) this alleged stylised fact is one of the main reasons why income distribution analysis up to now has concentrated on the functional distribution of labour incomes. The hypothesis of a stable wage bill in the long run underlies this argument. This hypothesis of a long-term stable macroeconomic functional distribution of income has also become known as Bowley's Law. Krämer (1996) recently critically analysed this hypothesis considering different wage bill concepts.

Certainly, in the U.S. the wage bill seems to have been relatively stable over long periods of time. If the wage bill in fact was rather stable, a Cobb-Douglas production

function would thus be an appropriate approximation to model long-term U.S. production. By contrast, in the same period in Germany the wage bill fluctuated considerably, cf. Bedau (1990), Henschel (1987) and Krämer (1996), with respect to the change in the macroeconomic wage bill. This also applies to the wage bills of other large European economies, cf. the French case documented in OECD (several volumes a). From an empirical point of view, Krugman's (1995) justification of ignoring the factor physical capital is therefore not well-founded, in particular when he models the European scenario. Besides, because of aggregation problems one should be aware of the wage bill being a macroeconomic concept, since Krugman (1995) aims at the analysis of allocative effects due to economic internationalisation. In a word, the problem is that Krugman (1995) backs up his allocative analysis with the empiricism of the wage bill.

On the other hand, equation (3.22) raises a theoretical objection: factor prices are functions of goods prices and factor endowments. Hence, a change in goods prices implies a change in the capital rental as well. A sole change in the functional distribution of labour income due to a change in goods prices thus has to be contradicted theoretically. Consequently Krugman's (1995) analysis required an additional theoretical explanation of the wage bill's constancy. Another severe problem arises from the model's reduction to two different labour skills because the two labour factors are no longer homogeneous of degree one. Finally, Krugman (1995) emphasises his interest in the personal distribution of labour incomes. With respect to the concepts developed in Section 2.1, however, Krugman (1995) merely analyses the functional distribution of labour incomes.

First of all the debate will now return to empirical issues of the trade and wages debate. In the following section, a common, purely descriptive approach to describe changes in employment and income shares will be presented. These changes serve as a basis for economic interpretation using the Stolper-Samuelson concept.

6

International Goods Trade

6.1 From Measuring Without Theory back to Theory

The decomposition of price and quantity effects aims at a descriptive identification of what could have caused changes in labour demand leading to a change in relative wages. Identification of whether there were within-industry or between-industry changes allows conclusions as to the forces having affected relative income positions to be drawn.

The procedure is to decompose a variable's total change into its components. This procedure will be demonstrated by the change of unskilled workers' relative income share of total labour income across industries. Let there be i industries. The change of the income share earned by low-skilled workers is decomposable into the change of the within-industry income share as well as the change of the between-industry share. Formally,

$$\Delta \frac{W_u}{W} = \sum_{i=1}^n \Delta \frac{W^i}{W} \left(\frac{1}{n} \frac{W_u^i}{W^i} \right) + \sum_{i=1}^n \Delta \frac{W_u^i}{W^i} \left(\frac{1}{n} \frac{W^i}{W} \right). \quad (6.1)$$

The first term W_u on the right-hand side represents the change of low-skilled workers' income share of total income W between the i industries. This share is formed by the sum of the relative change in total labour income earned in industry i times low-skilled labour's average share of total labour income in industry i . The second term on the right-hand side describes the change in the income share of low-skilled workers of the total income in industry i . That share is formed by the sum of the relative change of income earned by low-skilled workers of total labour income in industry i times the average income share of low-skilled labour in all industries i . Of course, the procedure in (6.1) is not restricted to only one period.

Decomposition analysis applied in this way represents a methodological approach to describe relative shifts in income shares both between and within subgroups. Subgroups are defined as industries, and the idea is to look for the industries where relative income shares of high-skilled labour changed significantly. Then, results can be interpreted against the background of consistent theoretical hypotheses catching the various causes of changing income shares of different labour qualities. However,

one should be aware that decomposition analysis is only a descriptive procedure without any deeper analytical foundation. Decomposition thus cannot stand on its own when the interaction between trade, technology and wages is to be analysed. Therefore, decomposition often serves as an input for econometric testing more or less based on sound theoretical hypotheses.

Decomposition into the contribution of between-industry changes and within-industry changes to changes in total employment and income respectively can also be carried out by sectors. For example, Berman, Bound and Griliches (1994) disaggregate total employment, ascribing shares to industries according to the categories of private consumption, imports and exports, and defense. By the assumption of fixed input coefficients, a stable link between employment and output in all sectors is ensured. The factor content of domestic consumption is modelled as consisting of the factor content of domestic production plus the factor content of imports for domestic private consumption. Thereby the authors isolate to what extent within-industry labour demand shifts took place. The Berman, Bound and Griliches (1994) example forges links to another trade and wages related decomposition analysis. As will be shown below, under certain assumptions there is a link between the factor content of trade and changes in the functional distribution of labour income.

But why use decomposition of employment and income to isolate within-industry and between industry shifts? The economic logic is to interpret within-industry shifts of factor demand as evidence in favour of technological progress leading to relative factor demand shifts and thus to relative changes in labour incomes. This hypothesis is then linked to the trade and wages puzzle by expecting international trade to shift goods demand between sectors. Hence, when factor intensities differ a relative labour demand shift would result. By contrast, within-industry shifts of labour demand are supposed to be inconsistent with factor movements between sectors induced by a change in relative goods prices when moving from one trade equilibrium to another. Since the Stolper-Samuelson theorem predicts relative wages for low-skilled workers to decrease when the relative prices of the low-skilled labour intensive good imported by the U.S. decreases, the implication would be an intersectoral reallocation of different labour skills. An example of this economic logic is Revenga (1992) dealing exclusively with between-industry effects. With respect to the outlined approach, her contribution works with the hypothesis of international trade as an expected cause of an employment shift between industries.

Bernard and Jensen (1997) criticize the use of highly aggregated data in the context of decomposition analysis. This seems to be reasonable not least because of the findings by Brown and Medoff (1989). The latter find a significant relationship between firm size on the one hand and both wage level and dispersion of wage differentials on the other. Furthermore, these findings do not only hold for U.S. data but also for German data. For the German case, empirical evidence in favour of a positive link between firm size and wage levels was found by Gerlach und Schmidt (1989), Schmidt and Zimmermann (1991) and Wagner (1991). For the periods 1973 to 1979 and 1979 to 1987, Bernard and Jensen (1997) therefore apply the decomposition method introduced above to plant-level data resulting from the disaggregation of industries. An overview of their data, procedure and findings is

Table 6.1

International Trade and the U.S. Distribution of Labour Income – Decomposition Analysis

Study	Data	Procedure	Findings
Berman, Bound and Griliches (1994)	ASM data reported for four-digit SIC industries; labour classified into production and nonproduction workers referring to production plants comprising roughly 93 percent of all plants; production and nonproduction labour is used as an approximation to unskilled and skilled labour respectively; COM data; NBER trade data; years 1959 to 1987; focus on manufacturing	Hypothesis: while the increase in international trade shifts labour demand between industries, technological change shifts labour demand within industries; distinction and decomposition of within-industry and between-industry employment shifts; further decomposition of within-industry and between-industry employment shifts along the four sectors domestic demand, exports, imports and defense; the within-industry change is examined by cross-section regression where the underlying functional form is a quasi-fixed cost function: within-industry variation in shares is put on the left-hand side as the dependent variable and the ratio nonproduction to production labour and the ratio capital to value-added are put on the right-hand side as independent variables; interpretation of the shift away from production towards nonproduction labour not explained by measured factors such as biased technological change; further direct evidence by analysing investment in computers and expenditures on research and development	Move away from production work took place more rapidly in the rest of manufacturing than in trade and defense; therefore, the main source of skill-upgrading within industries must have been unskilled labour saving technological change; the bulk of skill upgrading thus cannot be attributed to trade

Study	Data	Procedure	Findings
Bernard and Jensen (1997)	ASM data for the period 1976 to 1987; plant data with the total number of employees per plant divided into production and nonproduction work; total gross earnings paid in the calendar year to employees including benefits as supplemental labour costs; earnings are deflated by the BLS regional consumer price index; total value of shipments represents the plant output; technology data: data from the annual survey of Industrial Research and Development, COM and SMT data	Changes in the relative share of nonproduction labour in the total employment and in the total wage bill is decomposed into between-industry and within-industry shifts as well as between-plant and within-plant shifts; role of exporters in these shifts is isolated in order to identify their contribution to changing relative employment and relative wages; measure of the change in the wage gap is defined as the increase in the share of the wage bill paid to nonproduction workers in excess of what they would have been paid with constant relative wages; test of hypothesis that shifts within plants are technology-driven and shifts between plants are caused by international trade; regression of between-changes and within-changes in employment and wage ratios on the plant level on measures of changes in product demand, exports and technology for 1973 to 1979 and 1979 to 1987	On the industry level exporting firms contributed substantially to the skill-upgrading of employment; on the plant level the major shifts in the periods examined are shifts between plants; between-industry and particularly between-plant shifts contributed to a great extent to the rise in relative wages of nonproduction workers; finally, regression analysis reveals that the between-plant shift of both wages and employment towards high-skilled workers is strongly positively related to increases in both domestic and foreign demand; thus the between plant shifts have strong explanatory power as to why there was an increase in the wage gap between skilled and unskilled labour
Davis and Haltiwanger (1991)	LRD data on more than 300000 manufacturing plants during the census years 1963, 1967, 1972, 1977, 1982 and 50 to 70000 plants during intercensus years since 1972; data on individual workers from CPS	Decomposition of data among industries, among plants, and among within-plant components for production and nonproduction workers	Over half of total wage variance is accounted for by the dispersion in mean wages across plants: within-plant wage dispersion is much greater among nonproduction workers; between-industry wage dispersion is of comparable magnitude for production and nonproduction workers; manufacturing sector: first, dramatic and continuous expansion of wage differentials by plant size; second, leftward shift in the distribution of hours worked by plant size; third, pronounced upgrading of labour skill intensity; fourth, disproportionate occurrence of improvement in work-force quality at large manufacturing plants; therefore trade is not an important source of the increasing wage gap

given in Table 6.1. By means of regression analysis they try to show that factor demand shifts between plants were induced by changes in export goods demand as well as domestic goods demand. By contrast, they try to show factor demand shifts within plants being induced by technological progress. In view of their data covering the period from the early seventies to the late eighties Bernard and Jensen (1997) emphasise that their analysis falls in a period of decreasing manufacturing employment with employment of production work, i.e. low-skilled and unskilled labour, decreasing faster than employment of nonproduction work. A striking result of their work is that disaggregation puts above findings into perspective. From their point of view, international trade substantially contributed to the explanation of what was driving the increase in the income inequality of different labour skills, because plant-level factor demand shifts mainly took place between plants. Even if there were no labour demand shifts between industries or sectors, international trade could have been a driving force because there could have been labour demand shifts between plants.

Consequently, Bernard and Jensen (1997) interpret the extent of both types of factor demand shift with regard to the change in labour demand: while within-plant shifts were rather indicating technological progress according to their hypothesis, between-plant shifts indicated shifts in goods demand. Finally, the link to international trade is constructed by means of shifts in goods demand. Such a line of reasoning again implies that the hypothesis of the factor content of goods demand was linked to relative wages by changes in relative employment. By analogy, the explained decomposition procedure can easily be applied to employment variables. As a direct link between goods demand and technological progress on the one hand and labour demand on the other has to be assumed, the argument becomes more obvious. Without drawing on theoretically well-founded links between economic variables, only data organization could thus determine the perspective on interaction of trade and wages.

Davis and Haltiwanger (1991) also disaggregate the change of wage patterns as well as absolute wage gaps down to the plant level. Their findings for manufacturing show technological progress as the driving force of the change in relative wages. Resting on the findings for manufacturing presented by the four items in Table 6.1, the authors argue as follows: if demand shifts had been an important factor, the increasing qualification wage gap would have implied a demand shift towards skill-intensive goods. However, labour demand shifts through international trade thus contradicted the volume shift of worked hours away from large firms. Increased demand for their products meant an increase in employment measured by work hours, *ceteris paribus*. If only small firms whose production is skill intensive had been directly affected by the demand shift, in large plants decreasing relative wages of low-skilled workers should have induced substitution of skilled workers with low-skilled and unskilled workers. Yet this is not consistent with the increase in the average qualification level employed in large plants. In summary, this result points to low-skilled and unskilled labour biased technological change as the driving force behind the increasing functional labour income disparity. This result rests on two essential assumptions: the possibility of substituting different labour skills in large plants, and, the assumption of the complementarity of skilled labour and physical

capital. This assumption is supported by empirical findings. Corresponding evidence was found, for example, by Acemoglu (1998), Goldin and Katz (1996), Goldin and Katz (1998), Griliches (1969), and Machin and van Reenen (1998).

One has to be conscious that interpretation of the statistical decomposition of price and quantity effects requires theoretical insights into repercussions between prices and quantities as a basis. Only this way can the relevant repercussions between prices and quantities from decomposition analysis be inferred. The decomposition approaches discussed so far therefore do not stand on their own. At most, they serve as a basis for further econometric analysis.

6.2 Factor Content, Welfare and U.S. Trade and Wages

Classical trade theory and especially the influential Heckscher-Ohlin trade theory focus on inter-industry trade in final goods. Studies dealing with the contribution of international trade in goods to the increasing qualification wage gap in the U.S. can be distinguished in several respects. One category is applied data. Both country-specific national data sets and national data sets adapted for international comparison are used. The vast majority of authors solely analyses the U.S. case. In addition, there is a small number of internationally comparative studies. An overview of these contributions is given in Table 6.3. While internationally comparative studies use, for example, the LIS panel data containing adapted national data, country studies mainly recur to country specific data sets. Furthermore, most studies do not apply panel data but cross-section data like the income data set of the CPS.

The implied theoretical understanding of the repercussions between international trade and the functional distribution of labour income provides a second category for a meaningful comparison of empirical studies' perspective on the trade and wages puzzle. In summary, there are two dominating ideas. First, the hypothesis of a link between the factor content of trade and relative domestic labour incomes. Imports and exports are analysed with regard to their implicit content of inputs. By means of the implicit factor content, effects both on employment and on relative wages are analysed. In this connection, partial equilibrium analysis isolates the shift in labour demand due to international trade: under the assumption of exogenous domestic labour supply there would be a low-skilled and unskilled labour-biased shift in domestic demand because low-skilled and unskilled labour-intensive imports replace domestic production. Relative wages of low-skilled and unskilled workers would decrease. However such analysis neglects income effects and solely focuses on substitution of domestic factors by indirectly imported foreign factors. Second, going back to the concept of factor price dependence outlined in Subsection 3.2.2, this theoretical concept allows repercussions between changes in relative goods prices implied by goods trade and the change in relative factor prices to be directly analysed. What is analysed is the link between changes in relative goods prices as an outcome of the process of economic internationalisation and changes in the functional distribution of labour income. Table 6.4 gives an overview of these studies. Yet classical trade theory in the general equilibrium tradition does not provide a

direct relationship between the factor content of trade and relative factor prices.

In order to remedy this lack of theoretical foundation, Deardorff and Staiger (1988) point to the necessary assumptions that allow the inference of changes in relative factor prices from changes in the factor content of trade in general equilibrium trade models. According to factor price dependence, let a change in relative factor prices be induced by a change in relative goods prices when moving from one trade equilibrium to another. The economy thus moves from the original diversification cone to a new one. Now, the key concept is to find a trade equilibrium equivalent to autarky equilibrium. The new trade equilibrium is replicated by an equivalent autarky equilibrium whose factor endowment is augmented by the factor content of trade. The authors show the way factor prices in autarky can be derived from domestic trade equilibrium factor endowment plus factor content implied by the trade vector. Inside the diversification cone relative factor prices are constant, so that a specific trade vector's factor content implies specific relative factor prices. However, it must be assumed that domestic factor endowment plus endowment augmentation by the factor content of trade does not shift overall factor endowment outside the new diversification cone. In summary, if the factor endowment still lies inside the same diversification cone under the consideration of the factor content of trade, each non-specialized trade equilibrium can be reduced to an autarky equilibrium based on the difference between the trade equilibrium factor content and the factor content of trade.

There are several problems inherent in the concept of factor content analysis. First, factor content analysis establishes a direct link between the volume of trade and relative factor prices, because the former can be directly linked to its factor content by choosing appropriate input coefficients. As quantity growth in international goods trade in particular was offered as evidence in favour of an acceleration of the process of economic internationalisation, cf. Figure 1.1, this aspect is of special importance. However, if hypotheses build on factor price dependence by looking for Stolper-Samuelson effects, for example, the volume of trade does not play a direct role. A second problem is related to the assumption that the relevant equilibria have to remain inside the diversification cone. If the implicit factor content of trade implied a shift outside the diversification cone, factor prices would change and the results of Deardorff and Staiger (1988) would not hold any longer. Furthermore, the authors show that a strong link between changes in factor prices and changes in the factor content of trade exists only in Cobb-Douglas type models with both Cobb-Douglas production technologies and Cobb-Douglas preferences.

Another critical assumption is that the factor content of trade must be determined by evaluating the trade vector by domestic technology. Technically speaking, the input coefficient matrix of the importing highly industrialized country is multiplied by the trade vector, resulting in the vector of factor content. In consequence, the procedure developed by Deardorff and Staiger (1988) raises the issue of whether the evaluation of imports by domestic technology is actually appropriate. Would imports have been actually produced by means of available domestic technology or alternative goods? In his influential contribution to the trade and wages debate, Wood (1994) criticizes the use of input coefficients of Northern production to

evaluate the factor content of Southern exports imported by the North.

Wood's (1994) analysis of repercussions between trade and wages distinguishes the North and South. Industrialized market countries are labelled as North and industrializing countries richly endowed with low-skilled and unskilled labour and characterised by emerging markets are labelled as South. One approach Wood (1994) discusses is to take input coefficients of Southern production instead of Northern production, thus hypothesizing that if imports from the South were produced by the North, they would have been produced by means of Southern technology. Obviously, the key question becomes calculating the factor content of imports from countries richly endowed with low-skilled labour and unskilled labour by either domestic or foreign input coefficients. In Wood's (1994) opinion, neither of the two variants is able to catch the factor content of trade and thus its repercussions on domestic labour demand precisely. He emphasises that most goods imported from the South are non-competing. These goods would not have been produced, if they were not destined to be imported. Moreover, as classification problems of skill outlined in Chapter 2 show, both procedures are undoubtedly biased because skill categories are not homogenous across countries of different development stages. Therefore, Wood (1994) proposes to correct the chosen input coefficients in two respects: for factor price differences, and, for non-competing imports. While different factor prices reflect differences in labour qualities even if classified in the same category, e.g. skilled labour, taking non-competing imports into consideration reflects the attempt to correct for differences in technology.

Following Wood (1994) the dominant procedure of the factor content of trade studies is the estimation of input coefficients starting with

$$z_{ij}^N = A_N \alpha_j^N \quad (6.2)$$

where α_j^N is the share of Northern exports of the total production of manufacturing good x_j to the South. Input coefficient matrix A_N gives Northern technology. Hence, z_{ij}^N is the factor content of one unit of the Northern exports of good x_j , so that α_j^N has to sum to unity. Hence, z_{ij}^N is the vector of sectorally export-weighted Northern input coefficients. Now, the key procedure is to evaluate Southern imports to the North by input coefficients as if these imports would have been produced by Northern firms. To this end Southern export shares α_j^S of manufacturing good x_j to the North are weighted by Northern technology A_N :

$$z_{ij}^S = A_N \alpha_j^S. \quad (6.3)$$

This means that imports from the South are evaluated as if they had been produced in the North. This is simply the calculation of sectorally import-weighted input coefficients considering Northern technology.

The impact on Northern factor demand can now be derived by

$$\Delta v_{ij}^N = X_S (z_{ij}^N - z_{ij}^S) \quad (6.4)$$

with X_S as the total scalar value of Southern manufacturing exports to the North. Two cases can be distinguished: $z_{ij}^N > z_{ij}^S$ increases domestic demand for factor i ,

and the opposite holds for $z_{ij}^N < z_{ij}^S$. According to Wood (1994), the disadvantage of this procedure lies in the lack of correction for non-competing imports. This lack is due to the factor content of trade derived under the assumption that imports equal domestically produced goods. Non-competing imports are goods solely produced in one country. There is no incentive for the production of these goods in another country. The easiest way to evaluate the factor content of trade is to take Southern technology. But despite powerful Heckscher-Ohlin arguments and technological externalities in a world that is economically more deeply integrated, there are major differences in technology, in particular between Northern and Southern economies. Besides, it must not be forgotten that from a Ricardian perspective such differences motivate international trade.

Wood (1994) proposes to additionally correct for relative factor price differences between the exporting and importing country. This correction considers that a different technology would have been chosen by Northern firms due to cost considerations if goods were produced domestically instead of having been imported, since under cost minimisation Northern firms assumed to be price takers face other relative factor prices than Southern firms. Wood's solution to this problem is to substitute the sectorally import-weighted input coefficients in (6.4) by counterfactual sectorally import-weighted input coefficients z_{ij}^{S*} reflecting differences in relative factor prices:

$$\Delta v_{ij}^N = X_S(z_{ij}^N - z_{ij}^{S*}). \quad (6.5)$$

These counterfactual input coefficients are derived by CES production functions. First, parameters of the unit output CES production function are calculated. Then, input coefficients are calculated under relative factor prices in the South. Estimated elasticities of substitution of capital, i.e. human capital plus physical capital, on the one hand and low-skilled and unskilled labour on the other, are input to this procedure. The larger the substitution elasticity between these two factors in Northern production of Southern export goods, the less the counterfactual factor content of trade impact on Northern labour markets. If Southern exports had been produced in the North, firms would have substituted low-skilled and unskilled labour with physical capital and skilled labour that is less expensive relative to low-skilled and unskilled labour compared to the South. In Wood's (1994) interpretation, the elasticity of substitution shows the extent to which Northern firms' technology reflected by factor intensities to produce Southern exports deviates from that available in the South.

Up to now the factor content approach was characterised by an exclusively positive perspective on the repercussions between trade and wages exemplified by the Deardorff and Staiger (1988) foundation of factor content approaches and the debate by Wood (1994) on the problems of the standard approach's empirical implementation. An important shortcoming of Deardorff and Staiger (1988) is that their factor content of trade foundation neglects welfare. If the link between international trade and the functional distribution of labour income is to be analysed empirically by means of the factor content approach, welfare aspects of trade may not be ignored. Moving from one equilibrium to another has not only distributional but welfare implications as well. One should again be aware that it is just this suggested trade-off

between increasing inequality and expected welfare gains from trade that is at the core of the trade and wages puzzle. In contrast to Deardorff and Staiger (1988), Neary and Schweinberger (1986) choose an explicit welfare economic point of view when modelling the factor content of trade link. Their idea is to show not only conditions for the existence of a trade equilibrium equivalent autarky equilibrium, but a proof for gains from trade written in factor contents. In a word, gains from factor content trade implied by goods trade are modelled. Therefore, the authors introduce net goods import into the utility function:

$$u(\mathbf{m}, \mathbf{v}) \equiv \max\{u(\mathbf{x}) \mid g(\mathbf{x} - \mathbf{m}, \mathbf{v}) \leq 0\}. \quad (6.6)$$

In trade equilibrium, utility can be expressed as a function of net imports \mathbf{m} , which are exports minus imports and domestic factor endowment. Expression (6.6) shows the maximum attainable utility with respect to net imports \mathbf{m} and given domestic factor endowment \mathbf{v} . Now, this direct trade utility function is translated into a function explicitly showing how the factor content of net goods imports \mathbf{m} affects welfare. Expression (6.6) can be rewritten as

$$u(\mathbf{v}^m, \mathbf{v}) \equiv \max\{u(\mathbf{x}) \mid g(\mathbf{x}, \mathbf{v}^m + \mathbf{v}) \leq 0\} \quad (6.7)$$

with \mathbf{v}^m as the factor content of net imports \mathbf{m} . The utility optimisation problem of the representative household in an open economy can thus be written as follows:

$$\max u(\mathbf{v}^m, \mathbf{v}) \quad \text{s.t.} \quad \mathbf{w}\mathbf{m} \leq b \quad (6.8)$$

with b interpreted as a lump sum transfer from the rest of the world. From this, Marshallian factor content demand functions $M(\mathbf{w}, b, \mathbf{v})$ can be derived by Shepard's Lemma. In order to render different equilibria comparable with respect to welfare, the problem to solve is deriving Hicksian factor content demand functions depending on utility u . This requires a factor content expenditure function. Dual to the maximisation of utility subject to the factor content budget constraint is the minimisation of expenditures subject to a given utility level, that is,

$$\min \mathbf{w}\mathbf{M} \quad \text{s.t.} \quad U(\mathbf{M}, \mathbf{v}) \leq \bar{u}. \quad (6.9)$$

This minimisation problem equals the demanded expenditure function $E(\mathbf{w}, u, \mathbf{v})$. From (3.11) the optimal value function $E(\mathbf{w}, u, \mathbf{v})$ differs in factor prices \mathbf{w} and factor endowment \mathbf{v} instead of the goods price vector \mathbf{p} . By derivation with respect to factor prices, from $E(\mathbf{w}, u, \mathbf{v})$ income-compensated Hicksian factor content demand functions result. In autarky, these demand functions equal zero.

At the core of the trade and wages debate is changing relative factor prices of labour leading to an increased gap between skilled and unskilled workers. For the case of the U.S., the trade and wages puzzle implies two different factor price vectors characterising two different trade equilibria: because of economic internationalisation the U.S. moves from one trade equilibrium to another. To show whether this leads to gains from trade in an undistorted economy by means of expenditure functions is standard, cf. for example Dixit and Norman (1980). The Neary and Schweinberger (1986) study's importance lies in the explanation of how this proof can also be given

by means of expenditure functions written in factor content terms. Only this way can the factor content approach be exhaustively related to both the welfare and the distribution aspects of the trade and wages debate. By contrast, the Deardorff and Staiger (1988) approach only links two different factor price vectors comprising the distributional effects of economic internationalisation in the sense of increasing inter-industry trade to the factor content of trade.

By their approach Neary and Schweinberger (1986, p. 427) show that any two trade equilibria can be compared without knowledge of the autarky factor price vector: if the change in relative factor prices implies a welfare gain *then the factor content of trade in the new equilibrium . . . must be at least as great as the net revenue from restricting trade in the initial equilibrium*, expressed by b^0 . To compare factor prices implied by two different trade equilibria is simply the trade and wages puzzle with its supposed trade off between an increase in overall welfare and distributional effects to the disadvantage of low-skilled and unskilled American workers. In addition the authors provide a generalisation of the Heckscher-Ohlin model. Schweinberger and Neary (1986, p. 428) conclude that *factors which are expensive in autarky tend on average to be imported when trade is opened up*.

In summary, not only the link between changes in relative goods prices and changes in relative factor prices but also the link between changes in the factor content of trade and changes in relative factor prices can be established by trade theory. Neither approach requires the neglect of welfare or distributional effects in comparative static analysis. The perfect competitive framework provided by trade theory as reviewed above, is useful for both theoretical foundation and for derivation of testable hypotheses. In the following section it will serve as structuring concept to evaluate empirical contributions to the U.S. trade and wages debate.

6.3 Does International Trade Explain Increased Income Disparity in the U.S.?

As already mentioned in Section 3.1, Findlay and Kierzkowski (1983) pointed to the trade and wages puzzle being set in a field of conflict with general equilibrium trade theory and empirical labour market-oriented partial equilibrium analysis as benchmarks. For the bulk of the existing trade and wages literature, the latter approach serves as a starting point. As the overview given by Table 6.2 suggests, these studies focus on price and quantity effects on the labour market. In order to identify causes of the increasing wage gap in the U.S. during the eighties, these studies analyse labour supply and labour demand shifts. International trade is interpreted as an exogenous phenomenon. Classical trade theory contradicts this view: trade theoretical models try to explain why countries trade with each other, i.e. international trade becomes endogenous.

Commenting on the study by Sachs and Shatz (1994), Deardorff states: *Yet as a trade economist, I am much more inclined to explain trade on the basis of other things, rather than just take it as a forcing variable to affect other parts of the economy* (Sachs and Shatz, 1994, p. 71). It was this controversy that let Findlay (1991) demand a dialogue between empirical labour market economics and general

equilibrium trade theory. In the following subsection, the different understanding of international trade's responsibility for the controversy between labour economists on the one hand and trade economists on the other will serve as a key concept to structure the evaluation of empirical contributions to the trade and wages debate.

6.3.1 About Applied Partial Equilibrium Analysis and Trade Theoretical Arguments

An example of partial equilibrium arguments is Juhn, Murphy and Pierce (1993). A summary of their labour income inequality analysis can be found in Table 4.1. Two main objectives characterise their study. First, whether and to what extent the inequality of labour incomes distinguished by qualification increased. Second, the analysis of changes in supply and demand of different labour skills. Their main finding is an increase in labour income inequality distinguished by skill due to increased demand for skilled labour. Suggested causes of this labour demand shift are technological progress and international trade. Testing for these hypotheses is beyond their paper's scope, however.

Table 6.2 reviews further studies that chose a partial equilibrium approach. These contributions go beyond Juhn, Murphy and Pierce (1993) by explicitly analysing the link between international trade and demand for different labour skills: their hypothesis is that an increase in relative demand for skilled labour due to international trade caused increased dispersion in labour incomes distinguished by skill. Therefore, Murphy and Welch (1991) as well as Katz and Murphy (1992) first analyse whether labour demand was stable during the eighties in the sense of a movement on the labour demand curve caused by a labour supply shift. As the authors do not find empirical evidence in favour of this, they test for a causal link between a low-skilled labour biased demand shift and increasing international trade. Their methodology is the factor content of trade approach: treated exogenously, trade is expected to lead to a change in labour supply on the domestic labour market. With imports intensive in low-skilled labour, domestic supply of this factor is increased indirectly by the factor content of imports. Consequently, the low-skilled labour reward had to increase, *ceteris paribus*.

Following this line of reasoning, Borjas, Freeman and Katz (1992) also apply the factor content of trade approach. The authors estimate the volume of trade's implicit labour supply content and its composition. Then, by the aggregation of two different qualification groups, the authors analyse the hypothesis whether the effect of trade on the wage gap between skilled and unskilled labour was significant. Such aggregation allows estimation to be restricted to just one elasticity of substitution and thus considerably simplifies the analysis. Furthermore, there are also partial equilibrium approaches like Bound and Johnson (1992), who construct a complete stylised model for empirical testing.

Katz and Revenga (1989) apply the factor content of trade concept in their internationally comparative study. Unlike the comparative study by Gottschalk and Joyce (1995) using the LIS income data set, Katz and Revenga (1995) use country-specific data. Table 6.3 offers an overview of procedures and findings of international com-

Table 6.2
International Trade and the U.S. Distribution of Labour Income – Labour Demand and Labour Supply

Study	Data	Procedure	Findings
Borjas, Freeman and Katz (1992)	Demographic data from the 1980 Census and from CPS for 1964-88; NBER Immigration, Trade, and Labor Market Data Files covering four-digit SIC manufacturing industries from 1967-1985	Aggregation of manufacturing data into 21 industries for which employment by skills is estimated; estimation of the implicit change in the supply of person-hours due to trade flows in manufactures relative to total employment and relative to manufacturing employment; estimation of direct labour supply embodied in trade and immigration flows according to their educational composition; decomposition of trade flows according to their factor content with respect to efficiency units of labour; two different methods are used: in the first method, where imports and exports are assumed to affect production and nonproduction labour equally, labour market effects of imports and exports are treated identically; in the second method where imports are assumed to have no effect on the employment of nonproduction labour, the implicit labour supply contained in imports is only allocated to production workers	Seventies: slight reduction in the net labour supply due to trade; mid-eighties: a much larger contribution of trade to labour supply
Bound and Johnson (1992)	CPS data; usual weekly earnings and hours for 1973-74, 1979, and 1988; earnings by persons between 18 and 64 are examined; earnings are divided in 32 subsamples based on education, labour market experience and sex	Examination whether labour demand shifts overcompensate labour supply shifts on the basis of a stylized theoretical model in order to identify the causes of the increasing qualification wage gap; concentration on three aspects: first, changes in the industrial wage structure, i.e. decomposition of wage effects in effects due to changing industry weights, intra-industry wage effects and union wage effects; second, examination of product demand shifts; third, technological progress nonneutral with respect to different types of labour	International trade implying labour demand shifts seems to be of very low importance in explaining the increasing qualification wage gap; unskilled labour biased technological change and unobserved changes in labour quality seem to have been the main forces
Murphy and Welch (1991)	CPS data on wages and earners for 1963 to 1986; trade data from the 1988 Economic Report of the President; disaggregation of the CPS employment data into the groups of durable goods, nondurable goods, traded services and nontraded goods	Construction of a simple structural model of labour demand with domestic consumption equal to domestic production plus net imports as equilibrium condition; partial equilibrium analysis; both a trade effect and an industrial composition effect on labour demand is constructed; these effects are compared to observed changes in wages distinguished by race, gender and education	For 1963-1979 data are consistent with an ordinary production structure with marginal properties and stable demand; after 1979 the data test rejects the hypothesis of stable demand; comparison of constructed effects and observed changes in wages reveals trade as a mainspring of the increasing wage inequality

Study	Data	Procedure	Findings
Murphy and Welch (1992)	CPS data for 1963-1989; individual annual hourly wages for white men with at least 40 weeks of full-time employment during the year; distinction of 188 schooling-by-experience categories	Analysis whether the data are consistent with a stable factor demand structure; the issue is raised whether the increasing international competition shifted relative factor demand away from less-skilled male workers; changing international competition is measured as shifts in international trade proxied by the net imports of durable goods as a share of GDP	Data are largely consistent with stable demand over the period 1963 to 1979; the hypothesis of stable demand during the eighties can be rejected; increasing international competition could have been one possible reason
Katz and Murphy (1992)	CPS data for survey years 1964 to 1988; information on earnings and weeks worked in each calendar year; creation of two samples: first, a wage sample in order to measure weekly wages of full-time workers by demographic groups and, second, a sample to measure the amount of labour supply by each of these demographic groups; 320 groups of wage earners distinguished by sex, education and 40 single-year potential experience categories; the wage is measured as the average weekly wage of full-time workers within a gender-education-experience cell; data on imports, exports, and output from the NBER Immigration, Trade, and Labor Market Data Files	Measures of between-sector and within-sector demand shifts are constructed; direct labour supply embodied in trade is estimated; changes in employment due to changes in net imports are modelled as if these were changes in employment due to domestic output changes; variant where changes in imports are only allocated to production workers	Factor demand was not stable in the eighties; demand growth is an important component of the change in factor prices over the period as a whole and particularly during the eighties; adverse effects of trade on relative labour demand are concentrated on high school dropouts who are employed in large numbers as production workers in import-competing industries; although trade induced changes in relative demand moved in the expected direction they were quite small
Revenge (1992)	Panel of 38 three-digit and four-digit SIC manufacturing industries for the 1977 to 1987 period accounting for 72 percent of total imports and 35 percent of total employment in 1985; import price data from BLS; import price variable is a quarterly fixed-weight Laspeyres price index based on a 1980 market basket; an exchange rate index is computed for each industry; both variables are deflated by PPI; BLS data on production worker employment, average weekly hours for production workers, average hourly earnings for production workers, average hourly earnings in services, and average hourly earnings in trade; all wages are deflated by CPI; aggregate quarterly unemployment rate, quarterly real GDP, quarterly index of energy prices, quarterly index of the cost of materials in manufacturing from the Data Resources, Inc. U.S. Central data base	Exclusive focus on movements in relative industry employment and wages; supply and demand equations for a perfect competitive labour market are modelled to derive a reduced equations system; system is estimated for wages and employment as independent variables; aggregate quarterly unemployment rate and quarterly real GDP are used to capture cyclical fluctuations in demand	Workers are highly mobile across industries but not across skill groups; changes in import prices have large and significant effects on employment and wages; that is, sizable and statistically significant effects of import competition on both employment and wages in U.S. manufacturing

parison studies. In his internationally comparative study, Davis (1992) analyses the changes in relative labour incomes for thirteen highly developed and developing economies. Apart from disclosure of the driving forces underlying the change in labour income inequality, he is interested in describing these changes from an international comparative point of view. His hypothesis builds on the result of factor abundance theory. The effects on the functional distribution of income when an economy moves from autarky to free trade derived by this theory's basic model framework with two factors and two goods are translated into the case of an economy with two different labour skills: if barriers to trade were removed, international factor price convergence would emerge. However, problems arising out of transferability of the basic model's results driven by very restrictive assumptions to a multilateral world with many different goods where many production sectors can be interpreted in the sense of a large open economy and many different factors are ignored. In order to test for theoretical effects, Davis (1992) also recurs to the link between factor content of trade and relative factor prices.

Another example of an analysis of whether the changes in relative labour income are consistent with the Heckscher-Ohlin pattern is the aforementioned study by Sachs and Shatz (1994). In addition, Sachs and Shatz (1994) are an impressive example of leaving theoretical grounds in the sense of general equilibrium foundation and partial equilibrium testing: the authors postulate international trade as an exogenous phenomenon and thus leave general equilibrium trade theory's fundamental insight of trade as an endogenous phenomenon. Hence, this is another example of applied general equilibrium analysis having started from general equilibrium trade theory.

Perhaps one of the most influential factor content of trade studies contributing to the trade and wages debate is Wood (1994) who argues against the background of general equilibrium considerations but transfers a partial equilibrium estimation. As already explained in Section 6.2, Wood's (1994, p. 166) analysis is motivated by the insight that *the conventional calculations ... understate both the amount of unskilled labour embodied in the North's imports from the South, and the amount of skill embodied in the South's imports from the North*, and thus the impact on relative factor prices in the North. The reason given by Wood (1994) is that most of trade between North and South is noncompeting in the sense that imports and exports would not have been consumed in both regions if they not had been traded. By contrast, if the products imported by the North had been produced at home they would have been produced in more skill intensive and capital intensive manner because the North is richly endowed with skilled labour and capital. As a result, compared to the South these relative factor prices would be lower, inducing less goods supply because of higher production costs. Northern equilibrium production would have risen less than the volume of import if domestic production had been substituted for foreign production. The same would hold for Southern skill intensive noncompeting imports from the North. In summary, Wood's (1994) message is that the trading partner's input-coefficients had to be corrected for differences in relative factor prices.

Wood's (1994) proposal of how to correct for different factor prices and technological

Table 6.3

International Trade and the U.S. Distribution of Labour Income – International Comparisons

Study	Data	Procedure	Findings
Cooper (1992)	Countries compared: Germany, France, Italy, the Netherlands, the United Kingdom, and the U.S. in the eighties; unemployment rates, net exports of goods and services as percent of GDP and share of exports in GDP from IMF International Financial Statistics; dispersion of changes in ratio of exports to GDP from OECD; imports of manufactures from developing countries from United Nations Commodity Trade Statistics; employment data for textiles, apparel and leather from OECD Labor Force Statistics, U.S. Department of Labor, Eurostat Basic Statistics of the European Community and from national Italian and Spanish statistics	Several macroeconomic and structural hypotheses; the trade theoretical perspective is chosen against the background of structural hypotheses: the sharp increase in both import penetration and exports relative to GDP urges reallocation of resources from the production of nontradables to the production of tradables and replacement of the production of import-competing goods by the production of tradable goods; with a labour market not functioning smoothly and quickly this process might lead to unemployment at least in the short run; use of the Stolper-Samuelson results as a theoretical reference	No convincing empirical evidence for employment effects and effects on the dispersion of relative wages of skilled and unskilled workers due to growing international competition; wages of the unskilled are mainly determined in the nontradable goods sector
Davis (1992)	Data for several advanced and middle industrial countries: Australia, Brazil, Canada, Colombia, France, Japan, the Netherlands, South Korea, Sweden, United Kingdom, United States (March CPS data), Venezuela, and West Germany (LIS data); data for 18-64 years old male wage earners; unpublished data from the BLS of the U.S. Department of Labor; import and export data from the IMF International Financial Statistics	Analysis of cross-country patterns of changes in relative wages; adaption of the results of the factor-abundance theory in order to examine the role of international trade as a driving force of changes in qualification wage differentials; hypothesis that the reduction in barriers to international goods trade among the worlds national economies compressed the cross-country distribution of education wage differentials; investigation whether the within-country relative industry wage structure became more uniform across countries between 1975 and 1989; application of the factor content of trade approach; investigation whether the degree of openness (measured in imports and exports as a fraction of total GDP) is related to wage dispersion	Hypothesis of increasing uniformity in relative industry wages across countries is strongly rejected; increased openness seems to have induced greater cross-country uniformity in relative industry wage structures with the convergence-inducing effects limited to high-income economies; while growth in imports induces convergence toward the average structure of relative industry wages, growth in exports does not

Study	Data	Procedure	Findings
Gottschalk and Joyce (1995)	LIS data for two years on Australia, Canada, France, the Netherlands, Sweden, United Kingdom, and the U.S.; measures of earnings are real annual gross wages and salaries of male family heads; published data on imports and exports from OECD National Accounts 1960-1986 and OECD Labor Force Statistics 1967-1987	Three suggested reasons for the increasing wage gap between skilled and unskilled workers are investigated: deindustrialization, international trade, and technological progress; no rigorous analytical and empirical treatment of links between suggested reasons and the changes in relative factor compensation; interpretation of data and descriptive statistics	As to increasing income inequality, increasing international competition and processes of deindustrialization, the data disclose similar patterns of development in all countries; both technological change and increasing international trade seem to be relevant factors in explaining the increasing wage gap between skilled and unskilled workers
Katz and Revenga (1989)	CPS data for the U.S. for the periods 1973-1979 and 1979-1987: median annual money income for full-time, year-round workers divided into two gender groups, two experience groups and three education groups; data for Japan from the Chingin Kozo Kihon Tokei Chosa (Basic Survey on Wage Structure) for the periods 1974-1979 and 1979-1987: average monthly wages for male workers divided into three education and three experience groups	Investigation of demand and supply factors; demand shifts through international trade; estimation of a time-series model with international competition proxied by real net exports as a share of GDP	U.S.: while less-educated earners gained in the first period, this trend is reversed in the second period; from 1979 to 1987 educational wage differentials grew for all groups; Japan: especially less-skilled male new labour market entrants experienced real wage growth over both periods; obviously, patterns of development of earning differentials are sharply different in both countries; international trade reinforcing other causes could have been one out of the demand-side factors in explaining these differentials

differences was already discussed in Section 6.2. Empirical implementation confronts Wood (1994) with two main problems. First, as he aims at analysing causes of the increased wage gap between two different types of labour skill, namely skilled labour and unskilled labour, he has not only to solve the aggregation problem with respect to skills supplied on Northern and Southern labour markets, but like Leamer (1994), he faces the difficulty of identifying the share of skilled labour within the blue-collar group when classifying labour qualities by blue-collar and white-collar, cf. Section 2.4. Moreover, he also has to render aggregated skills internationally comparable. As a remedy, skill categories are made consistent by rough adjustments considering the much higher education and training level in the North. Wood (1994) estimates that skilled labour in the North is twice as qualified as skilled labour in the South, and that a standardised unit of skill in the North would be twice as expensive as a standardised unit in the South. Consistent with factor endowment theories, he finds relative skill costs higher in the South than in the North.

The second problem arises from correcting for noncompeting imports, which requires identification of those imports that would not have been produced domestically. This problem is solved heuristically. Wood (1994, p. 126) starts by assuming all manufacturing narrowly defined as noncompeting and excluding such manufacturing as *'processed primary' products such as food and refined petroleum*, being aware of the compromises inherent in this definition. Unlike the standard approach, competing imports are omitted, so that analysing factor content effects of noncompeting imports becomes the benchmark case for sensitivity analysis. Because these imports would not have been produced domestically, their impact on the domestic labour market is expected to be larger than if they had been produced at home instead.

Wood's (1994) data both on international trade and income stem from widespread sources, amongst others the ILO *Yearbook of Labour Statistics*, OECD *National Accounts*, UN *Industrial Statistics Yearbook*, *Labour Force Statistics* and World Bank, as well as from national sources like the US Department of Labor. Manufacturing data from OECD sources are structured according to the ISIC. The different data sets hint at another problem stated by Wood (1994) himself: aggregation of country groups. Naturally, modelling two groups of countries that are very different in endowments and development stage trading only two goods, where one goods production is skilled labour-intensive and the other is unskilled labour-intensive, is a very restrictive scenario. But this is simply the price of recurring to clear-cut theoretical results by endowment theories strongly reduced in the number of countries, goods and factors.

In order to calculate counterfactual input coefficients, i.e. input coefficients corrected for differences in factor prices, Wood (1994) uses a value of 0.5 as substitution elasticity between capital-plus-skill, i.e. physical capital and human capital, and unskilled labour recurring to common results. Unlike the standard procedure corresponding to the direct estimation of equation (6.2) for each sector, input coefficients are derived by decomposition of export costs among different factors; then factor prices are estimated. Finally, factor content coefficients result from dividing cost components by factor prices. By first using derived Northern input coefficients

and estimated elasticity of substitution, distribution parameters are calculated by a unit output CES production function. After that, counterfactual input coefficients are calculated by distribution parameters and Southern relative factor prices. These counterfactual input coefficients allow counterfactual output levels to be calculated.

On the basis of the above-mentioned data sets, Wood (1994) focuses on the mid-eighties. By application of the outlined factor content of trade analysis deviating from the standard approach, Wood (1994) finds that North-South trade decreased relative demand for unskilled labour in the North by roughly 20 per cent, plus or minus an estimated error of eight per cent. On the other hand he finds the creation of roughly twenty million manufacturing jobs in the South, even if very unequally distributed. At first sight, Wood's (1994) main results are consistent with the factor abundance theory scenario. Trade seems to have shifted Northern labour demand at the expense of low-skilled and unskilled labour. However, the usual objections raised against the factor content of trade approach and the problems inherent in its general equilibrium foundation apply, since Wood's (1994) correction procedure does not test for secondary effects. Furthermore, it has to be kept in mind that endowment theories like the Heckscher-Ohlin trade theory failed to explain trade of similar goods induced by preferences and monopolistic competition market structures, for example. However, some of these goods satisfy the non competing condition, albeit trade between North and South is mainly dominated by inter-industry trade.

In summary, even if conditions can be shown under which the factor content of trade approach is theoretically founded by general equilibrium trade theory and even if its empirical application is founded by general equilibrium arguments like in Davis (1992), the theoretical basis of the standard estimation approach is partial equilibrium by nature, cf. equation (6.2). Second order effects are widely ignored.

6.3.2 General Equilibrium Perspectives – Relating Goods and Factor Prices

The attempt to test directly for repercussions between changes in relative goods prices and changes in relative factor prices theoretically founded by the concept of factor price dependence is provided by Baldwin and Cain (1997). Those authors modify Jones' (1965) link between relative goods prices and relative factor prices for regression analysis. A summary of both their procedure and their findings can be found in Table 6.4. For the case of an economy with two goods and two factors, Lawrence and Slaughter (1993) use the Stolper-Samuelson mechanism. They justify their procedure by arguing that the analysis of higher dimensional symmetric Heckscher-Ohlin models had shown that the Stolper-Samuelson results hold, even if in a diluted way. The authors criticize attempts to test the Stolper-Samuelson link empirically by the factor content of trade approach because it depends on overly restrictive assumptions.

As shown above, in the basic model framework with only two factors and two goods, the Stolper-Samuelson theorem postulates an unambiguous link between changes in relative goods prices due to international trade and domestic relative factor prices. For the case of the human capital abundant U.S., the Stolper-Samuelson theorem

thus implies an increase in the relative price of low-skilled labour intensive imports because of the observed decreasing relative wages of low-skilled workers. Going beyond the two-by-two production side model, Jones and Scheinkman (1977) show that the Stolper-Samuelson results hold in higher dimension models, albeit in weaker form. A necessary assumption is that each good is produced by at least two inputs. Furthermore, joint production has to be excluded. Then, under the assumption of $\hat{p}_1 > \hat{p}_2 > \dots > \hat{p}_n$, for at least two factors, there exists the relationship

$$\hat{w}_r > \hat{p}_1 > \hat{p}_2 > \dots > \hat{p}_n > \hat{w}_z \quad (6.10)$$

with r and z out of $i = 1, \dots, m$. If one goods price increased, while one factor would unambiguously gain at least one other would lose. The economic idea is that changes in goods prices induce changes in relative factor prices that ensure zero profit conditions and factor market equilibrium conditions to hold. Thus, there is an incentive-compatible mechanism that guarantees agents' optimisation problems to be satisfied.

The chain in (6.10) is of considerable importance for the trade and wages debate: in the higher dimensional symmetric case some factors will gain whereas other factors will lose due to changes in relative goods prices. If several subgroups of skills are formed, the increase in the goods price of a relative skill intensive good can imply gains by higher skilled types of labour with at least one other lower skilled type of labour losing. Hence, there exists a theoretical foundation of contributions that refer to the two-by-two version of the Stolper-Samuelson theorem that is conscious of the problems inherent in the results of the theorem's reduced version. Approaches of higher dimension raise a serious question: how to identify relevant changes in relative incomes? The chain in (6.10) requires identification of those factors distinguished by skills between which significant changes in income distance took place. This demands clear ordering of skills and goods production skill intensities leading to complex structural models.

Finally, the remaining key empirical question is the direction of relative goods price changes of low-skilled labour intensive production competing with low-skilled labour-intensive imports. Or in other words, the fundamental question is whether the prices of relative skill intensive goods increased or decreased. The findings of Lawrence and Slaughter (1993), who do not find empirical evidence in favour of increasing relative low-skilled labour intensive manufacturing goods prices, contradict the Stolper-Samuelson predictions for decreasing unskilled labour wages. By contrast, Harrigan (1998) finds effects on relative factor prices caused by changes in relative goods prices consistent with the Stolper-Samuelson prediction. But this evidence is challenged by both the effects of changes in factor supply and the changes in import prices. From this Harrigan (1998) infers only minor or even no influence of import competition on relative factor price changes in the eighties. On the other hand, Sachs and Shatz (1994) contradict this result by finding a decrease of relative prices of low-skilled labour intensive goods. The authors apply different price data than Lawrence and Slaughter (1993), who focus on manufacturing.

Krueger (1997) analyses the period from the end of the eighties to the mid-nineties. Skill is distinguished by several categories: first, production and nonproduction

Table 6.4

International Trade and the U.S. Distribution of Labour Income – Factor Price Dependence

Study	Data	Procedure	Findings
Adams (1997)	First data set: CPS data on six major sectors from 1973 to 1988; wage cells classified by six sectors, three education and five experience groups; weekly earnings of white, male full-time labour force participants aged 18 to 65; trade data are ratios of net imports (U.S. Department of Commerce, Highlights of Foreign Trade, Imports and Exports for 1973 to 1988) by region (all of Western Europe, all of Asia plus Africa and Oceania and all of the Western Hemisphere) to values of U.S. industry output (Statistical Abstract of the United States); construction of variables on innovation and technological development; second data set: manufacturing from 1979 to 1993; wage data from CPS for white males aged 18 to 65; construction of means by wage cells classified by education, industry, and year; data on innovations by shares in the engineering and chemical literature and from data on patenting in the U.S.	Stylised general equilibrium model with two sectors; derivation of equations for wages and relative wages; whereas goods production in one sector is homogenous, the other good is produced under monopolistic competition; regression of wages and relative wages on innovation, education and experience variables with regard to year and other dummies; specification of innovation variables in shares and levels; cohort size, technology, and trade are expected key determinants of weekly earnings; therefore only earnings of white, male year-round workers are examined	Same direction of trade and technology effects on wages; wage gap is widened by the increase in both the world and the U.S. innovation stock; rise in the share of U.S. innovations increases U.S. wages; effects of trade become insignificant if variables for technological progress are introduced; i.e., trade does not seem to be the major source of the increasing qualification wage gap
Baldwin and Cain (1997)	Data on industries classified according to the 79 two-digit sectors of the input-output tables from the BEA; direct and indirect labour coefficients calculated from total requirements coefficients of these input-output tables; breakdown of value-added provided in each input-output sector between employee compensation and property-type income; prices of goods and services produced in these industries and employment data for each industry from the BLS; workers' educational level and wages by industry from CPS	The zero-profit conditions by Jones (1965) are adapted for regression analysis: the basic condition is completed by a capital component and an error term; changes in trade ratios, output, and in relative labour coefficients are examined	1968-1973: growing real wages in all education groups with highest growth in low education groups; 1973-1979: real wages for all education groups decline absolutely with the distribution of wages becoming more equal; in this period trade does not seem to have been the driving force underlying the observed changes because these changes move in the opposite direction as predicted by the authors' hypothesis of how trade affects wages; 1979-1991: real wages continue to decline for all education groups accompanied by an increasing qualification wage gap; trade is not the main factor leading to an increase in the qualification wage gap; however, trade could have contributed to a large extent to the decrease in the relative wages of the least educated

Study	Data	Procedure	Findings
Harrigan (1998)	Import, output and price data from the USNA; two-digit SIC GNP data and capital stock data from BEA for 1967-1995; labour data from March CPS for 1964-1996; aggregation of three types of labour and capital as four primary factors of production and aggregation of two final goods, one good being intensive in low-skilled labour and the other one being intensive in high-skilled labour; aggregation of three different types of imports	GNP is modelled by the value of output equivalent to the value of primary factors plus the value of imports which are inputs for domestic production; supply functions, demand functions and the factor prices result from the Envelope properties of the GNP function; then, the GNP function is approximated by a translog functional form; output, imports and factors are written in shares; a system is estimated where technological progress is incorporated by a trend in the change of the imports and factor shares of GNP; the approach emphasizes the importance of the analysis of changes in prices of imported intermediates	Large factor supply effects on factor prices are inconsistent with the 'one cone' models; relative factor price changes due to product price changes seem to correspond with the Stolper-Samuelson predictions; import competition has a negligible direct effect on relative factor prices
Lawrence and Slaughter (1993)	ASM data; Trade and Immigration Data Base; BLS data; focus on manufacturing	Manufacturing is examined because there are few data on trade in services and because manufacturing constitutes about 70 percent of total U.S. trade; rise of relative wages and of relative employment of nonproduction labour indicates a shift of the labour demand mix towards nonproduction labour; labour demand is derived from a production function under the assumption of perfect competition and profit maximizing firm behavior; labour supply is modelled by a standard labour supply function; a simple version of the Stolper-Samuelson theorem is used as an approximation to the suggested underlying mechanisms	Data reveal that only ten percent of all firms move to higher relative wages of nonproduction labour combined with a lower employment ratio of nonproduction to production labour; conclusion that Stolper-Samuelson effects could not have been the moving force behind the change in relative wages of skilled and unskilled labour; thus, international trade hardly could have been an important factor

workers; second, in order to test results for robustness qualification is distinguished according to school education and continuing education. Compared to the period examined by Lawrence and Slaughter (1993), Krueger (1997) refers to a later period. Nevertheless, the findings disclose some evidence in favour of the Stolper-Samuelson prediction. Interestingly Krueger's (1997) regression results do not depend on the consideration of dummies covering computer price changes. Whether price changes in computer markets should be considered or not has raised a basic controversy in the debate on Stolper-Samuelson effects because of the permanent and dramatic drop in prices on computer markets in a world of dynamic technological progress.

Krueger (1997) gives an example of the application of the standard estimation approach linking relative goods price changes as the left-hand variable and relative wages as the right-hand variable measured by relative factor cost shares. In the elegant words of Feenstra and Hanson (1999, p. 908), this approach's starting point is

a popular method to predict wage changes under zero profits: a regression of the change in industry prices on the level of factor cost-shares in that industries, where the estimated coefficients are interpreted as the predicted change in factor-prices that are consistent with the movement in product prices,

that is, to totally differentiate each of the equations in (3.19). Some authors expand totally differentiated zero profit conditions by a TFP measure, entering the estimation equation by a negative sign. Increasing factor productivity is expected to decrease total factor costs with the implication of sinking goods prices. This is exemplarily described by Feenstra and Hanson (1999). As a TFP measure they use value-added growth minus the weighted average growth of primary factors. Normally, the factor price changes are treated as a random variable, so that the error term becomes nothing else but the deviation from average industry wage. Feenstra and Hanson (1999) point to two potential sources of that deviation: first, unobserved factor qualities, and second, industry-specific rents. Recurring to the perfect competitive general equilibrium framework with its long-run orientation represented by (3.19) excludes the latter. By contrast, unobserved factor qualities are compatible with the perfect competitive neoclassical framework. Consequently, Feenstra and Hanson (1999) are able to disclose that the estimation approach derived by the total differentiation of (3.19) would become an identity if fully specified. To the exclusion of measurement errors, the regression would therefore fit exactly. This is shown by introducing EFFECTIVE TFP equal to TFP corrected by the standard approach's error term that measures deviation from average industry wages due to unobserved qualities.

Hence, the deciding question is whether this approach can still be applied meaningfully. The remedy proposed by Feenstra and Hanson (1999) is to decompose the estimation approach by suggesting a way innovations may work. Two aspects gain importance. First, the direct impact of structural variables on EFFECTIVE TFP, examples being measures for outsourcing in the sense of shifting production abroad, foreign direct investment and domestic investment in high technology capital; and second, the indirect impact of structural variables. The authors' procedure is as follows: a first equation captures neutral technological progress. The changes of

structural variables having caused changes in EFFECTIVE TFP can thus be identified, themselves entering the price equation as a right-hand variable. Then, in order to cover factor biased technological change, the structural variables' direct effect on prices is captured by considering these variables in the price equation. Combination of the two regression equations allows both direct and indirect effects to be analysed simultaneously.

Obviously, this approach requires a deeper understanding of how different forms of technological progress affect prices in a general equilibrium world of the benchmark type given in Section 3.2. In order to correctly interpret the coefficients provided by the estimation approach, the essential question becomes how technological progress affects prices when it is either of the specific or of the neutral type with respect to factors and sectors. Again, the two-by-two production side model serves as a theoretical benchmark with two aggregated output sectors and two aggregated factors skilled and unskilled labour representing the two types of average skill. Let there be a factor price diagram with two convex unit cost functions. If technological progress is neutral with respect to both factors and sectors, relative factor prices remain unchanged and the new equilibrium is found on a linear ray from the origin. Both unit cost functions shift outwardly and both factors earn higher incomes due to the productivity increase with relative factor prices unchanged. In the case of a small open economy, merely nominal and real wages and output of both goods would have increased to the extent of increased factor productivity. By contrast, if technological progress were neutral with respect to factors but sector specific only, the unit cost function of the sector where the productivity gains emerged would shift outwardly. Since the skilled labour intensive sector can pay both factors higher wages due to enhanced productivity, that can be thought as lower input of both factors necessary to produce one unit of output, recalling the assumption of diminishing marginal productivity. Under the assumption of a small open economy, factors would therefore shift to the sector affected by technological progress, reinforcing the output effect induced by increased factor productivity. Albeit not really consistent with the inherent long-term nature of the chosen framework, while the first output effect in the technological progress sector could be interpreted as a short-term effect, the output effect caused by factor reallocation could be interpreted as a more long-term output effect. By contrast, under homothetic preferences and the assumption of the internationally common technological shock, the price of the labour intensive good would drop, so that relative factor prices would remain unchanged.

The scenario is different if technological progress were both factor specific and sector specific. Assume that technological progress enhances unskilled labour productivity in the skilled labour intensive production sector. This means nothing else but factor biased technological progress at the expense of unskilled labour, the suggest causal link underlying the increase in labour income inequality competing with economic internationalisation. Then, the unit cost function would shift out in clockwise fashion, as described by Feenstra and Hanson (1999). Again, under the above assumptions the skill intensive goods price would drop. But now, as relative factor prices would have changed in this sector, labour markets would be no longer in equilibrium, recalling that factors are rewarded according to the value of marginal productivity. Because of unskilled labour productivity enhancing tech-

nological progress, relative inputs necessary to produce one unit of output would have changed. Therefore, factors would move from the unskilled labour intensive sector to the skilled labour intensive sector. Finally, while the unit cost function of the unskilled labour intensive sector would shift to the left, the unit cost function of the skilled labour intensive sector would shift to the right.

Now, the hypothesis is that effects due to factors like outsourcing or investment in high technology capital are factor biased. Econometrically, this is modelled by allowing such factors to enter the estimation approach as structural variables, not only via indirect effects on EFFECTIVE TFP but directly also in the price equation. Unlike neutral technological progress whose effects on factor prices are offset by the effect on EFFECTIVE TFP being reflected in a coefficient equal to minus one, in the case of factor biased technological progress the coefficients of the structural variables will differ from zero. Hence, the outlined typology of technological progress serves as a basis for correct coefficient interpretation.

Finally, the structural variables themselves are regressed against factor shares as if they had been the only force changing relative factor prices. The authors state that this equation is a modification of the equation relating goods prices to EFFECTIVE TFP and factor prices. At this point, it should be kept in mind that a problem emerges out of technological progress modelled in a context starting with zero profit conditions. Without supernormal profits there is no incentive for firms to innovate, so that technological progress is treated as completely exogenous in its nature.

It has already been made clear that the majority of the approaches discussed so far aiming at identification of the causes of wage inequality's significant increase treats international trade and technological progress as competing explanations. Even working with a sophisticated theoretical basis, most studies do not model technological progress in an explicit way, thus leading to the tautological estimation approach criticized by Feenstra and Hanson (1999). First, these studies try to isolate the effect of international trade on relative wages. Then, in a second step, the unexplained residual is accrued to technological progress, or technological progress is introduced by TFP. Perhaps one of the reasons for this procedure is that the theory of international trade is more integrated than the theory of technological change. Leamer (1996a) additionally takes the second-order conditions into account when he constructs the link between the change in goods prices and the change in factor prices on the basis of the total differentiation of the zero profit conditions in (3.19). That is, he tries to overcome the stated weakness by adding second-order conditions to his regression equations to consider discrete changes as well. In his approach, Leamer (1996a) is also aware of the considerable increase in income inequality within sectoral qualification categories during the eighties. His results are reviewed in detail in Table 6.4.

Adams (1997) is an interesting example of a general equilibrium framework modelling technological progress both at home and abroad in a world of open economies, although he does not model explicitly domestic and foreign factor prices of capital. His model consists of two production sectors and the market mechanism for the factor prices of skilled and unskilled labour. This ensures symmetry for the model, whose factor markets are assumed to be perfect competitive. The two capital fac-

tors are stock variables and determine the size of the skill intensive goods coefficient in the Cobb-Douglas unit cost function. Again, the unskilled labour intensive good is produced under perfect competition. By contrast, monopolistic competition prevails in the skilled labour intensive production sector. On the basis of his stylized general equilibrium model, Adams (1997) finds empirical evidence mainly in favour of technological progress as the driving force of the increasing qualification wage gap.

6.3.3 General Equilibrium Perspectives in a World of Institutional Changes

Politically, the trade and wages debate gained importance in the context of the 1992 U.S. presidential election campaign. Negative effects on the income and employment of unskilled and low-skilled workers due to the establishment of NAFTA became the topic of a broad public debate. NAFTA's establishment implied the liberalization of national goods markets by a step-by-step removal of tariff and nontariff trade barriers. Against this background, Leamer (1993) discusses potential effects of NAFTA on wages and employment of low-skilled workers. He, too, criticizes the mainly labour market economics-oriented trade and wages debate for its lack of theoretical foundation. In the context of modelling links and repercussions between relative wages and balance-of-trade deficits, he especially points to such deficits only being a temporary phenomenon, since it is a balance-of-trade deficit that characterised the U.S. case in the eighties.

From the trade theory literature it is well-known that in perfect competitive Walrasian general equilibrium models neither a balance-of-trade deficit nor a balance-of-trade surplus can be an equilibrium. If the reason for the increasing qualification wage had been a temporary balance-of-trade deficit, the increase in the qualification wage gap thus would have been a temporary phenomenon. The balance-of-trade deficit would have been a kind of exogenous shock with limited effects on relative wages. Under the assumption that such a shock's effect would not persist, there would be no contribution to the explanation of a long-term increase in the dispersion of income earned by different labour skills. However, from a general equilibrium trade theory point of view the relevant issues are the long-term effects of economic internationalisation on welfare and the distribution of income.

In order to distinguish the shorter run from the longer run more consistently, Leamer (1993) discusses several scenarios comprising both the national mobility and national immobility of physical capital. The assumption of intersectoral immobile factors means the introduction of another restriction, yet the equilibrium concept remains unchanged. The restriction of intersectoral immobile factors is thus a consistent way to approximate shorter run analysis of repercussions between relative goods prices and relative factor prices when the former change due to international trade, even if the introduced general equilibrium concept is long-run in its nature.

Leamer proceeds as follows: first, he analyses a Heckscher-Ohlin model with the two factors capital and labour and the three aggregated production sectors textiles, clothing and engineering. Then, aiming at the analysis of the incomes of different

Table 6.5
International Trade and the U.S. Distribution of Labour Income – the Heckscher-Ohlin Perspective

Study	Data	Procedure	Findings
Leamer (1996a)	<p>NBER data based on a cross section of 450 four-digit SIC industries; NBER data on the hourly earnings of production workers and the average annual earnings of production and nonproduction workers; data on price changes, TFP growth and factor shares</p>	<p>The one-cone Heckscher-Ohlin model is applied as a framework; changes in relative factor prices are assumed to work via the Stolper-Samuelson mechanism; the prices of tradables are assumed to be determined in world markets; total differentiation of zero profit conditions; construction of a measure for TFP which is subtracted from the changes of factor prices weighted by factor shares; thus, the effect of technological change can be isolated from the effect of globalization; through second-order effects, sector biased price changes due to technological change are introduced; this requires input coefficients to be endogenized; the pass-through rate of technological progress is assumed to be common for all sectors with a pass-through rate of zero for a small open economy; by integrating intermeditates value-added prices are constructed; finally, two equations with factor shares as explanatory variables are estimated: first an equation with sectoral growth of TFP, and second an equation with the sectoral inflation rate adjusted for TFP-induced technological progress as dependent variables</p>	<p>1961-1971 little TFP growth; 1971-1981 high TFP growth; 1981-1991 TFP growth averaging that of the periods before; Stolper-Samuelson effects in the seventies; no further substantial reduction of the prices of labour-intensive products; while in the seventies product price changes lowered the reward of labour and especially of low-skilled labour, in the eighties product price changes lower capital reward; while in the seventies globalization works against low-skilled labour, in the eighties technological progress works strongly against labour; however, assumption of a zero pass-through rate: in the seventies globalization works in favour of low-skilled worker wages whereas technology is the driving force lowering low-skilled labour wages</p>

Study	Data	Procedure	Findings
Sachs and Shatz (1994)	Focus on manufacturing; data for the past three decades are examined: trade data compiled from the official statistics of the U.S. Department of Commerce; data from 1989 to 1992 from the U.S. Bureau of Census; industry data mainly from the NBER; extension of these data by using the ASM and BEA data for the variables wage, value-added, value of shipments, and real output; research and development data from the Annual Line of Business Report; wage ratio is the local monthly manufacturing wage divided by the U.S. monthly manufacturing wage; data for foreign investment and input-output matrix from BEA; data on tariffs and quotas from the International Trade Commission; U.S. international transactions and GDP from the U.S. National Income and Product Accounts; import price indexes by industry from the BLS; skill data from Howell and Wolff ¹	Both employment effects and effects on relative wages of skilled and unskilled labour are examined; factor content versus price transmission of the effects due to international trade; employment is disaggregated according to skill intensity deciles (production employment as share of total employment per decile); these are related to imports and exports in order to examine Heckscher-Ohlin-Samuelson effects; distinction between intra-industry and inter-industry trade; role of multinationals is examined	U.S. trade patterns follow the predictions of the Heckscher-Ohlin trade theory; trade reduces the wages of low-skilled workers as well as employment in low-skilled labour intensive sectors; multinationals seem to use low wage countries abundant in low-skilled labour as a platform for production in order to reexport final products implying pressure on the relative wages of low-skilled workers in the U.S.

labour skills, a model with the three factors physical capital, skilled labour and unskilled labour is considered. Leamer (1993) estimates the Rybczynski link of relative output quantities and relative factor inputs. Finally, the symmetry of the Rybczynski theorem and the Stolper-Samuelson theorem allows the link between a change in relative goods prices and a change in relative factor to be analysed. This symmetry holds under certain assumptions, cf. Section 5.1. As an important result, Leamer (1993) expects the redistributive process characteristic for the eighties to continue in the following decade.

From a theoretical point of view, Leamer's (1993) contribution is important because as a theoretical basis for empirical work he applies asymmetric models to the trade and wages problem. This class of models gives not only a perspective to the analysis of conflict-generating product price changes in a world with both two different aggregated labour skills and physical capital, but it also gives a perspective to focus shorter run issues in the context of the equilibrium framework outlined in Section 3.2. Up to now, in addition to Leamer's studies have been only few attempts to test asymmetric specific-factors models for empirical evidence. An exception is Kohli (1993). However, Kohli (1993) aggregates the mobile factor labour with two sector-specific factors physical capital, as was done in the original specific-factors model framework. Kohli's (1993) model thus does not fit the trade and wages problem.

6.4 Trade, Wages and Specific Factors: Examining Shorter Run Issues

The restrictive Heckscher-Ohlin model with two different labour skills is perfectly symmetric as to treatment of the two perfect substitutable as well as homogenous factors, so that factor denomination remains arbitrary, cf. Section 5.4. This property was used by Slaughter (1995) and others to simply reinterpret the two factors as skilled and unskilled labour. Yet, from a rather shorter run perspective the trade and wages problem can theoretically be sharpened by giving up the symmetry assumption. One easy way to do this is to recur to the Ricardo-Viner or specific-factors model. Leamer's (1993) approach, discussed above, in particular shows it is worth examining more deeply the explanatory power of this way of thinking in the context of the trade and wages debate.

However, what should not be hidden when this approach is applied is that one must leave open the question of what exactly the concepts shorter run and longer run mean. This problem arises whenever static general equilibrium models are adapted to dissolve their inherent long-term nature. Therefore it has precisely to be analysed in which sense such assumptions as specific factors approximate periods of what extent. As will be shown the assumption of sector specific factors reveals a scenario of conflict-generating product price changes in models with at least three production factors. Hence, in the face of the deficits of the symmetric models, such a structure approaches the trade and wages problem now dealing with distributional conflicts between different labour skills as well as between labour and physical capital.

Asymmetric Models – a Basis for the Trade and Wages Debate?

Let goods x_1 and x_2 be produced by means of three inputs: skilled labour v_1 , unskilled labour v_2 and physical capital v_3 . This model, whose supply side can be found in detail in Appendix B.4, requires further assumptions with regard to factor intensity of goods production. Therefore, let x_1 be intensive in skilled labour and let x_2 be intensive in unskilled labour, i.e., $\frac{a_{11}}{a_{12}} > \frac{a_{31}}{a_{32}}$ and $\frac{a_{31}}{a_{32}} > \frac{a_{21}}{a_{22}}$. These intensity assumptions can be summarised as follows:

$$\frac{a_{11}}{a_{12}} > \frac{a_{31}}{a_{32}} > \frac{a_{21}}{a_{22}}. \quad (6.11)$$

Factor physical capital v_3 thus becomes a sort of middle intensity factor. Does the most reduced or most aggregated version of the asymmetric model type allow interesting conclusions to be drawn that elucidate the trade and wages problem in a first best open economy? To derive signs of the Stolper-Samuelson matrix in (B.11), additional assumptions to the substitution matrix in (B.10) are required. Therefore, let the two extreme factors skilled and unskilled labour be complements. By contrast let both types of labour as well as capital be substitutes. Hence, substitution matrix

$$\begin{bmatrix} s_{11} & s_{12} & s_{13} \\ s_{21} & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{bmatrix} = \begin{bmatrix} - & - & + \\ - & - & + \\ + & + & - \end{bmatrix}$$

results. While the elements s_{12} and s_{21} become negative, elements s_{31} , s_{32} , s_{13} and s_{23} are positive. This means that if the skilled labour wage rose, demand for this factor would fall in both sectors. Because of these factors being complementary, demand for unskilled labour would fall, too. On the other hand, the fall in demand for unskilled labour would imply its wage decreasing in order to guarantee full employment. The following signs of the Stolper-Samuelson matrix result:

$$\begin{bmatrix} \frac{\partial w_1}{\partial p_1} & \frac{\partial w_2}{\partial p_1} & \frac{\partial w_3}{\partial p_1} \\ \frac{\partial w_1}{\partial p_2} & \frac{\partial w_2}{\partial p_2} & \frac{\partial w_3}{\partial p_2} \end{bmatrix} = \begin{bmatrix} + & - & ? \\ - & + & ? \end{bmatrix}. \quad (6.12)$$

If the skilled labour intensive goods price p_1 increased due to international goods trade the wage earned by skilled labour would also increase. A larger qualificatory wage gap would therefore result. However, conclusions about the change in both the skilled labour and the unskilled labour wage relative to physical capital cannot be derived theoretically. Ambiguous results leave determination of the corresponding signs in the substitution matrix to empirical analysis. In consequence, from a theoretical point of view the issue of the functional distribution of income's change with respect to prices of labour relative to physical capital remains unsolved.

Another problem emerges from the *ad hoc* assumption of skilled and unskilled labour being complementary factors: empirical findings by Acemoglu (1998), Goldin and Katz (1996), Goldin and Katz (1998), Griliches (1969) and Machin and van Reenen (1998), for example, argue against the plausibility of this assumptions and find evidence in favour of complementary factors skilled labour and physical capital.

Thompson (1997) does not provide econometric testing but the simulation analysis of an asymmetric general equilibrium model. In his simulation analysis of the U.S. economy Thompson (1997) distinguishes eight different factors of labour, one aggregated factor of physical capital and three production sectors based on observed factor shares as well as industry shares. His simulation discloses that skilled labour is also a 'friend' of capital. Evidence was collected by Wood (1994) who reviews estimations of substitution elasticities between different labour skills and physical capital. The predominant result was only small substitution elasticities between low-skilled labour and capital.

By means of the additional assumption of substitutability of skilled and unskilled labour and substitutability of skilled labour and physical capital the following signs result:

$$\begin{bmatrix} s_{11} & s_{12} & s_{13} \\ s_{21} & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{bmatrix} = \begin{bmatrix} - & + & - \\ + & - & + \\ - & + & - \end{bmatrix}.$$

If the wage earned by unskilled labour fell, demand for physical capital would increase, too. By contrast, demand for unskilled labour decreases. However, in this case no obvious Stolper-Samuelson signs and thus no theoretical predictions about the changes in the functional distribution of incomes due to changes in relative goods prices can be derived.

The exercise carried out this far has shown that trying to give the trade and wages problem a theoretical framework by a reasonable expansion of the number of production factors leads to numerous problems. As to the relationship of factors, empirical evidence is necessary whether it is of the complementary or the substitutive type. In the following section, the assumption of perfect intersectoral mobility of all production factors will be given up in order to sharpen the perspective on trade and wages in the shorter run.

Which Factors are the Specific Ones?

At least in the short and medium runs, there is hardly substitutability of all production factors and least of all perfect substitutability of high-skilled labour by unskilled labour. Incidentally, this has also become apparent in the thinking about endogenous labour supply. Further training or retraining unambiguously requires a more or less extended training period. On a sound basis one can therefore assume some factors to be sector specific in the short and medium runs.

How does the most reduced version of the specific-factors model differ from the one in the section above? First, whereas skilled labour v_1 now only enters production of x_1 , by assumption, unskilled labour v_2 is only employed in sector x_2 . The input coefficients a_{12} and a_{21} become zero. Finally, let physical capital v_3 be the mobile factor that is complementary to both factors of labour. The following signs of the

substitution matrix result:

$$\begin{bmatrix} s_{11} & s_{12} & s_{13} \\ s_{21} & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{bmatrix} = \begin{bmatrix} - & 0 & + \\ 0 & - & + \\ + & + & - \end{bmatrix}.$$

A detailed overview of the underlying equation system can be found in Appendix (B.12). By means of the substitution matrix, signs of the Stolper-Samuelson matrix can be derived:

$$\begin{bmatrix} \frac{\partial w_1}{\partial p_1} & \frac{\partial w_2}{\partial p_1} & \frac{\partial w_3}{\partial p_1} \\ \frac{\partial w_1}{\partial p_2} & \frac{\partial w_2}{\partial p_2} & \frac{\partial w_3}{\partial p_2} \end{bmatrix} = \begin{bmatrix} + & - & + \\ - & + & + \end{bmatrix}. \quad (6.13)$$

If goods price p_1 increased due to international trade in final goods, the reward of factor v_1 would increase. It is this factor that enters sector x_1 as a specific input. An increase in goods price p_1 undoubtedly refers to the stylised fact of final goods trade mainly characterising trade between countries with different factor endowments. While the factor price of physical capital w_3 also increases, the factor price w_2 earned by the second specific factor unambiguously falls. As a result, not only the qualificatory wage gap increases but unskilled labour's relative position to physical capital worsens. As compared with capital, the change in skilled labour's relative income position, however, depends on the extent of both factors' unidirectional change.

Furthermore, with three production factors it is now possible to turn back to personal distribution of income issues. However, this requires the stylised construction of households differing in factor endowments. Distinction of two aggregated factors labour suggests at least two types of households, with one household above all supplying unskilled labour and the other household above all supplying skilled labour. At this point, one should once again recall the most important roots of theoretical income distribution analysis from the nineteenth century until at least the middle of the twentieth century: in the nineteenth century, theoretical debates on income distribution were inspired by society's class structure, loosely said, confronting capital owners with labour suppliers, supplying mostly unskilled labour. Perhaps it was this point that provided the strongest argument in favour of neglecting personal distribution of income issues, since explanation of the functional distribution of income more or less allowed directly inferring the personal income distribution as the functional income distribution. However, compared to some of the important nineteenth century stylised facts, social reality with respect to the distribution of factor ownership and thus factor rewards has meanwhile become very complex, making the task of representing a society's socio-economic structure by few or even only two different household types much more difficult.

Nevertheless, the most reduced model world would be the distinction of two household types, one household endowed with unskilled labour, and the other household endowed with skilled labour and capital. Without thinking of the deficits of such a construction, the debate on the emergence of a 'two-thirds society' that dominated numerous discourses on social change in the eighties and nineties suggests itself. Following this line of reasoning, under the assumption of homothetic preferences

the specific-factors model formulated above suggests that the household endowed with unskilled labour unambiguously loses, independent of its consumption pattern, since unskilled labour's real wage falls in terms of both goods.

Another cue would be the hypothesis of a vanishing middle class, cf. Section 2.2. The more complex household typology requires starting from households supplying unskilled labour, households supplying skilled labour and capital, and households supplying high-skilled labour and capital. At this point, why the problem remains insoluble with respect to a more problem-oriented distinction of households lies in the aggregation of only two labour qualities. Middle income households can be supposed to supply labour characterised by some skill. These more intuitive considerations show an important theoretical dilemma: to construct a sound theoretical basis for the trade and wages problem, model reduction as to the numbers of factors and goods is indispensable. However, such reduction of structural functional distribution analysis makes reasonable household distinction almost impossible. Skills relevant for a socio-economic household distinction have to be subsumed either under unskilled or skilled labour in the two labour qualities case. Finally, it may not be forgotten that the functional income distribution in the model framework discussed so far is still determined on the economy's supply side.

Despite the clear-cut results of the theoretical prediction of changes in the qualificatory wage gap derived by the introduced version of the specific-factors model, one should critically address the question whether the assumption of unskilled labour to be sector specific is well-founded. Relative factor price effects due to changes in goods prices critically depend on which of the three factors are assumed to be specific. In the first scenario, skilled labour was assumed to be one of the specific factors. This seemed reasonable because at least in the short run, labour skills might partly be firm-specific because of specialization due to specific human capital investments. Intersectoral mobility thus induces a time-requiring transformation process for human capital to become employable in other production sectors. The same applies to physical capital. This point of view is in the tradition of the early specific-factors models that worked with different factors of physical capital as specific factors without disaggregating labour. However, an objection would be that as compared to unskilled labour, skill possibly allows faster adjustment to new activities due to mobility enhancing skills like high communication competence or high analytical abilities.

Yet further scenarios can be imagined. In a second scenario let human capital v_1 again be assumed sector specific. Now, let the second specific factor be physical capital v_3 . In a model with only three production factors, unskilled labour inevitably remains as a mobile factor. Therefore, input coefficients a_{12} and a_{31} become zero with the substitution matrix

$$\begin{bmatrix} s_{11} & s_{12} & s_{13} \\ s_{21} & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{bmatrix} = \begin{bmatrix} - & + & 0 \\ + & - & + \\ 0 & + & - \end{bmatrix}$$

resulting. Once more the Stolper-Samuelson matrix's signs can be derived by means

of the signs of the substitution matrix:

$$\begin{bmatrix} \frac{\partial w_1}{\partial p_1} & \frac{\partial w_2}{\partial p_1} & \frac{\partial w_3}{\partial p_1} \\ \frac{\partial w_1}{\partial p_2} & \frac{\partial w_2}{\partial p_2} & \frac{\partial w_3}{\partial p_2} \end{bmatrix} = \begin{bmatrix} + & + & - \\ - & + & + \end{bmatrix}. \quad (6.14)$$

If the human capital intensive goods price increased, the skilled labour wage w_1 would increase. The unskilled labour reward w_2 would also increase. Whether the qualificatory wage gap grows or shrinks depends on the extent to which factor prices of both skilled and unskilled labour change. On the other hand, physical capital's income position relative to both factors labour unambiguously worsens. In any case, whether or not unambiguous conclusions as to changes in relative factor price distances between both factors labour can be drawn depends on which factors are assumed to be sector specific and on the extent to which relative goods price changes affect factor prices.

Another problem with the perfect competitive models focused on so far is that in a sense firms do not actually exist because there is no residual profit accruing to firm owners. This problem arises irrespective of whether factors are assumed to be sector-specific or not, or which factors are supposed sector-specific. However, specific factors do provide an approximation of firms in a perfect competitive model world: in a specific-factors model the concept of firm can be grasped by a kind of log-in effect that arises from missing factor mobility. Firms can be identified as production by means of factors that cannot instantaneously be transformed. Unlike symmetric models, the factors' denomination no longer remains arbitrary with respect to distributional conflicts. Furthermore, in both scenarios goods price changes lead to distributional conflicts between factors. This is a basic property. It serves to distinguish meaningfully asymmetric models with some factors specific from perfect competitive symmetric models with all factors perfectly mobile between sectors.

6.5 Enhancing the Supply of Higher Education – a Panacea?

The empirical debate on trade and wages is characterised by partial equilibrium approaches on the one hand and approaches that started from general equilibrium trade theory on the other. Findlay (1991) postulates the reconciliation of trade theory approaches with partial equilibrium approaches, cf. Section 6.3. A basic problem in meaningfully applying the two-by-two model to the trade and wages problem is its missing structure. A remedy focusing on the shorter term was to introduce a further restriction by means of immobile factors. Naturally, the Heckscher-Ohlin model as discussed in Section 5.4 with its two-by-two core also suffers from this lack of structure. However, not only in asymmetric but also in symmetric models can the assumption of a homogenous production factor labour easily be given up. Findlay and Kierzkowski (1983) drop the homogeneity assumption to give the two-by-two Heckscher-Ohlin model its missing structure, and so find the missing structure with respect to the trade and wages problem. However, this structure has itself to be established.

Findlay and Kierzkowski (1983) provide such deeper foundation by renaming the production factors of the basic model and by giving up the exogenous skilled labour supply by means of an optimal investment decision in education. A third factor capital v_3 enters the model on the stage of human capital accumulation. With this in mind the model is decomposed. Human capital accumulation is modelled by a linear homogeneous production function Q under the assumption of a constant qualification period θ for those who decide to get training:

$$q = f(k) \quad \text{with} \quad \frac{\partial f}{\partial k} > 0, \quad \frac{\partial^2 f}{\partial k^2} < 0, \quad (6.15)$$

with

$$q = \frac{Q}{E} \quad \text{and} \quad k = \frac{v_3}{E},$$

where E is the number of those deciding to become educated. Let lifetime of each individual be T . Hence, total lifetime of all individuals equals the sum of lifetimes of those who demand education, of those who remain unskilled, and of those who supply skilled labour:

$$NT = \theta E + UT + (T - \theta)E = \theta E + v_2 + \frac{v_1}{q}, \quad (6.16)$$

where N is the population size and v_2 is total unskilled labour endowment. Skilled labour endowment v_1 is written in efficiency units. Obviously, total lifetime is assumed to be exhaustively divided into cumulated training periods and cumulated working periods. The trade-off between labour and leisure is neglected. Endogenizing skilled labour supply thus implies the sole substitution of work by education. The required zero profit conditions and factor market equilibrium conditions correspond to (3.19) and (3.20) for the case of two goods and two factors. By assumption good x_1 is always intensive in skilled labour, i.e. $\frac{a_{11}}{a_{21}} > \frac{a_{12}}{a_{22}}$ with both factors of labour rewarded by their marginal product. Expressed in efficiency units, factor reward earned by skilled labour becomes qw_1 .

The investment decision in human capital is modelled as an optimization problem in the tradition of human capital theory. Skilled labour wage w_1 and unskilled labour wage w_2 set on perfect competitive markets are treated parametrically by the individual who maximizes net gain γ from education. Since the number of those who are educated in equilibrium is treated parametrically by the individual with respect to its optimization problem, per-capita qualification production q is also treated parametrically. Net gain from education is the difference of gross revenue from education

$$\int_{\theta}^T w_1 q e^{-rt} dt = \frac{1}{r} w_1 q (e^{-r\theta} - e^{-rT}) \quad (6.17)$$

and total educational costs

$$\begin{aligned} & \int_{\theta}^T w_1 \frac{\partial f}{\partial k} k e^{-rt} dt + \int_0^T w_2 e^{-rt} dt \\ &= \frac{1}{r} [w_1 \frac{\partial f}{\partial k} k (e^{-r\theta} - e^{-rT}) + w_2 (1 - e^{-rT})], \end{aligned} \quad (6.18)$$

that is

$$\gamma = \frac{1}{r} [w_1 \frac{\partial Q}{\partial E} (e^{-r\theta} - e^{-rT}) - w_2 (1 - e^{-rT})] \quad (6.19)$$

taking

$$\frac{\partial Q}{\partial E} = q - \frac{df}{dk} k$$

into account with r as individual rate of time preference. The first term in (6.18) stands for the reward of the specific educational input K during the training period and the second term stands for the total opportunity costs of the choice to become educated. These costs amount to the unskilled worker's income over her total lifetime T . Individuals who decide to demand education never supply unskilled labour. Now, the net gain γ is a sole function of the number of those who become educated. If this gain becomes larger than zero for at least another individual there exists an unambiguous educational incentive. Maximization of the net gain by the N identical individuals shows

$$\frac{\partial \gamma}{\partial E} = \frac{1}{r} w_1 (e^{-r\theta} - e^{-rT}) \frac{\partial^2 Q}{\partial E^2} < 0, \quad (6.20)$$

since due to (3.19) the second order condition holds as well:

$$\frac{\partial^2 Q}{\partial E^2} = -\frac{K}{E^2} \frac{\partial f}{\partial k} - \left(-\frac{K}{E^2} \frac{\partial^2 f}{\partial k^2} k - \frac{K}{E^2} \frac{\partial f}{\partial k} \right) = \frac{1}{E} k^2 \frac{\partial^2 f}{\partial k^2} < 0.$$

Hence, in the long run equilibrium there is no incentive for the unskilled to invest in education and net gain from education has to decrease to zero. Immediately, the long-term equilibrium condition

$$\frac{\partial Q}{\partial E} \equiv \lambda = \frac{w_2}{w_1} \frac{(1 - e^{-rT})}{(e^{-r\theta} - e^{-rT})} \quad (6.21)$$

results from (6.19). Due to factor price dependency, λ just depends on terms-of-trade $p = p_1$ with p_2 set to unity. This means the higher p the higher the relative factor price earned by v_1 , the lower λ and therefore the higher the number of those in equilibrium who decide to demand education. λ is nothing else but the marginal contribution to qualification of the last person being educated. Equation (6.21) thus gives the equilibrium relationship between relative wages earned by different worker types and the marginal contribution of the last one demanding education.

Because of the assumption of both national and international identical preferences and of perfect competitive factor markets, cumulated incomes discounted to their present value earned by skilled workers have to equal those earned by unskilled workers. In addition, the worldwide rate of time preference must also be equal, first, because the factor price equalization theorem results in the international equalization of skilled and unskilled workers' period incomes, and second, long-run equilibrium will be characterised by equalization of cumulated period incomes discounted to their present value. Yet, domestic discounted cumulated period incomes of unskilled workers will decrease due to the decrease of period incomes when moving to free trade. Consequently, in the highly developed country discounted cumulated period net incomes earned by skilled workers also have to decrease.

Turning to the two country case, the model's Heckscher-Ohlin core implies that countries can be distinguished by factor endowments, so that different capital endowments lead to different human capital endowments. The original free trade equilibrium will initially be characterised by the highly developed country exporting human capital intensive good x_1 and the less developed country exporting unskilled labour intensive good x_2 . If inter-industry trade were intensified and the two countries shifted to a new trade equilibrium, according to (5.2) unskilled labour's relative price in the highly developed country would increase. To overuse this approach in a way: now not only the stylised fact of the deteriorating position of unskilled labour seems to be approximated, but also the stylised fact of the secular trend towards less relative unskilled labour employment by the induced increase in skilled labour supply employment. Endogenous labour supply effects would increase the structural change implied by expanding inter-industry trade. According to (5.4), this is nothing else but an additional Rybczynski effect. However, the other side of the coin is the predicted decrease in skilled labour employment in the country poorly endowed with physical capital. This result clearly contradicts expected spillover effects between countries of different development stages. In a sense, these spillover effects are part of the model's assumptions because production technology is internationally available. However, not only production technology (3.1) but also education technology (6.15) is assumed to be internationally available. In consequence, the fact of dramatically differing educational infrastructure, as one of the main differences between countries of different development stages, makes the model's assumptions appear in an unfavourable light, especially because these differences are not only quantitative differences in the supply of education but also differences in educational quality.

Findlay and Kierzkowski (1983) undoubtedly offer a synthesis of a human capital investment decision that represents more partial equilibrium thinking and the general equilibrium thinking on international trade. In a general way, they reconcile the two ways of thinking. Perhaps this statement hints at one of the reasons why their model was referred to quite often when interaction of trade and wages was analysed. Furthermore, as will be explained later on, endogenization of human capital by Findlay and Kierzkowski (1983) was not only integrated into models of perfect competition, but as well into models that take distorted labour markets into consideration. Their model thus serves as a proposal to organize thinking about the flip-side hypothesis. An example is Flug and Galor (1986) starting with Brecher's (1974a/b) approach.

The model by Findlay and Kierzkowski (1983) exhibits several problems when applied to the trade and wages issue:

1. There has to exist a capital market on which this factor's market price is set, since those who acquire qualification in equilibrium demand loans to finance their education. However, the authors do not model the factor price setting of r that is treated parametrically by agents. As a remedy they assume that this price is set on a perfect competitive world market implying the small open economy assumption to be satisfied, i.e., capital supply is perfectly elastic.
2. Second, as already stated the Heckscher-Ohlin framework is long-term in its

nature. Hence, factor endowments must be interpreted as factor endowment stocks. In a sense, to integrate accumulation of factor qualities into such a framework as done by Findlay and Kierzkowski (1983) is counter-intuitive and not consistent. This important point should be kept in mind.

3. Third, there emerges a qualificatory wage gap in period labour incomes that changes in case of changes in world market prices according to the Heckscher-Ohlin mechanisms. However, due to the assumption of perfect competitive factor price setting on labour markets and the assumption of identical preferences, discounted cumulated lifetime incomes earned by skilled and unskilled workers always equalize. As to a meaningful distinction of incentive compatible individual behaviour, the decision to invest in human capital therefore seems to be of an arbitrary and unfounded character: first, the individuals' endowments with physical capital is irrelevant since on the perfect competitive world capital market loans can be demanded without any restrictions; second, the individuals do not differ in their ability to accumulate human capital.

This provides the starting point of Borsook's (1987) modifications. Borsook (1987) recurs to a class of theories that assumes an exogenously given distribution of basic intellectual and practical abilities denoted as a . Let these abilities' distribution be

$$\int_0^1 g(a) da = 1 \quad (6.22)$$

with $g(a)$ as the density function. The number of individuals characterised by a certain ability level is

$$N(a) = Ng(a) \quad \text{with} \quad 0 < a < 1. \quad (6.23)$$

Borsook (1987) specifies the per-capita production function (6.15) by a Cobb-Douglas technology and introduces ability into the production of qualification as an explanatory variable:

$$\begin{aligned} q(a) &= (1 + a)A[k(a)]^\sigma \\ \text{with } k(a) &\equiv \frac{v_3(a)}{N(a)} \quad \text{and} \quad b \leq a < 1, \quad 0 < \sigma < 1. \end{aligned} \quad (6.24)$$

Parameter b stands for the critical level of ability. Individuals with abilities above this value decide to invest in human capital. In addition, when modelling technology Borsook (1987) takes a technology parameter A into consideration. Corresponding to (6.16) the population's total lifetime is divided into

$$\begin{aligned} NT &= \theta N \int_b^1 g(a) da + UT + (T - \theta)N \int_b^1 g(a) da \\ &= \theta N \int_b^1 g(a) da + v_2 + \frac{v_1}{\int_b^1 q(a) da}. \end{aligned} \quad (6.25)$$

Capital supply is exogenously given and can be formulated as capital demand per ability level according to

$$v_3 = \int_b^1 v_3(a) da = N \int_b^1 g(a) k(a) da. \quad (6.26)$$

As the market for capital is assumed perfectly competitive this factor is rewarded by its marginal product:

$$\frac{\partial q(a)}{\partial k(a)} = \sigma(1+a)A[k(a)]^{\sigma-1} = w_3. \quad (6.27)$$

With respect to (6.26), by means of (6.27) an equation can be derived that determines the competitive price of capital. Capital use as an input into qualification accumulation depends on nominal factor supplies N and v_3 as well as ability level b :

$$w_3 = \sigma A \left(\frac{v_3}{N} \right)^{\sigma-1} \int_b^1 g(a)(1+a)^{-\sigma} da. \quad (6.28)$$

Differentiation with respect to b exhibits $\frac{dw_3}{db} < 0$. If the number of individuals demanding qualification decreases, i.e. the number of individuals endowed with ability above b , per-capita demand for capital decreases. Hence, in order to maintain capital fully employed, per ability capital input during education has to increase. And as an implication of decreasing marginal productivity, the price of capital w_3 must decrease.

Equation (6.28) is nothing else but the equilibrium condition for the market for physical capital. In the model by Findlay and Kierzkowski (1983), net gain γ arising out of qualification is given by equation (6.19). In comparison, in Borsook's (1987) model this net gain differs solely in the explanatory variable ability and the functional specification of $\frac{\partial Q}{\partial E}$ owing to the Cobb-Douglas technology:

$$\gamma(a) = \frac{1}{r} [w_1(1-\sigma)(1+a)^{\frac{1}{1-\sigma}} A \left(\frac{w_3}{\sigma A} \right)^{-\frac{\sigma}{1-\sigma}} (e^{-r\theta} - e^{-rT}) - w_2(1 - e^{-rT})]. \quad (6.29)$$

In equilibrium net gain $\gamma(a)$ arising from qualification necessarily becomes zero, so that those individuals characterised by critical ability level b are undecided whether to invest in qualification or not with $\gamma(b) = 0$ implied. The demanded relationship between b and w_3 can therefore be derived from equation (6.29):

$$w_3 = \left[\frac{w_2}{w_1} \frac{(1 - e^{-rT})}{(e^{-r\theta} - e^{-rT})} \right]^{-\frac{1-\sigma}{\sigma}} \sigma(1-\sigma)^{\frac{1-\sigma}{\sigma}} [A(1+b)]^{\frac{1}{\sigma}} \quad (6.30)$$

with $\frac{dc}{db} > 0$. This relationship implicitly gives capital demand per ability level determining qualification incentives.

The equation system consists of (6.28) as well as (6.30) and it enables simultaneous determination of the equilibrium values of b and w_3 . While the net income earned by those who have decided not to become qualified corresponds to their gross factor reward, i.e.,

$$w_2^{net} = w_2, \quad (6.31)$$

net income of those who have decided to become qualified corresponds to the efficiency unit reward. This reward depends on acquired qualification minus qualification capital reward determined by capital's share σ :

$$w_1^{net}(a) = (1-\sigma)w_1A \left(\frac{w_3}{\sigma A} \right)^{-\frac{\sigma}{1-\sigma}} (1+a)^{\frac{1}{1-\sigma}} \quad \text{for all } a \in [b, 1]. \quad (6.32)$$

Net capital reward thus becomes

$$w_3^{net}(a) = \sigma(1+a)A[k(a)]^{\sigma-1}w_1 = w_1w_3. \quad (6.33)$$

This leads to the important result that, compared to the model by Findlay and Kierzkowski (1983), in equilibrium a unique skilled labour wage does not exist. Equilibrium net wages earned by skilled labour are distributed according to the ability distribution. This distribution also determines whether within-group disparity increases or decreases in the case of moving from one trade equilibrium to another.

The analysis of effects due to international trade is again established by the reasonable endowment assumptions introduced earlier. As the benchmark case for the U.S., let the terms of trade p_1 increase when moving from one trade equilibrium to another. Accordingly, relative factor price $\frac{w_1}{w_2}$ increases, i.e., the wage gap changes in favour of skilled labour, since the country richly endowed with human capital exports the skill-intensive good x_1 as an implication of trade. The highly developed country is richly endowed with human capital because it is richly endowed with educational capital. As b decreases the grown wage gap increases the incentive to invest in human capital, implying increased demand for educational capital, so that per-capita availability of educational capital diminishes. Hence, the capital reward increases because of assumed decreasing marginal productivity. If $\frac{w_1}{w_2}$ increases w_3 will also increase, cf. (6.30). Yet it is this increase in education costs that counteracts the increase in gross income earned by skilled labour. By contrast, capital owners will unambiguously gain because both w_1 and w_3 increase, cf. (6.33). Because there are no differences in workers' gross lifetime incomes, again the situation of both skilled and unskilled workers worsens, accompanied by a worsening relative position relative to capital. With respect to the Rybczynski effects induced by increasing human capital supply, the same result holds as in the model by Findlay and Kierzkowski (1983).

The model by Borsook (1987) remedies the deficits inherent in the model by Findlay and Kierzkowski (1983):

1. Its explanation of human capital accumulation by means of the ability distribution introduces within-group inequality issues. The importance of changes in within-group inequality during the eighties was shown by the findings concerning the characteristics inherent in the change of inequality of the functional U.S. income distribution during this decade. Depending on the underlying ability distribution, inequality in the skilled worker incomes can both increase and decrease due to a fall in ability threshold b .
2. When modelling skill acquisition, Borsook (1987) explicitly considers price formation of the third factor capital. This is achieved by model decomposition with physical capital only entering on the stage of human capital accumulation. The background Heckscher-Ohlin trade model focuses on endowment differences as the moving force of international trade in final goods, so that an initial endowment with labour and educational capital is postulated *ad hoc*.
3. With respect to this section's demanding question, nothing definitive can be said on the basis of the two models. Yet from a policy perspective, the

seminal approach by Findlay and Kierzkowski (1983) and its extension by Borsook (1987) offer an important starting point to discuss whether human capital accumulation should be encouraged in an open economy on distributional grounds. Furthermore, the Findlay and Kierzkowski (1983) approach allows distinguishing the cross-sectional functional income distribution from the functional distribution of income over workers' lifetimes. At first glance, this aspect of the model seems to suffer from the assumption of identical individuals. Nevertheless, differences between distributional effects once in the shorter run and once in the longer run lead to an important problem inherent in policy decisions: given some consensus on distributional justice, the main question becomes which kind of distributional effects induced by economic internationalisation should induce redistributive policies.

Naturally, the model by Borsook (1987) can also be criticized starting from the main point made by the critics of ability theories: an ability distribution has to be assumed. But first, even if only observable by the choice of more or less appropriate proxies there is some plausibility as to how intellectual and practical abilities might be distributed. Second, ability theories at least establish human capital formation more deeply. And finally, hypotheses on human capital formation are reconciled with a trade model, thus contributing to the deeper understanding of distributive effects in open economies due to world market price changes.

The Perfect Competitive U.S. Economy – Objections

7.1 Challenging the Benchmark’s Explanation Power

An economy with perfect competitive goods and factor markets has served as the main benchmark for hypotheses dealing with presumed repercussions between international trade and U.S. wages. This also applies to the specific-factors model where, compared to the benchmark model in Section 3.2, an additional restriction was introduced. In all these model types gains from trade were unambiguously guaranteed by the additional assumption of a small open economy that treats international goods prices parametrically. Even if distributional effects due to economic internationalisation in the sense of formerly nontradeable goods having become tradeable were to deteriorate the relative positions of low-skilled and unskilled workers in a socially undesired direction, the gains from trade would offer scope for redistribution. However, if there were imperfect competition in goods or factor markets the resulting second-best scenario would no longer allow welfare issues to be separated from distributional issues. Hence, there would no longer be such clear-cut welfare implications of economic internationalisation and redistributive policies in the form of lump sum transfers as compensation of those who lose. In Section 3.3 it has been argued that in the longer run U.S. labour markets could be approximated by applying the perfect competition benchmark. Compared to the German case, unemployment did not persist, cf. Figure 3.1 where the dramatic differences of long-term unemployment’s share in overall unemployment could additionally be studied. In the U.S., restrictions on a flexible factor price formation have been unambiguously diminishing, especially during the eighties: the minimum wage legislation has become decreasingly binding, for example. Another aspect has been the diminishing wage bargaining power of trade unions. Furthermore, stronger restriction of unemployment benefits and income support in size and time has aimed at creating stronger labour supply incentives.

However, unemployment rates fluctuating around an average, as shown in Figure 3.1, temporarily showed high values. Especially at the beginning of the eighties, the unemployment rate was far from its supposed natural rate. Yet, the suitability

of the perfect competition approach has not only been questioned with respect to labour markets. Explaining intra-industry trade, which forms the bulk of trade between highly developed economies characterised by similar incomes, also requires to deviate from perfect competitive goods markets. The relevance of multinational firms to the trade and wages puzzle is closely linked to this issue. Therefore more recent studies have decided to deviate from the perfect competition assumption both on labour and on goods markets.

In what follows, the focus will be on the Dinopoulos and Segerstrom (1999) approach, who introduced Cournot quantity competition on goods markets, thus deviating from the perfect competition assumption on goods markets. In addition, their approach simultaneously allows a more sophisticated treatment of technological progress. With respect to the labour supply side, Dinopoulos and Segerstrom (1999) build on the work by Findlay and Kierzkowski (1983), introduced in the preceding section.

7.2 Trade, Wages, and Imperfect Markets – Empirical Evidence and Theoretical Perspectives

Only few contributions to the debate on U.S. trade and wages deal with imperfect goods markets. An exception is Borjas and Ramey (1994). In the face of empirical evidence, the authors argue that U.S. durable goods production was mainly characterised by concentrated industries. Their partial equilibrium model consists of two sectors. Whereas one sector is assumed to be perfectly competitive, the other sector is characterised by a monopoly rent. Borjas and Ramey (1994) deduce that foreign market entries directly affect domestic wages caused by decreasing monopoly rents. The authors' empirical findings on the basis of their stylised model can be found in Table 7.1.

Another study considering imperfect competition is Adams (1997). His study was already of interest when repercussion between trade and wages was analysed from a general equilibrium point of view. In contrast to Borjas and Ramey (1994), Adams (1997) refers to the general equilibrium tradition of trade theory. Imperfect competition is integrated by assuming monopolistic competition in one of the two aggregated output sectors. Adams' (1997) results can be found in Table 6.4. Furthermore Adams (1997) also tried to analyse shorter term issues inherent in the trade and wages puzzle. The specific-factors model introduced in Section 6.4 serves as a theoretical framework. Specific factors are modelled by a payment markup arising from sector-specific skills. In consequence, incentives to change sectors only result in the case of the wage decreasing to the extent of the markup.

Against the background of only minimal empirical evidence on the role of imperfect competition on goods markets in changing relative wages and the dominating perfect competition presumption, Dinopoulos and Segerstrom (1999) propose to change perspectives on the trade and wages puzzles by going beyond the classical Stolper-Samuelson link. With respect to labour markets, they start from the Findlay and Kierzkowski (1983) and Borsook (1987) frameworks. By integrating an endogenous qualificatory structure of labour supply into a household maximization

Table 7.1

International Trade and the U.S. Distribution of Labour Income – Imperfect Competition

Study	Data	Procedure	Findings
Borjas and Ramey (1994)	Annual Demographic Files of the CPS for 1984-1989; sample of men aged 18-64 who worked full-time year-round in the civilian sector; wage variable is log average weekly earnings; four groups of education	A regression model is used to obtain experience-adjusted wage differentials across education groups; analysis of growing international trade in the form of increasing foreign entry in home markets characterised by a high concentration ratio as a suggested cause underlying the increase in wage inequality in the U.S.; a stylized partial equilibrium model with perfect competition in one industry and concentration in the other one as theoretical basis: entry in the concentrated industry has a direct effect on wages because it enables foreign competitors to capture a significant portion of production and rents; the trade deficit is used as an approximation to the degree of foreign competition; thus, the entry in either competitive or in concentrated industries is decisive because the U.S. trade deficit, above all, concerned durable goods which are mainly produced in concentrated industries	Although the durable goods sectors are small industries relative to GDP, high rents and spill-over effects through income effects and upstream linkages on wage inequality seem to be likely; therefore trends in foreign competition in highly concentrated industries could have accounted for much of the trends in wage inequality from 1963 to 1988
Krueger (1997)	BLS data on price growth with prices adjusted for changes in the quality of goods, intermediate goods prices and skills for 1989-1995; input and output prices at the four-digit SIC level; goods prices from the PPI; labour shares, intermediate shares and the share of production workers from the ASM	A price growth equation for firms is modelled where average wage growth of skilled and unskilled labour, the proportionate growth in the cost of capital, the proportionate growth in the prices of intermediate goods and an error term stand on the right-hand side; the price growth equation is originally derived from the zero profit conditions of firms; then this equation is modified to consider imperfect competition, sampling errors and measurement errors; if the price of the skill-intensive good grew, according to the Stolper-Samuelson theorem the wages of skilled workers should have grown faster than the wages of unskilled workers; different versions of the price growth equation are estimated	Results support that the Stolper-Samuelson mechanism being at work; growth of output prices in high-skilled labour intensive industries is much higher than in those intensive in low-skilled labour

problem, the authors reformulate this framework. The maximization problem consists of the household utility function that is maximized under the restrictions of each household member maximizing her own utility out of goods consumption and the family wealth constraint. Consumed goods are of certain innovative quality having passed k innovation stages. Supplied by industry j and consumed at time $t = s$, goods consumption by an individual of ability a therefore is $x_a^d(k, j, s)$, where $j \in [0, 1]$ and where superscript d stands for demand. Each family consists of $N_0 e^{-(r-\zeta)s}$ individuals characterised by the same ability level a at time s . N_0 stands for the number of individuals constituting a family in period 0. As before r stands for the subjective discount rate, and ζ is the exogenous population growth rate. With $w_3(t)$ as the interest rate at time t the steady state condition for consumption is

$$\frac{\partial x_a^d(t)}{\partial t} = w_3(t) - r. \quad (7.1)$$

Steady state consumption only increases if the interest rate exceeds the subjective discount rate. Each household is characterised by a certain ability level that implies either remaining unskilled or demanding education in equilibrium. In a sense, this model additionally offers a concept for approaching personal income distribution issues.

Integration of the endogenous qualificatory structure of labour supply into the intertemporal consumption optimization problem leads to determination of the share of unskilled and skilled workers in equilibrium. In steady state the critical ability level from which individuals demand education is

$$b = \frac{w_2}{w_1} \frac{(1 - e^{-rT})}{(e^{-r\theta} - e^{-rT})} + \gamma. \quad (7.2)$$

Unambiguously, one recognizes the similarity to equation (6.21). Again, b denotes the ability level that divides those who decide to become educated in the steady state from those who decide to remain unskilled. According to Dinopoulos and Segerstrom (1999), $(a - \gamma)w_1$ is the effective wage paid to workers of ability a in steady state. In contrast to (6.21) γ is introduced as the minimum ability to become educated. Hence, the steady state supply of unskilled workers becomes

$$v_2(t) = bN(t). \quad (7.3)$$

The steady state labour supply of skilled labour is

$$v_1(t) = \frac{b + 1 - 2\gamma}{2} (1 - b) \frac{(e^{\zeta(T-\theta)} - 1)}{(e^{\zeta T} - 1)} N(t). \quad (7.4)$$

Furthermore, the steady state is characterised by growth rates of the unskilled labour and skilled labour supply equal to the population growth rate ζ . The message is clear-cut: if unskilled workers' relative wage fell, a larger population share would decide to become skilled with the implication of a higher steady state supply of skilled labour, meaning a falling b .

Up to now, the focus has been on the factor supply and goods demand side of markets. On the firm side a continuum of domestic industries $j \in [0, 1]$ produces

standard manufacturing good x by means of a linear homogenous technology. Following (3.9) the cost function can be written as

$$C_m(x, \mathbf{w}) = c_m(\mathbf{w})X = X \quad (7.5)$$

with $\mathbf{w} = (w_1, w_2)$ and X as total output. In order to standardize, the unit cost function is set to unity. According to (3.10), derivation of factor demand is straightforward. From the perfect competitive benchmark model the authors deviate by modelling Cournot quantity competition; that is, they introduce oligopolistic competition. As the authors assume structurally identical countries, only an assumed positive tariff levied on imports distinguishes product prices faced by the oligopolistic firm on the home market from product prices faced on the market abroad. Hence, this approach can be interpreted as a model of trade between the the U.S. and Germany, which are in many respects similar economies. Therefore, let G denote Germany and let U denote the U.S. As the authors model an innovation race, leading firms can be distinguished from following firms. While the latter produce under constant returns to scale and earn zero profits, on foreign markets the U.S. leaders are profit maximizing oligopolists according to

$$\pi_{Ul}^G = p_{Ul}^G X_{Ul}^G - X_{Ul}^G = \frac{x^{dG} N^G X_{Ul}^G}{(1 + \tau) \left(X_{Ul}^G + \frac{X_{Gf}^G}{k} \right)} - X_{Ul}^G \quad (7.6)$$

where l stands for leader and f for follower, so that π_{Ul}^G is a U.S. leader's profit on the German market. As long as the leaders are leaders in the sense of producing the most innovative good, their goods production is protected by patent. Unit costs also equal unity for the oligopolists, cf. (7.5). The first term on the right hand side of (7.6) contains German consumers' arbitrage condition between the U.S. leader's goods supply and the German followers' goods supply:

$$p_{Ul}^G(1 + \tau) = k p_{Gf}^G. \quad (7.7)$$

The right hand side shows the German price of the followers' goods supply adjusted by the innovation stage reached by the U.S. supplier relative to the innovation stage reached by the German followers.

The U.S. leaders' maximization problem on their home market only differs by the dropping tariff rate. Naturally, the assumption of the two economies being structurally identical also implies the structural identity of the leaders' maximization problems in the two trading countries. Hence, following the profit function approach in (3.3), profits in (7.6) are maximized leading to the Cournot equilibrium quantities and the cumulated profit flows of the leaders from exporting and selling goods on home markets:

$$\pi_l = \pi_l^G + \pi_l^U = x_l^d(t) N(t) \left[\frac{(k - 1 - \tau)^2}{(1 + \tau)k^2} + \frac{(k - 1)^2}{k^2} \right]. \quad (7.8)$$

Again, the structural symmetry assumption implying $N^U = N^G$ and $x^{dU} = x^{dG}$ becomes important, so that subscripts distinguishing German firms from U.S. firms could be omitted.

In contrast to the technologically leading firms, the home and foreign followers earn zero profits. Once again, it has to be stated that both U.S. and German home leaders only compete with foreign followers and domestic followers because of their technological leadership. As long as the leaders export they earn positive profits under the assumption of $0 \leq \tau < k - 1$. Otherwise, the tariff would be prohibitive. Consequently, the stronger the technological leadership and the lower the tariff rate, the higher the profits. The market segmentation implied by the pattern of trade determined by technological differences means that changes in tariffs only change the leaders' profits, leaving relative goods prices unchanged, with differences in innovation dynamics manifested in patents. Particularly, overall demand does not change and thus leaders' goods production does not change either. At this point, one should recall the Heckscher-Ohlin model where factor price equalization critically depends on the assumption of internationally identical technologies. Now, patents as an outcome of technological leadership imply exportation, provided $0 \leq \tau < k - 1$.

This leads to a measure of economic internationalization whose level depends on the institutionally set tariff rate τ and the attained innovation stage k . For the U.S. this measure is

$$\frac{X_{Ul}^G k}{X_{Ul}^G k + X_{Gf}^G} = 1 - \frac{1 + \tau}{k}. \quad (7.9)$$

Hence, the higher the tariff rate the lower the share of the U.S. leader's exports of total German goods consumption. According to the arbitrage condition (7.7), a tariff decrease changes the structure of U.S. demand, that is, U.S. consumers substitute the standard manufacturing good produced by the U.S. follower for the German technological leaders' export supply. Here, economic internationalisation arises out of changes in tariffs. As these tariffs are assumed to be set exogenously, the debate leads back to earlier reasoning on changing economic policy paradigms. Naturally, because in the case of two structurally identical trading economies one country's exports are the other's imports, the openness measure applies to both Germany and the U.S. Finally, Dinopoulos and Segerstrom (1999) model the emergence of innovations. They start from an innovation race between firms. Emergence of innovation is assumed to be ruled by a Poisson process. The cost function of an innovating U.S. firm U_i in producing good j is

$$[c_R(w_1, w_2)\xi(j, t)] I_{U_i}(j, t) \quad (7.10)$$

with $c_R(w_1, w_2)$ as the standard unit cost function of R&D. $\xi(j, t)$ denotes the difficulty of innovation and $I_{U_i}(j, t)$ the firm's unit cost of R&D services. Inputs to the innovation process are the two types of labour. As the two trading economies are assumed to be structurally identical there is no incentive to trade R&D. Independent distribution of returns to R&D across firms implies an industry-wide instantaneous probability of success in industry j of $I_U(j, t) = \sum_{U_i} I_{U_i}(j, t)$, so that the arrival of innovations equal the global amount of R&D services $I_U(j, t) + I_G(j, t)$. As the innovating firm's profits

$$\pi_U^e(j, t) I_{U_i}(j, t) dt - c_R(w_1, w_2) I_{U_i}(j, t) dt \quad (7.11)$$

are driven to zero by a free entry assumption, with $\pi_U^e(j, t)$ as the expected discounted profits of a U.S. quality leader after having innovated successfully, the

authors derive a kind of relative price of innovation:

$$S_U(j, t) \equiv \frac{\pi_U^e(j, t)}{\xi(j, t)} = c_R(w_1, w_2). \quad (7.12)$$

Dinopoulos and Segerstrom (1999, p. 460) call this link *a Schumpeterian version of the SS mechanism*. The Stolper-Samuelson dimension of this link immediately becomes clear due to the direct link of a kind of relative 'price' of innovation and relative factor prices. On the other hand, the Schumpeterian dimension of this link is changes in relative factor prices as an implication of changing rents out of innovation. In the factor price space, there are two zero profit conditions whose slope depends on the underlying technologies' skill intensity. Similar to the two factor and two goods case, the assumption of whether R&D or manufacturing is more skill intensive necessarily becomes important.

Reviewing the Dinopoulos and Segerstrom (1999) study should mainly serve to elucidate some important elements both of similarity to the benchmark approach and of problem-oriented deviations. Obviously, factor price dependency does not hold exactly in the form known from the benchmark concept, but it holds in an extended sense. By linking factor markets and goods markets and under consideration of either temporary effects of technological change on growth, that is

$$\frac{\frac{\partial \xi(j, t)}{\partial t}}{\xi(j, t)} = \mu [I_U(j, t) + I_G(j, t)] \quad (7.13)$$

with constant $\mu > 0$, or permanent effects of technological change on growth, that is

$$\xi(j, t) = \rho N(t) \quad (7.14)$$

with constant $\rho > 0$, this framework allows important results to be derived. Among other things, the authors show that a tariff reduction reduces the relative wage of unskilled labour if and only if R&D investment is skill intensive relative to manufacturing. This is because the tariff reduction raises the innovation rents of the leaders and thus raises the left-hand side of (7.12). As an implication the unit cost function shifts to the left and the relative price of skilled labour increases in equilibrium. The increasing relative price of skilled labour naturally increases incentives to become educated, so that the population share that remains unskilled in steady state decreases, cf. (7.2).

In the perfect competitive benchmark model, tariffs imply the distortion of the behaviourally relevant price signal system. Undoubtedly, tariffs are an important parameter of economic policy. As outlined in Subsection 1.2.4, regional as well as international trade liberalization has been characterised by far-reaching efforts to reduce tariff rates. If a goods tariff is introduced in a perfect competitive goods and factor markets economy, there will be a welfare loss. Without entering into the details of the tariff issue, it should be emphasised that the Dinopoulos and Segerstrom (1999) study shows how tariffs work in a trade and wages context deviating from the benchmark in two important respects. First, for goods markets the perfect competition assumption is dropped. Imperfect competition with the implication of innovation rents is established by the emergence of innovations in a

Schumpeterian sense. Second, exogenous tariff reductions induce economic internationalization by changing the relative price of innovation and not relative goods prices. Clearly, thinking more deeply about the links between innovation and international economic activities directly leads to the role of multinational activities in explaining changes in the distribution of labour income. The debate will return to this point in the following chapter. On the other hand, with respect to the market for skilled and unskilled labour, the Dinopoulos and Segerstrom (1999) approach still uses elements of the benchmark concept by the application of the Findlay and Kierzkowski (1983) and Borsook (1987) extension of the basic perfect competitive labour market model.

In summary, the objective of Dinopoulos and Segerstrom (1999) is an empirically more sophisticated treatment of the trade and wages puzzle. While in the benchmark model tariffs change the deciding price signal system and thus factor price dependency, in Dinopoulos and Segerstrom (1999) the tariff does not change goods prices but only reduces domestic leaders' rents. Such a procedure emphasises that unskilled labour might lose in a world of positive innovation rents in the case of skilled labour intensive R&D, an unambiguously realistic assumption, when tariffs are diminished, since for innovating firms, sinking tariffs imply higher net rents so that innovating becomes more profitable. Obviously, against the background of the benchmark framework clear-cut effects can be derived by positive analysis. By contrast, compared to the benchmark considerations, welfare effects are far from being clear, as Dinopoulos and Segerstrom (1999) state, even if tax revenues are assumed to be redistributed as lump sum transfers in order to avoid by welfare effects complicating the approach. Yet as seen, getting an impression of the welfare effects of economic internationalisation is decisive. Positive analysis of the repercussions between trade and wages on its own does not suffice to establish economic policy conclusions. In this connection Segerstrom and Dinopoulos (1999) themselves warn against using their results to legitimate protective trade policies.

In the literature, the terms Europe and America conceptually served to outline the presumed trade-off between rising wage dispersion on the one hand and rising unskilled and low-skilled labour unemployment on the other hand induced by economic internationalisation. However, as already stated in Section 3.3 and reconsidered at the beginning of this chapter, not only Germany, representing the European case in this study, but also the U.S. economy suffered from involuntary unemployment. Against the background of stylized facts, market characteristics and institutional settings, differences in the characteristic features of unemployment are obvious. Furthermore, especially with respect to the eighties, the neglect of involuntary unemployment when working with a perfect competitive labour market framework has to be challenged. Consequently, not only must the perfect competition assumption on goods markets be questioned for the U.S. case, but rationing on labour markets should be taken into consideration as well.

In order to draw a consistent line from the perfect competitive benchmark to deviations on the labour market and to deal with all aspects of U.S. labour market reality, the debate on U.S. trade, wages and unemployment shall be postponed until the more comprehensive debate on trade, wages and unemployment in the context

of the analysis of the German case is considered. Postponing these questions is a conceptual decision. Since the analysis of the German case requires more detailed considerations on labour market imperfection, there the relevant theoretical lines of reasoning shall be revised in summary. In addition, in the direct light of the German case, particular aspects of U.S. trade, wages und unemployment will become more obvious.

Outsourcing

8.1 Once Again: Deviating from the Benchmark Model

Apart from the international inter-industry goods trade, one of the stylised facts characterising the process of economic internationalisation is the presumed changing quantitative and qualitative role of multinational firms. Important issues stemming from this changing role were discussed in Chapter 1. There, the close link of multinational firm analysis to the outsourcing phenomenon and the change in intra-industry trade was also emphasised. Intra-industry is the trade type that especially characterises trade between highly developed countries. These countries mainly export and import similar products, i.e., goods that are more or less close substitutes. In order to model this kind of trade, the new trade theory established trade models that integrate monopolistic competition. The perfect competitive benchmark equilibrium outlined above does not recognize firms in an institutional sense. In equilibrium the number of firms is infinite. Atomistic competition means individual supply and demand decisions derived from individual profit maximization do not affect prices. The monopolistic competition model provides a remedy to modelling firms institutionally, an indispensable prerequisite for approaching multinational activities. With monopolistic competition prevailing in goods production, each firm produces only one unit of the differentiated good, that is one unit of the variety. Closely linked to multinational issues is technological progress, cf. Chapter 1. Imperfect competition on goods markets and implied supernormal profits let firms also exist in the sense of incentives to innovation.

Trade equilibria may imply an increased number of varieties. Furthermore the market for each variety increases, which is called the market expansion effect. In the monopolistic competition model type, household utility increases because utility functions are normally constructed to increase as the number of consumed varieties increases. Hence, an explanation for gains from trade also exists in monopolistic competition models. Again, these gains from trade can be compared to distributional effects. Moreover, against the background of no generally accepted model of imperfect competition, equilibrium analysis remains tractable by the application of the monopolistic competition concept, since in equilibrium each firm produces just

one variety under goods price equal to average costs. This holds due to the firms' markets being contestable. If the marginal productivity condition did not hold, an incentive for new firms to enter the market would exist. Depending on consumer preferences each trading country would import varieties produced abroad. Additionally, modelling varieties trade not only provides a framework to discuss intra-industry trade but multinational activities as well.

In summary, there are two main advantages of integrating monopolistic competition within trade models. First, compared to perfect competition models, firms exist due to economies of scale making specialisation of differentiated goods production either at home or abroad efficient. Second, the monopolistic competition perspective seems to be a sound approach to model highly developed economies, since many goods sectors do not match perfect competition. Hence, analysis of the trade and wages puzzle gets a new perspective. In the following section, approaches recurring to the outlined deviations from the perfect competitive benchmark model shall be revisited to evaluate their contribution to an explanation of the increased U.S. qualificatory wage gap during the eighties and early nineties.

8.2 Outsourcing and Multinational Activities – Approaches

In order to provide a framework mapping links between multinational activities and wages and in order to identify the relevant issues, in Subsection 1.2.2 a concept of outsourcing was developed. Defining outsourcing exactly is of great importance because the outsourcing concept serves as a critical basis for theoretical modelling, for quantification, and for econometric testing. Without discussing the problems of definition, Slaughter (1995) applies a very general concept of outsourcing in his general equilibrium model: outsourcing is defined as arbitrage of international factor price differences by internationally mobile capital. Because of different international relative factor prices, firms settle production in that country where the costs of factors in which their output is intensive are minimized. Following the attempt to define outsourcing in Chapter 1 and assuming the existence of firms in Slaughter's (1995) model, this definition means multinational emergence in the sense of operating plants abroad either as subsidiaries or through arm's length relationship.

Slaughter (1995) builds on the model by Helpman (1984). Helpman (1984) aims at explaining repercussions between international outsourcing and international factor price differences. These factor price differences are induced by internationally different factor endowments. Factor endowment differences explain whether or not production is internationalised. But when do factor endowment differences induce production internationalisation? The procedure is to integrate multinational activities within the framework of a two country-model. Each of the two countries produces two goods by means of two factors, i.e., a model in the Heckscher-Ohlin tradition revisited in Section 5.4 serves as a framework. Whereas the firms by which the homogenous good is supplied compete on a perfect competitive goods market, the market for differentiated goods is characterised by monopolistic competition. Therefore, Helpman (1984) is able to model both intra-industry trade and inter-industry trade. If the factor endowment vector lay inside the diversification cone,

the model would differ from the basic model by nothing but intra-industry trade. Depending on consumer preferences, one country exports and the other country imports the homogenous good. This is the inter-industry trade case already discussed as a benchmark for trade and wages issues focusing on U.S. trade with countries richly endowed with low-skilled and unskilled labour. Again depending on preferences, one country becomes an exporter of varieties and the other country imports differentiated goods. This is the intra-industry trade case.

The next step is to specify how multinational activities work. As before, one production sector is assumed to produce a homogenous good and the other is assumed to produce varieties. Varieties are now produced by means of an input that has become a firm-specific input in a first production stage. In the subsequent production stage, utilization of this firm-specific input is independent of location. If the factor endowment were found outside the diversification cone in the standard model, specialization would emerge because zero profit conditions no longer hold for both goods. Flexible use of the firm-specific input now allows production to be internationalised and the firm thus demands the firm-specific input in the country where its relative factor price is lower. By contrast, the other factor is demanded in the country abundant in this factor. In a word, the firm-specific factor's international freedom of movement is the reason why internationalisation of production is more efficient than trading this input internationally.

The possibility of production internationalisation enlarges the range of factor endowments leading to factor price equalization: now, factor price equalization no longer emerges only in the case of factor endowments lying inside the diversification cone. Since the new equilibrium production point can be found just on the diversification cone's border, one country specializes in the production of the homogenous good, and the other one specializes in varieties production.

Slaughter (1995) adapts this model framework by assuming two different kinds of labour: skilled labour v_1 and unskilled labour v_2 . The economy produces two goods x_1 and x_2 . Good x_2 is produced by means of a linear-homogeneous technology $x_2 = \mu v_2$ in just one production step with μ as the productivity parameter. As only unskilled labour v_2 enters goods production x_2 , this good is trivially intensive in unskilled labour. Production of x_1 consists of two different production steps, also characterised by linear homogeneity. First, headquarter services are produced through skilled labour, i.e. $v_{1h} = \psi v_1$ with ψ as the productivity parameter. Second, assembly occurs by means of unskilled labour, i.e. $v_{2a} = \eta v_2$ with η as the productivity parameter. Finally, headquarter services and assembly enter a linear homogeneous technology to produce final product x_1 :

$$x_1 = \gamma v_{1h}^\alpha v_{2a}^{1-\alpha} = \psi^\alpha \eta^{1-\alpha} \gamma v_1^\alpha v_2^{1-\alpha}. \quad (8.1)$$

By cost minimization, Slaughter (1995) derives cost functions for x_1 and x_2 being dual to the equivalent profit functions. In order to model a representative household on the model's goods demand side, international identical and homothetic preferences are assumed, i.e., the structure of goods demand is assumed to depend only on goods prices. The structure of household consumption is thus independent of the household's absolute income level.

With respect to the trade and wages debate, Slaughter's (1995) model is of interest because it tries to clarify the link between outsourcing modelled as the possibility of vertical production internationalisation and the relative wages of different labour skills. Certainly, he only makes the functional wage gap a subject of discussion. But the analysis of links between outsourcing and the national functional distribution of incomes in highly developed countries appears to be a first step towards a broader debate analysing the repercussions between the process of economic internationalisation and the distribution of income including a third production factor physical capital.

Compared to Helpman (1984), Slaughter's (1995) approach explicitly raises the issue of repercussions between outsourcing and a highly developed country's functional labour income distribution. If factor price equalization does not emerge, there is an incentive for firms to assemble the final product in that country with a lower relative factor price of unskilled labour. On the other hand, headquarter services are produced where the relative factor price of skilled labour is lower. The emergence of multinational firms is endogenized and is explained by different relative factor prices building on internationally different factor endowments.

Taking highly developed economies abundant in high-skilled labour as a starting point, it follows that if factor endowment lies outside the diversification cone and equalization of factor prices does not take place, assembly of the final product will be shifted abroad, since the foreign country is characterised by a lower relative unskilled labour wage due to its factor endowment. Therefore, unskilled labour reward will decrease at home, so that Slaughter (1995) offers a theoretical explanation of the increasing wage gap between skilled and unskilled labour due to North-South outsourcing in the sense of multinational activities. Nevertheless, factor price equalization will emerge in the long-run equilibrium because the range of factor price equalization will be extended beyond that of the benchmark model.

Unlike Slaughter (1995), Feenstra and Hanson (1996) apply a broader and more concrete concept of outsourcing: irrespective of whether being sold to customers or entering production as intermediates, all imported intermediates and imported final goods are added to multinational imports. Again, one country representing the South is abundant in unskilled labour. The other country representing the North is abundant in skilled labour. In addition, the North is abundant in physical capital with a higher relative capital rent implied. In each of the two countries only one final good is supplied. Final goods are produced by a continuum of intermediates without further value-added. For this, the continuously formulated Heckscher-Ohlin model by Dornbusch, Fischer and Samuelson (1980) serves as a basis.

Inputs are produced by means of three different factors: unskilled labour, skilled labour and capital with labour and capital as substitutes. Formally, the latter is satisfied by the use of a Cobb-Douglas constant returns technology. For goods production a continuously formulated Cobb-Douglas production function is assumed. Under the assumption of fixed wages, the unit cost function becomes a function of continuously formulated intermediates. Equating North and South cost functions and writing down full employment conditions allows the derivation of the index number of that intermediate separating Northern from Southern production. The

higher the index number, the more skill intensive the intermediates production becomes. From index number zero to the separating intermediate's index number, intermediates are produced in the South. All the rest is produced in the North.

Within this framework outsourcing is modelled as capital flow from North to South. This capital flow is due to the higher capital rent in the South, which is poorly endowed with capital and abundant in unskilled labour. Again, international relative factor price differences provide the incentive to pursue an outsourcing strategy. Due to the capital flow from North to South, the average skill-intensity of intermediate production in both the North and South increases, since production of skill-intensive intermediates previously produced in the North is now located in the South, implying an increase in demand for skilled labour not only in the South but also in the North. Therefore, the wage gap between skilled and unskilled labour increases in both the North and South. Obviously, Feenstra and Hanson's (1996) results clearly differ from Slaughter's (1995), whose model is limited to the analysis of two different kinds of labour: in his model, unskilled labour gains in the country poorly endowed with skilled labour.

Feenstra and Hanson (1997) apply their approach developed in Feenstra and Hanson (1996) to the analysis of repercussions between outsourcing and relative factor prices for the case of the Mexican *maquiladoras*. *Maquiladoras* are in-bond enterprises subject to a special customs legislation, their exports subject to a special customs legislation not only in the country where they produce but also in the country to which *maquiladoras* export. Mexican *maquiladoras* import the bulk of intermediates necessary for production and export the bulk of final products intensive in low-skilled and unskilled labour.¹ The greater part of foreign, in particular American, direct investment to Mexico flows into this kind of project. Usually, new factories are built. From 1975 to 1979 the share of *maquiladoras* trade in total U.S.-Mexican trade amounted to 20 per cent, to increase by over 25 per cent to 39 per cent in 1996, cf. Hummels, Rapoport and Yi (1998).

In Feenstra and Hanson (1996) labour supply is a function of relative factor prices and thus endogenously determined. However, the assumed technology gives rise to the problem of the different labour qualities not being substitutes. In order to ensure equilibria, the authors assume that labour supply immediately adjusts to changes in the qualification structure of labour demand. Transaction costs as well as human capital investment decisions are neglected. As a remedy, Feenstra and Hanson (1997) introduce a vector of exogenous variables to explain human capital investment decisions. But this procedure does not solve the main problem of a missing theoretical foundation of labour supply adjustment in the sense of human capital theory, theoretically outlined by the exemplary contributions of Findlay and Kierzkowski (1983) and Borsook (1987). In addition, theoretical problems that arise from the sound assumption of no short-term possibility to substitute unskilled labour for skilled labour remain unsolved: in the end, both factors skilled and unskilled labour are nothing else but a type of specific factor.

The contributions of the approaches discussed so far to a theoretical clarification of

¹'Maquila' denotes low-skilled and unskilled labour intensive production. *Maquiladoras* are the factories of this kind of production. Cf. Molina and Cobb (1992).

the reasons underlying the increasing U.S. qualification wage gap since at least the mid-seventies is rather limited:

1. Slaughter (1995) only reinterprets the two factors constitutive for the well-known two-by-two standard model as skilled and unskilled labour. This enabled a production side constrained analysis of the distribution of labour income distinguished by labour qualities. But production neglects physical capital. The sole modelling of two factors without taking at least a third factor into consideration essentially limits income distribution analysis, because international flows of physical capital are excluded a priori. This means lack of integration of income distribution analysis dealing with production abroad on the one hand, and income distribution analysis dealing with physical capital flows on the other. However, real capital flows interpreted as one form of outsourcing are a constitutive element of the economic internationalisation process known as globalization.
2. Slaughter's (1995) restrictive assumptions concerning technology, preferences and the structure characterising the global economy brings into focus international relative factor price differences as the determinant whether a firm pursues an outsourcing strategy or not. Thus, like in Helpman's (1984) model, further essential incentives to pursue outsourcing strategies remain unconsidered.
3. In Slaughter's (1995) model, opening up from autarky to free trade implies gains from trade:
 - (a) changes in factor prices imply changes in household incomes, *ceteris paribus*;
 - (b) if goods prices are changing with the implication of a change in factor prices, this means that households can both gain or lose compared to autarky and the former trade equilibrium respectively.

Therefore, the debate on personal income distribution topics needs a precise distinction of households and the criteria by which they are characterised. In consequence, a model solely reduced to two factors cannot serve as an appropriate basis.

4. The model by Feenstra and Hanson (1996) seems to be more adequate. The authors distinguish three different factors of production. In their model income distribution analysis is not solely limited to two different factors of labour, but is extended by explicitly modelling outsourcing as an international capital flow. Within this framework, the authors come to the interesting conclusion that the capital flow from North to South, resulting from the North being abundant in physical capital, is identically conflict-generating as to incomes of skilled and unskilled labour in both countries. Furthermore, considering three factors provides a basis for the analysis of the personal income distribution: in the case of three factors more than only two different households can be meaningfully distinguished.

Finally, looking at the numerous and complex attempts to define outsourcing, one should emphasise that the limits of models like Slaughter's (1995) and related contributions lie in their choice of very limited approaches to explain endogenously

the emergence of multinational firms. The arbitrage of internationally different relative factor prices is only one possible condition for multinational emergence. In the model by Feenstra and Hanson (1996) as well, outsourcing is merely a capital flow from one country to the other. At this high level of abstraction, structural changes inside economies due to inflow and outflow of capital are hardly sophisticated. One can think, for example, of technological spillover effects on production sectors because of capital inflow. An empirical analysis of such spillover effects referring to feedback and repercussion effects on relative wages of different labour skills is provided by Aitken, Harrison and Lipsey (1996), for example.

Moreover, Markusen (1995) points to only limited empirical evidence for explaining multinational internationalisation strategies by internationally different factor endowments. Alternative approaches deal with the role of tariff and nontariff trade barriers. Furthermore, transaction costs, especially transport costs, differences in capital and income taxation, differences in legislation as well as institutional settings, and proximity to market demand are analysed as incentives for the internationalisation of production. In addition, information asymmetry, economies of scale² and firm specific conditions are suggested as determinants.

The theoretical approaches introduced so far have also served as theoretical foundation for empirical testing. In the following section, both important methodological aspects and essential results shall be explained. An overview can be found in Table 8.1.

8.3 Empirical Evidence

Slaughter (1995) emphasises that his data set does not consider the multinational service business. He argues that the number of firms in the manufacturing sector predominated in the period of interest. Outsourcing of unskilled labour intensive services, to a great extent, proved to be unlikely because of large transaction costs. Slaughter (1995) examines four different questions: First, whether there was an increase in employment in multinational affiliates. Second, whether there was an increase in unskilled labour employment in affiliates abroad. Third, whether unskilled labour employment increased relative to skilled labour employment in multinational affiliates. Finally, whether there are links between unskilled labour employment in domestic production, on the one hand, and the relationship between relative factor prices in parents and affiliates abroad, on the other.

In two steps, Slaughter (1995) reconsiders these hypotheses as to plausibility. In the first step, he interprets the selected data set and finds four stylised facts: First, in the period under consideration affiliate employment decreased absolutely. Second, compared to employment in parents, unskilled labour employment in affiliates increased slightly. Third, compared to parents, affiliate employment became more unskilled labour intensive. And fourth, there is no evidence for a systematic link between relative factor prices in parents on the one hand and in affiliates on the

²For example Brainard (1993) models the trade-off between economies of scale in the case of production in just one factory and proximity of production to the sales market. However, Brainard (1993) is not interested in a theoretical explanation of the increasing qualification wage gap.

Table 8.1
Multinationals and the U.S. Distribution of Labour Income

Study	Data	Procedure	Findings
Feenstra and Hanson (1996)	NBER productivity database and trade database; sample consisting of 450 four-digit SIC manufacturing industries for the periods 1953 to 1973, 1973 to 1979 and 1979 to 1987; distinction between production labour as approximation to high-skilled labour and nonproduction labour as approximation to low-skilled labour	Different regressions with either nonproduction labour or production labour as a share of the total wage bill as dependent variable; annual change in natural log of real output, annual change in natural log of capital, plant and equipment as a share of real output as independent variables; finally, annual change in imports as a fraction of total shipments plus imports; in addition several time dummies; in the periods under consideration the industries are weighted according to their average share of the wage bill in manufacturing	For disaggregated industries at the four-digit SIC level all industries with the exception of one show a positive relation between the increase in the nonproduction share of the wage bill and rising imports; between 15 and 33 percent of the shift towards nonproduction labour within manufacturing industries can be explained by the rising import share
Brainard and Riker (1997)	Manufacturing firm-level data on affiliate activities classified according to ISI from the Annual Survey of U.S. Direct Investment; exclusion of U.S. parent employment because of classification problems due to data constraints, so that different labour qualities can not be distinguished	A two-stage fixed proportions technology serves as theoretical foundation; the two stages distinguished are basic production and assembly	Cross-wage elasticities of labour demand are negative between affiliates and developing countries; i.e., the increase in labour demand by outsourcing implies decreasing domestic labour demand

Study	Data	Procedure	Findings
Slaughter (1995)	BEA data for the years between 1977 and 1989; number of parents and affiliates in 32 manufacturing industries with both nonproduction and production employment of parent and affiliate by industry; capital stock by industry; each parent and affiliate is assigned to the three-digit SIC; within multinationals parents and affiliates are classified on their own and by country	Estimation of elasticities of demand by estimating translog cost functions for multinationals considering the possibility of choice from domestic and foreign factors; parent and affiliate production labour were price substitutes	Outsourcing does not seem to have significantly contributed to the labour demand shift in the U.S.; very small contribution to rising income inequality
Slaughter (2000)	BEA data on manufacturing multinationals and data for total U.S. manufacturing from NBER on the four-digit SIC level covering 1987 to 1994; labour qualification is distinguished by nonproduction and production workers	Analysis of employment and employment level of production and nonproduction labour; in regression analysis, capital is assumed as quasi-fixed factor, so that labour cost minimisation can be analysed by a translog production function; level change in the skilled-labour share of the total wage bill is regressed against the logarithm of relative wages, relative share of capital to real-value added, value added and time dummies	Massive decline of the number of both parents and affiliates 1977 to 1982; gradual expansion from 1982 to 1994; growing number of affiliates consistent with the outsourcing hypothesis; from 1977 to 1989 multinationals seem to have shifted their labour input mix towards nonproduction workers in parents and towards production workers in affiliates; outsourcing hypothesis is consistent with changes in shares of production and nonproduction workers but is contradicted by changes in levels; trade flows within multinationals measured by value-added rose

other.

Above all, these findings contradict the arbitrage of relative labour costs. Hence, the stylised facts suggest unskilled labour biased technological change. As well, econometric testing done in the second step, whose methodology can be found in Table 8.1, does not confirm the hypothesis of different relative factor prices having been the main incentive for outsourcing presumed to have induced an increase in inequality of labour incomes in the country richly endowed with human capital. Against this background, Lawrence (1994) points to the fundamental problem of mis-specifications within the scope of Slaughter's (1995) data due to the classification and summary of multinational activities as just one industry category; see also Bonturi and Fukusaka (1993). This procedure is doubtful, because Slaughter's (1995) results not only critically depend on the classification of firms but on the evidence that production firms predominate and the firms classified as service industries do not outsource to a great extent. However, multinationals often pursue strategies of diversification. Manufacturing firms supply complementary services; for example, the motor industry offering its customers complementary financial services. In addition, Ethier (1994) and Ethier and Horn (1991) point to foreign direct investment by service industries having sharply risen since the beginning of the eighties.

In his recent work, Slaughter (2000) distinguishes several forms of outsourcing from the multinational strategy of shifting internationally production stages that remain within the firm. Slaughter (2000) calls this production shift multinational enterprise transfer. Multinational firms are defined as domestic firms running one or more affiliates abroad. However, what Slaughter (2000) calls enterprise transfer and distinguishes from outsourcing does match the outsourcing concept in Subsection 1.2.2. He focuses on outsourcing in the form of foreign direct investment by U.S. multinationals that pursue the strategy of substituting parts of low-skilled and unskilled labour intensive domestic production by low-skilled and unskilled labour intensive foreign production. This production shift is thought to induce the fall of relative wages of unskilled workers by decreasing relative demand for this labour quality. In this connection the results of Brainard and Riker (1997) are worth mentioning, albeit they neither relate to a closed theoretical framework nor disaggregate labour by skills. Yet, they confirm the factor demand shift at the expense of domestic labour caused by production internationalisation. Hence, for the U.S., Slaughter (2000) examines one of the key questions constituting the trade and wages debate with respect to the role of multinationals in the process of economic internationalisation: does increasing international intra-firm trade, i.e. vertical trade in intermediates within multinationals, affect relative wages at the expense of low-skilled and unskilled workers? Slaughter (2000) thus contributes to closing the gap as to empirical evidence on international inter-firm trade and wages outlined in Subsection 1.2.1.

Feenstra and Hanson (1996) recall measurement problems. They criticize Lawrence (1994) for recurring to multinational imports as a measure for outsourcing. This procedure gave rise the problem of production internationalisation only being measured as the substitution of home production by affiliate production abroad. By

contrast, the broader approach to measuring outsourcing used by Feenstra and Hanson (1996, p. 107) *includes all imported intermediate or final goods that are used in the production of, or sold under the brand name of, an American firm*. By means of this concept, outsourcing is not reduced to substitution of domestic production by foreign production, which is finally reimported in the context of the international division of labour within multinationals.

As stated above, Feenstra and Hanson (1997) empirically analyse the hypothesis of increasing labour income inequality to the disadvantage of unskilled labour caused by outsourcing for the case of Mexico. According to their theoretical terminology this is exemplary for a North-South capital flow. For the period of 1975 to 1988, the authors find increasing relative demand for skilled labour induced by foreign direct investment. The labour demand shift considerably contributed to the increasing inequality of relative wages. Thus, an important result is that the process of economic internationalisation could also result in income shifts within industries, as shown by the *maquiladoras*. In consequence, domestic demand for skilled labour increases by shifting low-skilled and unskilled labour intensive production stages to countries abundant in that kind of labour. Furthermore, the authors find significant influence of outsourcing in the form of *maquiladoras* production on the relative wages of low-skilled workers within these industries. In a word, relative within-industry demand shifts as well as relative within-industry income shifts do not necessarily refer to low-skilled labour biased technological progress.

In Feenstra and Hanson (1999) the authors apply a narrow and a broader definition to measure the extent of outsourcing. The narrow definition measures outsourcing as inputs purchased from the two-digit SIC industry to which the domestic output belongs relative to total nonenergy intermediate inputs. These inputs are considered as if they could have been produced domestically by the importing firm. Relating imported intermediate inputs that are the sum of the input purchases of a good ascribed to an industry weighted by the share of that good's imports in its total domestic consumption, to total expenditure on nonenergy intermediates in each industry additionally provides a broader definition of outsourcing. The propositions by Feenstra and Hanson (1999) of how to reassess consistently and meaningfully the standard estimation approach derived by total differentiation of the zero profit conditions in (3.19) have already been introduced in Subsection 6.3.2. Consistency and meaning were restored by complementing the standard approach by direct and indirect effects of structural variables. As such structural variables, the two outsourcing measures full under the estimation approach.

Feenstra and Hanson use data from the NBER Productivity Database for U.S. manufacturing industries in the period 1979 to 1990. They consider 447 four-digit SIC industries. The distinction of different labour skills is approximated by the distinction of production and nonproduction workers. Data for high-technology capital stem from the Census of Manufactures. Data for high-technology capital are from BLS. Averaged over all industries, the broader outsourcing measure increases from 5.3 per cent in 1972 to 7.3 per cent in 1979 to 12.1 per cent in 1990. In comparison, the data for the narrow measure are 2.2 per cent, 3.1 per cent and 5.7 per cent. Whichever of the two measures is chosen, in the eighties the outsourc-

ing share significantly increased. Feenstra and Hanson (1999) also find the widely confirmed increased qualificatory wage gap in the eighties, serving as the left hand variable. Irrespective of the outsourcing measure, Feenstra and Hanson (1999) find a significant impact on relative wages at the expense of production labour.

Undoubtedly, this more integrated approach goes beyond just treating technological progress and international trade as competing hypotheses. Outsourcing as an important aspect of the process of economic internationalisation and technological progress is linked by the integration of structural variables within the standard approach. Moreover, the Feenstra and Hanson (1999) contribution allows discriminating among different forms of sector and factor biases. Like Leamer (1996a), whose procedure can be found in Table 6.5, this approach is able to distinguish different pass-through rates of technological change, according to different country sizes. In the case of a small open economy the pass-through rate is zero, since the domestic goods supply is perfectly elastic with respect to changes in world market prices.

Despite the structural variables approach making obvious the different impacts of technological progress and outsourcing on prices, the basic concept recurs to the zero profit conditions in (3.19). Again, one should become aware of the fact that the assumption of perfect competitive goods and factor markets is crucial for zero profit conditions to hold. But zero profit conditions are incompatible with incentives to innovate. Therefore, in a strict sense the concept of firm behind the estimation approach does not fit the requirements of meaningfully modelling innovation and the internationalisation of production.

Sachs and Shatz (1994), who reason on the basis of economic plausibility, completely forgo a theoretical model to establish empirical analysis. The authors construct a measure covering multinationals' relative importance to international trade in goods and services by calculating the quotient of the sum of total multinational imports and exports as well as the sum of the economy's total imports and exports. Then, in econometric testing this measure is used as an independent variable. The quotient of domestic wages and foreign wages in several industries distinguished by skill-intensity of production serves as an additional independent variable. Finally, the dependent variable is net trade. Sachs and Shatz (1994) work only with an intuitively deduced link between quantities on the one hand and the relationship of domestic and foreign factor prices on the other. However, there is no theoretical transmission mechanism underlying the analysis. The results of Sachs and Shatz (1994) can be found in Table 6.5.

Conclusions

Despite the application of different income data sets and measurement methods, empirical analysis showed

1. the powerful increase in inequality of labour incomes distinguished by skills starting in the late 70s/early 80s the change from the seventies to the eighties; and
2. that it is this change in the functional distribution of income that has mainly been determining the change in inequality of household incomes, that is, inequality of the personal distribution of income.

However, the attempts to measure the income inequality of persons and households were largely restricted to monetary income as the relevant variable. Ryscavage and Henle (1990) emphasise that CPS data only reported monetary labour income and property income, for example. As the discussion of a more broadly defined concept of income in Section 2.1 undoubtedly showed, looking solely at monetary income seriously restricted the analysis of income inequality because the pure monetary concept of income

excludes the growing proportion of employee compensation that is in the form of noncash benefits (for example, employer-financed health insurance, retirement benefits, and life insurance). However, noncash benefits are more common among middle to high-level earners, which might tend to increase inequality of earnings. (Ryscavage and Henle, 1990, p. 4)

As to the evaluation of the findings so far, this important restriction should be kept in mind: certainly, for consumption data representing a much better approximation of permanent income, Johnson and Shipp (1997) also find confirmation of increasing inequality between income groups differing by education and family type. However, Mayer and Jencks (1993) only derive weak evidence in favour of a link between the trend toward a more comprehensive material inequality and the inequality in monetary income. These authors map material inequality by means of expenditure data and non-monetary income data in order to compare findings with findings on the basis of monetary income data.

International trade and technological progress were suggested as the leading causes of the increasing qualification wage gap. The vast majority of the analyses above

found only little evidence in favour of the international trade hypothesis. Yet the debate on the empirical approaches to test one hypothesis against the other disclosed several theoretical and methodological problems:

1. At issue remains both the selection and the degree of aggregation of appropriate data. This does not only refer to trade data but to income data as well.
2. Classical trade theory challenged the applicability of partial equilibrium approaches. Two main objections are of great importance:
 - (a) General equilibrium models consider complex repercussions between markets. Income effects are modelled to catch spill-over effects.
 - (b) International trade is modelled as an endogenous phenomenon thus becoming a subject of explanation.

A very specific type of general equilibrium modelling often referred to is the Heckscher-Ohlin approach. Yet there are several problems inherent in this model's structure when trade and wages issues are to be analysed: first, in its basic variant its reduction to only two factors, and second, its focus on the functional distribution of income. In any case, some contributions offer theoretical and empirical approaches that are hardly identifiable as to either theoretical basis or implications, Cooper (1994) serving as an example. Going beyond the criticism so far one can speak of theoretical deficits of parts of the trade and wages debate.

3. A popular method often used as an alternative to directly linking relative goods prices and relative factor prices is the factor content of trade approach. One of the main advantages of this approach lies in allegedly easier measurement of factor contents compared to price measurement as an input of direct testing for Stolper-Samuelson effects, for example. Methodologically following Neary and Schweinberger (1986), the factor content of trade approach does not necessarily reduce to only positive analysis of repercussions between trade and wages. Moreover, the empirical contribution by Wood (1994) shows that factor content of trade studies may be aware of repercussions when skill-intensity changes in the North due to intensifying North-South trade, that is, spill-over effects.
4. Albeit the reduction of the debate's theoretical foundation to only two factors means at least the neglect of personal income distribution issues and severe aggregation and classification problems as to both goods and factors, the two factor world shows that there are 'winners' and 'losers' from economic internationalisation. Undoubtedly, if restrictions imposed by the number of goods and factors are relaxed, identification problems emerge. Nevertheless, the higher dimension case shows that the result of the two factors framework of unambiguous 'winners' and 'losers' holds more generally, thus providing strong insights into potential distribution conflicts in a world of economic internationalisation.
5. Feenstra and Hanson (1997) contradict the hypothesis of the process of internationalisation as an increase in international trade and progressive outsourcing solely resulting in relative demand and relative income shifts between

sectors. Their work explains shifts of low-skilled and unskilled worker income shares due to outsourcing to emerge as shifting income shares within industries. Because of outsourcing of labour intensive production by multinational firms to countries abundant in low-skilled and unskilled labour. An example are the northern Mexican *maquiladoras*. This challenges numerous contributions explaining technological progress as the driving force of the increased qualification wage gap solely by relative demand and relative income shifts either within sectors or industries or plants.

6. A suggested condition of the increasing wage gap between skilled and unskilled workers in the U.S. is the economic activities of multinational firms. Modelling multinational firms profoundly requires linking technological change and the concept of the firm. Incentives to innovate critically depend on supernormal profits, that contradict the atomistic zero profit firm in the perfect competitive general equilibrium world discussed as a benchmark. This also applies to econometric testing, thus confronting approaches like Feenstra and Hanson (1999) with consistency problems. Another problem is due to the introduced models analysing only few selected causes of why firms pursue strategies of outsourcing, as outlined in Subsection 1.2.2. Therefore, and on account of the small number of existing empirical studies, it is hardly possible to conclusively evaluate the contribution of the internationalisation of production by firms to the increasing qualification wage gap.
7. Few approaches discuss the effects of increasing international trade on the distribution of income earned by different labour skills under imperfect competition, that is, neither under imperfect factor markets nor imperfect goods markets. However, at least for some important goods sectors of the U.S. economy the assumption of imperfect competition seems to be more realistic. Moreover, when the analysis turns to the German case, the integration of non-price cleared labour markets will also become indispensable.
8. International trade and technological progress normally are treated as competing hypotheses. In this connection Leamer (1996b) points out that the bulk of studies introduced in Section 5.2 first tested hypotheses on the effects of international trade on the functional distribution of labour incomes. Then, if these hypotheses could be falsified, it is concluded that technological progress is the cause of the increased qualification wage gap. Without theoretically well-founded hypotheses approaching the nature of technological change, in a sense such findings remain provisional. Recent studies which explicitly examine technological progress as to its contribution to the increased qualification wage gap in order to close this gap are Autor, Katz and Krueger (1998), Berman, Bound and Machin (1998) as well as Machin and van Reenen (1998).
9. Only few studies take the nontradable goods sector into considerations. Exceptions include Cooper (1992) and Murphy and Welch (1991). This neglect is problematic, because the bulk of goods production is still nontraded, and trade in services is still small relative to total U.S. GDP, since changes in the trade structure due to the movement from one trade equilibrium to an-

other also imply changes in nontraded goods sector factor allocation. Hence, it remains an open question to which extent factor price changes in the non-traded goods and service sectors caused by changes in traded goods sectors contributed to the increasing wage inequality, or as Richardson (1995, p. 48) put it: *The trade tail might still wag the nontradable dog.*

III

The Case of Germany

Persisting Involuntary Unemployment and the Distribution of Income

The analysis of changes in the U.S. income distribution in Chapter 4 showed that inequality of both the functional distribution of labor incomes and the personal distribution of income increased during the eighties. A further important finding was that inequality within groups, again distinguished by qualification, grew. This happened in the context of specific institutional arrangements and under changing technological and market conditions, especially with respect to international market integration. Moreover, in the period under consideration U.S. politics was led by a more or less broad consensus on the political aim of a deeper market integration both in form of regional arrangements as NAFTA and participation in multilateral international arrangements such as GATT, and subsequent, the WTO. The resulting academic debate started from causality considerations and has been considering the question whether economic internationalisation or technological progress, or both affecting each other, caused the inequality increase. To speak in terms of the flip-side hypothesis or two-side-of-the-same-coin hypothesis, these are the U.S. side issues.

The other side of the coin suggested here is the Western European scenario. So far, the flip-side hypothesis offers a structuring framework for a comparison of the U.S. and Germany, since the German case, which will be the subject of the following chapters, fits several important characteristics of the European scenario. Therefore, the focus on the German case requires reassessing the unemployment problem. The working hypothesis to which many studies of the U.S. case refer is the full employment assumption for labour markets, at least in the longer run. This was the argumentative basis for the application of zero profit conditions to derive estimation approaches for causality analysis. Actually, according to OECD measurements reviewed in Figure 3.1, U.S. unemployment moved around an average in the past decades, although there was a trend towards increased unemployment from the end of the sixties reaching its peak in the mid-eighties. Clearly, a long-term characteristic.

This finding stands in sharp contrast to what happened in Germany. There, total involuntary unemployment increased with a secular trend, starting from the beginning of the seventies, cf. Figure 3.1. Neither economic development in the nineties

nor the dramatic structural changes in Eastern Germany's labour markets following German unification altered this persistent trend. To return to the stylised facts outlined in Section 3.3, there were also interesting differences in unemployment duration. Figure 3.1 shed light on the details of differences in unemployment duration in both countries for the period from the mid-eighties to the end of the nineties. Compared to the U.S., in Germany the average share of long-term unemployment in total involuntary unemployment was about three times that of the average U.S. share. Naturally, short-term involuntary unemployment generates distributional effects different from those caused by long-term involuntary unemployment. If workers suffer repeatedly from involuntary unemployment, accelerating depreciation of their human capital may lead to lower reservation wages in the case of reemployment. Or, repeated long-term involuntary unemployment may lead to long-term dependency on transfer payments accompanied by extensive negative saving affecting non-labour components of personal income. Such analysis requires panel data. In a word, for the German case the full employment assumption does not fit. The flip-side hypothesis thus postulates different price and quantity effects under the two different scenarios. While in the U.S. case factor prices are expected to clear labour markets in the longer run and thus induce market equilibrium, in Germany quantity adjustment ensured a rationing equilibrium.

Comparing the main changes in the German and the U.S. income distribution means that distributional effects implied by involuntary unemployment have to be carefully considered especially with respect to the German case, as suggested by the flip-side hypothesis. Interpreting the flip-side hypothesis in an oversimplified manner, the German case should be examined as to whether involuntary unemployment has borne the brunt of distributional effects caused by economic internationalisation or technological progress, or their interaction. Naturally, involuntary unemployment generates distributional effects, for the German case cf. for example Hauser and Wagner (1997). Yet, when unemployment is neglected, the bias of wage inequality analysis rises in the case of an increase in unemployment with absolute employment unchanged, since the considered number of income recipients would decrease. Therefore income inequality analysis requires the investigation of changes in both unemployment and employment.

The probability of becoming unemployed is correlated with an individual's labour characteristics. The flip-side hypothesis and the trade and wages debate focus on skill. In this connection, two remarks with respect to the endogenous skill structure of labour supply: first, there are unemployment determinants that can be influenced by individual labour supply decisions as to time, space and skill. Second, there are conditions like ability constraints or structural changes that have to be treated either exogenously or parametrically when labour supply decisions are made. From the perspective of the trade and wages puzzle, the latter might be induced by either technological progress or economic internationalization.

Once again, it should be emphasised that the trade and wages debate took income distribution descriptions that found significant structural changes in the U.S. as a starting point. Furthermore, it is worth stressing that by reconstructing the empirical debate and identifying the roots of the appropriate theoretical approaches,

which were developed at the same time as the empirical trade and wages puzzle without a problem-orientated link, the way to the recently more integrated research can be better understood. Three main questions serve as a guideline:

1. Did the qualificatory structure of involuntary unemployment really change in the direction implied by the flip-side hypothesis? Or, differently put: were unskilled and low-skilled workers really much more concerned by involuntary unemployment compared to those with higher qualifications?
2. How did the functional distribution of labour incomes change in the eighties, a decade in which functional labour income disparity in the U.S. increased to a significant extent ?
3. What distributional implications resulted from structural changes in involuntary unemployment?

The following section will address whether, to which extent, and in favour of which factors and households, the functional and personal distribution of income changed in Germany during the last decades.

10.1 Distribution, Employment, Skills and the Flip-Side Hypothesis

As to the distribution and composition of individual incomes, Chapter 2 outlined the complex effects due to involuntary unemployment. Firstly, involuntary unemployment means loss of functional labour income. Normally, the highly developed German social security system partly compensates these losses by transfers paid on basis of claims to the social security system. Subsequently, if unemployment persists the unemployed receive transfers first in form of *Arbeitslosenhilfe* and later on in form of subsidiary *Sozialhilfe*. Even if social security benefits or transfer incomes received by the unemployed partly compensate missing labour income, continuing unemployment leads to significant changes in the structure and level of household incomes. If there is persisting labour market rationing of certain qualification groups, effects on the workers' personal incomes themselves affecting the overall distribution of personal income can thus be expected. Albeit simplifying and superficial, this line of reasoning again emphasises that the duration structure of involuntary unemployment is of importance when the nature of its distributional effects is to be understood more comprehensively.

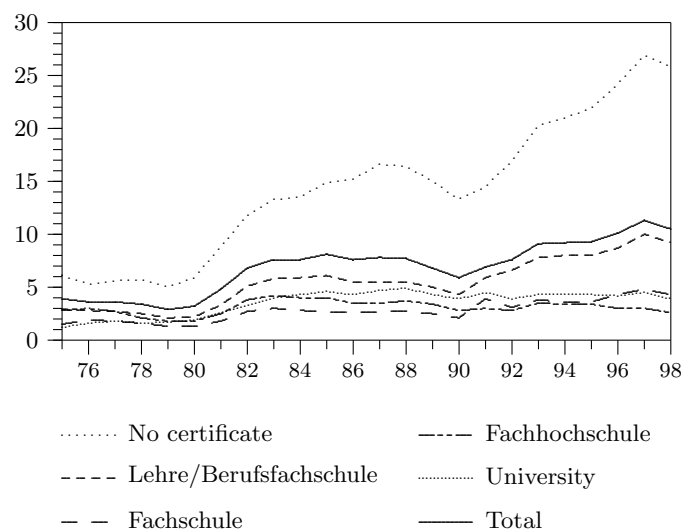
Households react to rationing on the labour market by both short-term and long-term endogenous labour supply decisions. In principal, due to transaction costs and time-consuming learning processes in the shorter run, endogenous labour supply decisions are mainly expected in the form of quantity reactions. By contrast, in the longer run there are additional endogenous supply reactions as to labour quality. It was the latter effect that underlay the functional income distribution analysis by Findlay and Kierzkowski (1983). Relative goods price changes due to international trade imply changes in relative factor prices and thus create incentives to demand either more or less education. Therefore, the skill composition of the long-term labour stock would change. However, the German case does not fit the assumed

perfect competitive scenario on goods and labour markets assumed by Findlay and Kierzkowski (1983). The debate will come back to this issue below.

Besides the persistence phenomenon, what are the stylized facts characterising involuntary unemployment in Germany in the two decades where wage disparity was increasing in the U.S.? For Germany, Figure 10.1 gives an overview of qualification specific unemployment rates and the overall unemployment rate from the mid-seventies to the end of the nineties. Overall unemployment rates in Figure 10.1 may differ from those in Figure 3.1 because in the latter, unemployment rates calculated by the OECD were used for reasons of comparability. By contrast, Reinberg (1999) calculates the unemployment rates shown in Figure 10.1 on the basis of the BFA definition, where unskilled labour is defined as *without certificate*, medium-skilled labour as *Lehre/Berufsfachschule*, and high-skilled labour as *Fachhochschule*

Figure 10.1

Unemployment Rates for Germany Classified by Educational Levels



Source: Reinberg, 1999, p. 444.

or university. Surely, such classification ignores other important characteristics like vocational experience in forming qualification categories and to analyse the extent to which they are affected by involuntary unemployment. Furthermore, this procedure puts aside additional principal problems that arise from skill classification by educational levels like those discussed in Section 2.4.

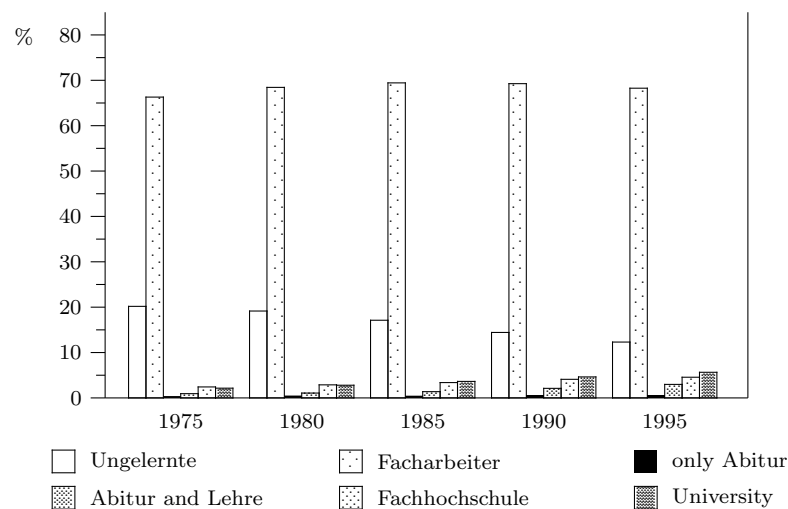
What is most striking is the discrepancy between the average unemployment rates skilled and unskilled workers have been suffering on the one hand and the average unemployment rates of high-skilled workers on the other. While markets for highly skilled labour seem to have been characterised by almost full employment, at least in the longer run, unskilled labour suffers from unemployment rates of around 25

per cent. If one believes Reinberg (2000), this severe labour market segmentation with respect to the degree of rationing of different labour skills, *ceteris paribus*, must be expected to increase in the future.

The differences in the level of unemployment rates are not the only point: the significant structural difference of their changes is also notable. While unemployment rates of high-skilled labour, i.e. those workers who have acquired at least a *Fach-*

Figure 10.2

**Proportional Share of Different Educational Levels
in Total German Employment**



Source: Möller, 1999, p. 12.

hochschule degree, have been moving around averages, unemployment rates of all other qualifications were clearly persisting, even though level shifts observable for *Lehre/Berufsfachschule* and *Fachschule* were not nearly so dramatic compared to the level shifts of unemployment rates of unskilled workers.

At the same time, the persistent rise in unskilled labour unemployment rates accompanied the dramatic decrease of this qualification's share in total employment, as shown in Figure 10.2. For the U.S., Figure 4.1 indicated similar structural changes with respect to the skill composition of total employment. There, skill upgrading in recent decades has become obvious. Certainly, Figure 10.2 is only superficial in its description. Undoubtedly, educational levels in the U.S. and Germany cannot be readily compared because of numerous semantic and formal differences. What can be learned from Figure 10.2 is a clear secular trend towards increased employment shares of higher skills, that can also be observed for the changes in the qualificatory structure of U.S. employment. In particular, the share of unskilled workers decreased dramatically, and this trend is far from having ended, cf. Tessaring (1994). These structural changes are also reflected in the income shares earned by different

socio-economic groups. Becker and Hauser (1995) emphasise that from the early seventies to the beginning of the nineties, workers' share of total income decreased from about 38 per cent to about 26 per cent. This development is part of a structural change characterised by the increasing share of *Angestellten* jobs and by the increasing female labour supply, to name only some characteristics of the changes in employment composition.

The structural changes in the qualificatory composition of both employment and involuntary unemployment occurred against the background of an almost ten per cent increase in total employment in the period from 1975 to 1990, as shown by Fitzenberger (1999a, 1999b). In his methodologically sophisticated studies he found a decrease in employment of low-skilled workers of almost 50 per cent. Moreover, he found that employment of skilled workers almost doubled, so one can indeed speak of a strong skill upgrading in overall employment. Turning from employment to involuntary unemployment, the structure of qualification-specific involuntary unemployment shown by Reinberg (1999), cf. Figure 10.1, was confirmed by Fitzenberger (1999b), who distinguished low-skilled labour, medium-skilled labour and high-skilled labour.

Employment also shifted sectorally in the form of a decreasing share of *Facharbeiter* in services since the mid-eighties and an increasing share of *Facharbeiter* in manufacturing, as found by Möller (1999). Yet what Figure 10.2 shows is that the overall share of medium-skilled workers, i.e. *Facharbeiter*, forming the bulk of total employment, has remained almost constant. IABS employment data are suitable for this, because they can be disaggregated by sectors, and thus sectoral employment shifts can be analysed. In particular, the increasing share of high-skilled workers, that is those who either finished *Fachhochschule* or university, confirms the trend towards considerable skill upgrading since the seventies. Hence, unskilled labour's share in unemployment was increasing as its share in total employment was falling to a large extent. The sectoral structure of employment has changed as well: the share of manufacturing in total employment decreased. This development is unambiguously similar to the U.S. situation, as highlighted by Abraham and Houseman (1995) and others. Again, this seems to underline what the flip-side hypothesis suggests: despite complex changes in both the qualificatory and the sectoral employment structure, relative income positions of unskilled and low-skilled workers relative to skilled workers have been stable.

To complete the stylised facts necessary for a strict formulation of the flip-side hypothesis requires the functional distribution of labour income to be analysed, since the German part of the flip-side hypothesis critically depends on a stable degree of inequality of the functional distribution of labour incomes. From the point of view of distributional analysis, it should be emphasised that a stable functional distribution of income focuses solely on the labour incomes of those who remain employed. Unemployment's distributional effects on the functional distribution of labour incomes are neglected. The hypothesis of a rather stable degree of income inequality, ensured by market results compensating welfare state mechanisms, may have encouraged this neglect. Even if measures of income inequality has shown such stability they must be examined to determine whether any forces were at work

cancelling each other out. The comparative poverty study by Hanratty and Blank (1992) illustrates this well and serves as an example for a distribution study that finds considerable differences in the extent to which the distributional effects by similar forces have been compensated or not once in Canada and once in the U.S.

In the following section, the stylised facts characterising the German income distribution shall be examined on the basis of distribution studies that focus on either both the functional and the personal distribution of income or on only one of the two distributions. In this connection particular attention will be paid to the eighties. Only by such a procedure that builds on sophisticated methods to describe several dimensions of income inequality can the question of whether the predominant view of the German distribution of income as globally more equal than the U.S. is correct in any sense be answered. In addition, this procedure is a necessary step because only deeper insights into the characteristics of the income distribution's anatomy allow a clear identification of the central theoretical issues: are the forces that determine the changes in the U.S. income distribution also at work in Germany? Up to now this analysis has remained incomplete.

10.2 Exploring the Functional Distribution of Labour Income

Table 10.1 gives an overview of income distribution studies that explore changes in the degree of functional labour income inequality, where labour is distinguished by skill, in Germany. Naturally, there exist far more studies than listed here. However, the most interesting point of the chosen studies is the different data sources on which they are based. Both cross-section data such as data from the EVS and the BFA, and longitudinal data from the GSOEP are analysed. Whereas the GSOEP takes both employment liable to social security and self-employment into consideration and builds on a more comprehensive income concept including additional payments, the social security data of the BFA are restricted to data from dependently employed workers below the social security income threshold with only regular payments recorded. Incomes higher than the social security threshold are counted as if workers would have just earned the threshold income. As to the data limitations and characteristics outlined in Section 2.4 the deficits of each data set can be carefully evaluated when empirical findings on changes in the degree of functional income dispersion are to be compared. In order to measure income inequality, these studies also use the measurement concepts thoroughly discussed in Section 2.2. A deeper understanding of these measures thus serves once more as an important input to the evaluation of results derived by empirical income distribution analysis.

In his more recent study, Grund (1998) analysed the functional distribution of labour incomes on the basis of GSOEP income data. The author calculated different percentile distances, Gini coefficients, the Atkinson measure for different sensitivity coefficients, and the I^T -measure from the generalized class of entropy measures. Moreover, he did not only analyse overall income inequality but also inequality of labour income distinguished by skill, measured as the highest completed educational degree: skill categories are *ungelernt*, *Berufsausbildung* and (*Fach-*)

Table 10.1
The Functional Distribution of Labour Income in Germany

Study	Data	Procedure	Findings
Abraham and Houseman (1995)	Period covered 1976 to 1989; social security micro data from the BFA on gross earnings of full-time male workers distinguished by education; data on average gross monthly earnings from the GSOEP; mean weekly earnings data for full-time blue-collar workers and mean monthly earnings data for full-time white-collar workers; earnings are distinguished by broadly defined skill categories of the Survey of Compensation in Industry and Trade	Relative income shares; percentile ratios; earnings ratios of median incomes distinguished by skill	Except for the 90th/10th and the 50th/10th percentile ratios which fell in the period between 1983 to 1989, all other percentile ratios remained largely constant, i.e., at the bottom there was a slight narrowing of the income distribution; no widening of earnings differentials across education groups; no increase in within-group earnings inequality
Becker (1996)	EVS data from 1962/63 to 1988; first, all persons with non-zero wage and salary income are included; second, concentration on those who have been employed the main part of the survey year and earned above the lower social security threshold; amongst other things blue-collar workers, white-collar workers and civil servants are distinguished as qualification groups	Gini coefficient; Atkinson measures with low and high inequality aversion; Theil measure; quintile shares	Sharp increase in civil servants' within-group income inequality; compared to income inequality within the group of blue-collar workers and civil servants, income inequality within the group of white-collar workers was highest, where within-group inequality sharply increased; overall income inequality remained quite stable; slight increase in almost all indicators since the beginning of the eighties; the high inequality aversion Atkinson measure had increased until the end of the seventies and fell afterwards; while the 90th/50th percentile ratio remained almost stable, the 50th/10th and the 90th/10th percentile ratios increased to a greater extent; the Theil measure increased from the end of the sixties to the beginning of the eighties and then remained more or less stable

Study	Data	Procedure	Findings
Giles et al. (1998)	GSOEP data from 1984 to 1992 taken as a series of cross-sections; both wages and incomes are analysed; gross income is net income plus taxes and social security contributions; for earnings functions estimation only wages of male full-time workers aged 23 to 29 years are considered; distinction of low-skilled, medium-skilled, and high-skilled workers measured by total years spent in the educational system	Adjustment of incomes by equivalence scales; inequality measures: Gini coefficient, coefficient of variation, percentile ratios, variance of the logarithm of income, I^{-1} -measure estimation of earnings functions	Gini coefficients for gross incomes are considerably higher than those for net incomes; within the period under consideration no trend in changes in the Gini coefficients in the sense of long-term stability; almost even growth across all income ranges for both gross and net incomes; measured inequality is robust to the use of different measures; income is concentrated around the mean; the 90th/10th percentile ratio shows slightly decreasing inequality of gross earnings; while the qualificatory wage gap between university educated and basic educated workers was slightly increasing until the end of the eighties, afterthat it began to fall again; between-group inequality did not really change
Steiner and Wagner (1998)	IABS and GSOEP labour income data for men aged 16 to 66 for 1984 to 1990; apprentices, self-employed and their family members and civil servants are excluded in order to make the data comparable	Quintil-analysis; Gini coefficients; mean logarithmic deviation; estimation of earnings functions for 1984 and 1990; decomposition analysis in order to identify the change in personal characteristics	Summary measures show only slight changes in the degree of overall income inequality despite their different sensitivities; the level of inequality for the IABS is similar to that for the GSOEP data if right-censored as well; while the estimation results for GSOEP data show a slight decrease in within-group inequality along skill and labour market experience, those for IABS data exhibit a slight increase; earnings-experience profiles became a little bit flatter; the overall differences between profiles remained relatively stable; decomposition analysis reveals counteracting forces being only of minor importance; there is a slight decrease in earnings dispersion in the lower part of the income distribution

Hochschulstudium. Methodologically, he also applied the decomposition property of the I^T -measure, cf. Section 2.2 and Appendix A.

Including data for the early nineties, his study seems to confirm the presumption that the degree of labour income inequality was fairly stable from the beginning of the eighties to the early nineties. In addition, Grund's (1998) decomposition analysis, by means of the decomposed I^T -measure, clearly shows that the bulk of inequality can be attributed to intra-subgroup inequality. The fact that there was no significant change in intra-subgroup inequality stands in contrast to increased within-subgroup income inequality in the U.S., cf. Table 4.1. Following Grund (1998), it can be concluded that significant areas of difference between the U.S.-German cases include the lack of change in overall inequality, qualificatory wage gaps and within-group inequality dispersion in the German functional distribution of labour income. However, in this connection Grund (1998) emphasises that the dominant literature neglects distributional effects induced by involuntary unemployment.

The values of the Atkinson measure I_2^A give further interesting insights. This measure exhibits high sensitivity to inequality in the lower range of the income distribution. On average this measure slightly decreased until the mid-nineties compared to the beginning of the eighties. This finding is undoubtedly in accordance with expected larger labour income compression in the lower range of the income distribution under the German welfare state and the collective bargaining system of employers and employees.

Another study using GSOEP data is Giles et al. (1998). Here, the authors compare Germany and the United Kingdom, another case representing stylised distributional facts contrary to those in the main Western European economies. For Germany, by and large their analysis does not find any significant changes in inequality by skill in the eighties. Furthermore, gross earnings are distributed significantly more unequally than net labour income, which is unsurprising, given the German welfare state institutions. As expected, taxes and transfers significantly decrease the degree of income inequality.

By contrast, Möller (1999), to which Figure 10.2 already referred, uses the IABS cross-section data from 1975 to 1995. This period covers complete business cycles up to the beginning of the nineties. As the author emphasises, this is because to changes in inequality are correlated with the business cycle. In general, this is an important point. Business cycles are short-term fluctuations; therefore, inequality analysis might produce biased results when observations end either at the peak or at the base of the business cycle. The wages are distinguished according to the skill categories in Figure 10.2. Moreover, as already stated, these wages can be disaggregated sectorally. When the causes of changes in wage disparity are to be analysed sectoral disaggregation becomes an important data property. As the analysis of the U.S. case by trade theoretical approaches shows, economic internationalisation can induce sectoral shifts, most prominently illustrated by the classical theorems. In addition, taking the German scenario, the short- and medium run-assumption of mobility rigidities between sectors is far more realistic than for the U.S. case. Consequently, if international trade were supposed to be a driving force of the changing qualificatory

wage structure, again the specific-factors model would apply as a framework.

Möller's (1999) analysis is both descriptive and econometric. His descriptive analysis focuses on changes in employment shares of different labour skills, cf. Figure 10.2, and on the analysis of changes in relative wages by decile distances, especially between the second decile, the median and the eighth decile. He thus examines distances common in inequality analysis to describe changes in income gaps between the lower, middle and upper ranges of the income distribution. Finally Möller (1999) estimated earnings functions that allow the identification of whether income inequality changed because of changes in labour characteristics.

An important finding is the significant overlapping of the different labour skills' income distributions. Looking at the groups of *Facharbeiter* and *Ungelernte*, within both subgroups income inequality increased. Furthermore, *Facharbeiter* in the upper range gained relative to high-skilled labour in the lower range of the corresponding distribution and relative to unskilled labour in the same range of the income distribution. Albeit real wage levels seem to be influenced by sector and qualification, there is no evidence of sector differences in real wage growth.

Interestingly, if labour incomes earned by medium-skilled workers and unskilled workers of the same decile are compared, instead of average incomes of medium-skilled workers relative to unskilled workers in the lower range of the income distribution income distances did not change to a large extent. Additionally, there was no clear-cut trend at all. Yet, if workers in the upper range of both income distributions are compared the picture becomes different: there, the income distance grew. By contrast, the distance of high-skilled worker incomes to unskilled worker incomes in the lower ranges of the income distributions remained quite stable. At this point, the problem of right-censorship outlined in Section 2.4 gains significance. Right-censorship is mainly a problem when wages earned by high-skilled workers are analysed. In the IABS data set, beyond the second decile there is no information for this group of workers. Hence, the income distribution's upper range can neither be compared to the incomes earned by *Facharbeiter* nor to unskilled worker wages because of missing data.

Finally, Möller (1999) did not find evidence in favour of sector-specific effects on real wage growth. Payment seems to have been determined not by sector-specific and qualification-specific effects but by economic factors affecting sectors and skills similarly. Against the background of simple labour demand and labour supply shift reasoning this result has been read as challenging whether economic internationalization is a driving force of changes in wage disparity.

Because of the advantages and disadvantages inherent in the available data sets, Steiner and Wagner (1998) use both the panel data of the GSOEP and the IABS data. Reviewing contributions like Steiner and Wagner (1998) brings up the important debate on advantages and disadvantages inherent in the data sets due to the concept of data collection. As summarised in Section 2.4, whereas the GSOEP data rest on voluntary information given by a representative sample of households and is therefore flawed, the IABS is a one per cent sample of all workers and employees liable to social security payments. Employers are under a legal obligation to disclose information, so that information is approximately complete. Naturally,

interpretation of data completeness always depends on the concept behind the data set. For example, wages paid in the shadow economy are omitted by definition by such a data set like the IABS. In addition, because of the social security threshold data are biased in the upper range of the income distribution. Hence, since skill is positively correlated with income, mainly the analysis of highly skilled workers' income positions is biased. Due to its underlying definition the IABS does not cover self-employment. Consequently, the authors restrict all data as to age and employment status. Like most of the others, Steiner and Wagner (1998) do not find relevant changes in the degree of income inequality of the functional distribution of labour incomes in former West Germany during the eighties, cf. Table 10.1.

The study by Steiner and Wagner (1998) is not the only one that tries to analyse how sensitive findings react to the choice of different data sets. On the basis of a detailed analysis of the same two data sets, Bellmann and Möller (1996) and Möller (1998) challenged the mainstream research result of a relatively stable degree of labour income inequality in the eighties. They distinguished 20 industries on the two-digit industry level and three skill groups: unskilled workers, *Facharbeiter* and highly skilled workers. Once again, the already identified shift in the qualificatory structure of total employment becomes evident. As expected, they also find a more flexible wage structure in the group of highly skilled workers with a university or *Fachhochschule* degree.

To gain further evidence, the authors estimated earnings functions for each of the qualification groups. Between first-time employees and workers in their professional prime, the wage disparity is the higher the skill. In addition the return on experience seems to have increased in the period under consideration. Furthermore, inter-industrial wage differentials can be observed, by and large, over all qualification categories. Consequently such differentials do not seem to have been induced by skill specific effects to any great extent.

But to what extent was the sectoral employment shift responsible for the measured changes? The authors also tested for the role of sectoral shifts by holding sectoral weights constant when estimating differentials and their variances. Yet, regardless whether the chosen approach corrected for sectoral employment shifts or not, all differentials increased in the eighties. And irrespective of the method by which the standard deviations are derived, they are also found to have increased. In a word, contrary to the mainstream finding of a rather stable degree of inequality of the functional distribution of labour income, the authors find a significant trend towards increased labour income inequality in the eighties. This applies to overall wages, wages distinguished by skill and qualificatory wage differentials. Because all three skill groups are affected similarly, approaches appropriate to explain this trend by means of skill-specific conditions can be excluded. Bellmann and Möller (1996) therefore conclude that forces like those thought to have caused the increased qualificatory wage gaps in the U.S., that is, technological progress or economic internationalization or both affecting each other, must have been at work.

For the IABS data set 1975 to 1990, Möller (1998) confirmed the finding of increased inequality of the functional distribution of labour income. Irrespective of sector and skill, overall income inequality seems to have increased, albeit to a different extent,

with an implied income disparity increase between industries, that, however did not change the inequality ranking of manufacturing and service industries. Income inequality found in the lower range of wages earned in the service sector was larger than in the upper range. Whereas for *Facharbeiter* in the upper range income dispersion grew almost monotonically across sectors, at the end of the period income inequality was still a little larger in services than in manufacturing.

The impression given by these findings contradicts the of more or less stable overall functional income inequality found by other studies. Yet there is one main exception, which perhaps reconciles results with the flip-side hypothesis: in contrast to the almost overall increase in income inequality across skill groups and sectors, there was an U-shaped change in income inequality in the group of low-skilled workers, though income inequality in this also began to increase at the beginning of the eighties after having fallen in previous years. At this point one should recall Möller (1999) who found that, in contrast to the U.S., not only high skilled workers enjoyed real wage growth but also workers in the lower range of the income distribution. Compared to the U.S., the relative income position of high skilled workers, that is those with a university degree, seems to have slightly worsened.

To summarize the problems at issue: beyond data choice, once again it has become obvious that without clear identification of the different labour characteristics' effects there can be no sound basis in form of stylised distributional effects for a trade, wages, and unemployment debate. In his sophisticated analysis Fitzenberger (1999b) exposed this problem in detail. Descriptive inequality analysis on the basis of cross-section data gives impressions of overall income inequality and inequality between and within meaningfully distinguished subgroups, apart from deterministic summary measures of income inequality, to which aim quantile distances and quantile variances for wages distinguished by skill, sector, gender, and other characteristics can be analysed. However, there might be effects due to workers' age structure, as shown by Fitzenberger (1999b). If there were skill upgrading for younger cohorts, a positive age earnings profile would mean an increase in the share of elder low-skilled workers in total low-skilled labour employment. Therefore, average wages earned by low-skilled workers measured by descriptive approaches might increase disproportionately to other skill groups *though wage ratios between equally productive workers (after controlling for age) have not changed*, as Fitzenberger (1999b, p. 31) emphasised. Fitzenberger (1999b) called this the composition effect, here in the sense of changing human capital accumulation across different age cohorts.

A second class of effects can be called selection effects, is for example, changing average skill within the group of employed low-skilled workers due to this subgroup being disproportionately rationed on the labour market. Against the background of the German unemployment experience, the potential importance of this kind of selection effect seems to be intuitively obvious. Income inequality analysis therefore needs to control for such effects, since the theoretical implementation of stylised facts critically depends on changes of functional labour income inequality that really happened along the category skill, and were not caused by changes of subgroups' average skills, for example. If this were not the case, a trade, wages, and unemployment debate would rely on empirical artifacts. In the end, the bulk of theoretical

reasoning makes critical use of stylised facts on the distance of skill groups' average incomes, rendered particularly obvious by the two-by-two model type.

Fitzenberger (1999b) recurred to the IABS data set and, like other researchers, distinguished three skill groups: unskilled workers, i.e., workers without a vocational training degree, medium-skilled workers, i.e., workers with a vocational degree comprising the important group of *Facharbeiter*; and high-skilled workers, i.e., workers with a technical college or a university degree. In order to minimize composition and selection effects caused by full-time and part-time work, early retirement, and gender-specific labour market participation, he restricted data to full-time male workers aged 25 to 55, particularly thinking of the significant skill upgrading in the group of female workers. The reference analysis is a descriptive quantile analysis focusing the 20th, 50th and 80th quantile of the overall wage distribution. The 80th quantile was chosen because it is always uncensored, compared to the often used 90th quantile. Even if there was also a slight inequality increase below the median, mainly the inequality increase above the median was responsible for the increase of overall male labour income inequality between the top and the bottom of the income distribution.

Relative to medium-skilled workers, wage growth was higher for both low-skilled and high-skilled workers. Despite an increasing inequality in the upper range of the functional distribution of labour income and even below the median, there was still higher wage compression at the bottom, leading back to one of the important elements of the flip-side hypothesis. Another interesting point concerning income distance changes in the lower range of the income distribution was low skilled worker wages clearly moving towards wages earned by medium-skilled workers. Within the group of low-skilled workers, Fitzenberger (1999b) also found an U-shaped change in income inequality: until 1982, within-subgroup inequality decreased, before slightly increasing in the second half of the eighties. This scenario, which dominated the eighties, found its mirror in an increase in labour income inequality within the subgroup of highly skilled workers. And to go back to another of Möller's (1998) main conclusions: again, results clearly contradict the hypothesis of a roughly stable labour income distribution, despite the U-shaped income inequality change at the bottom.

Taking descriptive evidence as a reference, Fitzenberger (1999b) checked these results by applying a detailed and sophisticated quantile estimation approach. He thus deviated methodologically from the dominant techniques of quantile time trend estimations as well as least square and tobit regressions. The latter is used in the case of censored data as done by Möller (1998), for example, cf. Section 2.4. Data are grouped by the already introduced three different skill groups, age and time building cohort-year cells. For each of the three skill groups he examined the 20th, 50th and 80th quantile.

The problem is to separate earnings changes due to age effects from intertemporal wage changes, that is, effects that concern all cohorts similarly in a certain year irrespective of worker age, since on the one hand wages of a cohort might change uniformly over the life-cycle. On the other hand, wages might change uniformly across cohorts, that is, to affect earnings of workers at a different age similarly. Moreover,

Fitzenberger (1999b) additionally controlled for effects caused by sectoral differences. First, obviously there are differences in wage bargaining structures, once in manufacturing and once in service industries. Bargaining institutions, i.e., employers and trade unions, are weaker in service industries. Second, there are differences with respect to the share of nationally and internationally tradable goods. As well the question has to be addressed whether services are more unskilled-labour intensive compared to manufacturing and whether unskilled jobs are less qualification-demanding than those in manufacturing. Therefore, in addition earnings data from manufacturing and service industries are analysed separately.

And third, to treat the German case reasonably, selection effects by involuntary unemployment have to be considered. The question is whether changes in income inequality are due to changes in employment or to changes in wages earned by those workers who remain employed. Therefore, Fitzenberger (1999b) assigned the lowest possible wage to those who are unemployed in each cohort-year cell. This assumed that the minimum wage is never found in the 20th percentile, because in the period under consideration involuntary unemployment never reached 20 per cent for unskilled workers as Figure 10.1 shows.

By and large, Fitzenberger (1999b) found slightly increasing within-subgroup labour income inequality. He revealed a uniform trend he calls the macroeconomic wage trend. However, inequality changes between skill subgroups differed, that is, with respect to the lower range of the income distribution, wage compression increased between skill groups. While there was actually a general trend of a falling labour income distance between medium-skilled workers and low-skilled workers, the picture becomes different if one looks at the labour income distance between medium-skilled workers and high-skilled workers. Compared to wages earned by medium-skilled workers, wage growth in the lower range of the high-skilled labour income distribution was weaker and wage growth in the middle range was stronger. Moreover, Fitzenberger (1999b) found unemployment selection effects only for the lower range of the unskilled labour income distribution. Cautious interpretation of these results suggests stylised facts not completely conflicting with the flip-side hypothesis, albeit the distributional reality is very complex.

10.3 What Happened to the Personal Income Distribution?

For the U.S. case, authors like Gottschalk and Smeeding (1997) claim to have found changes in the personal distribution of income determined by changes in the functional distribution of labour income, cf. Section 4.2. However, there are several problems with this: Up to now there has been no highly developed comprehensive model of the effects of the functional distribution of labour income on the personal distribution of income and vice versa, nor a model that would integrate approaches to explain what drives changes in the distribution of labour income in such frameworks. Thus, evidence based on descriptive concepts has to be judged cautiously. With respect to the German case this warning especially applies to modelling involuntary unemployment in the context of links between the functional distribution of labour income and the personal income distribution. Finally, empirical anal-

ysis of changes in inequality of the personal income distribution also has to be aware of selection and composition effects. As outlined in Section 2.1, equivalence scales normally chosen *ad hoc* corrected for household composition. However, long-term analysis challenged the meaningful application of only one equivalence scale for the whole period of investigation. In recent decades, the household structure changed considerably, if households are distinguished by the head of the household. If changes in the functional distribution of labour income had also contributed to this structure's change, again skill upgrading might have had effects on the rise or fall in inequality of the personal income distribution, albeit at first glance on cross-section earnings data such effects might be far from obvious.

According to Bedau (1990), the German case was also characterised by a changing structure of the household income distribution when households are distinguished by means of socio-economic categories. Finally, in the last three decades the absolute number of households has risen as well: Bedau (1990) found an increase of more than five millions in the number of households since the beginning of the seventies. These changes happened in the context of significant demographic changes, for example changes in the age distribution. According to Giles et al. (1998) these demographic changes continued in the nineties. In a word, studying household income inequality requires changes in household structure and composition to be taken into consideration.

Once again, the debate on the German personal distribution of income brings back the problem of data suitability. For example, Becker und Hauser (1995, 1998), whose results can be found in Table 10.2, used EVS data. Yet Giles et al. (1998) whose results are also reproduced in table 10.2 pointed out that EVS data are not really suited for distributional analysis because of the underlying data collection procedure, cf. Section 2.4. That procedure leads to overrepresentation of certain household groups, especially middle-class households. Such justified criticism was put into perspective by Becker (1996, p. 4) who states that *each approach is subject to some kind of bias* when data sources and findings of different studies are compared. It can not be forgotten that the EVS offers some advantages for personal income distribution analysis, cf. the debate on approximating personal income. Another problem is households concerned by involuntary unemployment: in Becker und Hauser (1998), unemployed persons are excluded when unemployment lasted over the whole year, so that only short-term unemployment's effects on factor incomes are explicitly examined.

A first impression of changes in the degree of inequality of the personal income distribution can be received from Figure 10.3. Schmid (1992) analysed DIW household income data for the period 1950 to 1988 in search of long-term trends. Disposable incomes are distinguished according to four different household types: *Arbeiter*, *Angestellte* and civil servants, self-employed, and finally pensioners. In contrast to most researchers, Schmid (1992) does not only use overall summary measures but also their decomposition properties. First, he applied the decomposition properties of the generalized class of entropy measures. Again, the use of different entropy measures serves to distinguish different degrees of income inequality sensitivity in

Table 10.2
The Personal Distribution of Income in Germany

Study	Data	Procedure	Findings
Becker und Hauser (1995)	Evs data for 1973, 1978 and 1983; GSOEP data for 1983 to 1990 used as cross sectional data base; household equivalence net incomes	Gini coefficient, decomposable Theil measure, Atkinson measure, quintile shares	All measures remained relative stable over the whole period; result is confirmed by quintile analysis; only a very slight trend towards an increase in inequality; in general no overall trend; however, those measures sensitive to inequality changes in the lower tail of the income distribution exhibit larger changes in the eighties; intra-group inequality dominates and increases if population is divided in socio-economic groups
Becker und Hauser (1998)	Evs data for the years 1973 to 1988	Gini coefficient; Atkinson measure; Theil measure; kernel density estimators; yearly gross factor incomes; yearly equivalence factor incomes; OECD equivalence scale	Almost constant degree of inequality of gross factor income over the whole period; only slight fluctuations; however, the density function for 1988 exhibits an increase in the degree of polarization compared to 1973, indicating a shrinking middle group of factor incomes due to development in the seventies; considerable increase in equivalence net income inequality according to all inequality measures; for factor equivalence incomes including households without own factor income all comparisons in pairs indicate an increase in polarization; the increasing share of households without factor income only strengthened this trend; the bimodal distribution of factor equivalence incomes is transformed into a unimodal distribution of net factor equivalence incomes by taxes and transfers

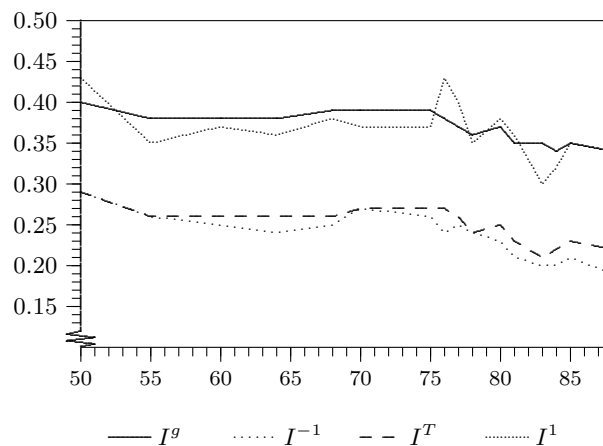
Study	Data	Procedure	Findings
Giles et al. (1998)	GSOEP data from 1984 to 1992 taken as a series of cross-sections; both wages and household incomes are analysed; gross income is net income plus taxes and social security contributions	Adjustment of incomes by equivalence scales; inequality measures: Gini coefficient, coefficient of variation, percentile distances, variance of the logarithm of income, I^{-1} -measure; decomposition of the squared coefficient of variation by income sources	Gini coefficients for gross incomes are significantly higher than those for net incomes; in the period under consideration no trend in changes of the Gini coefficients representing the characteristic long-term stability inherent in the distribution of income; almost even income growth across all income ranges for both gross and net incomes; measured income inequality is robust to the use of different measures; income is concentrated around the mean
Prinz (1990)	Evs data for 1969, 1973, 1978 and 1983 divided into six groups according to the age of household head; net household incomes	Gini coefficient corrected for age structure effects according to Paglin; in order to make changes in within household subgroup inequality visible, the modified Gini coefficient is decomposed with household groups distinguished by size; decomposed coefficient of variation	Except for the decomposed Gini coefficient corrected for household size that indicates a slight increase in both within-subgroup and between-subgroup inequality over the whole period, all inequality measures approximately show the same finding: overall income inequality is lowest in 1973, increasing afterwards; no secular trend can be derived; due to life-cycle effects and decreasing household size, higher within-subgroup income inequality the elder the head of household
Schmid (1992)	For selected years between 1950 and 1988, Diw income data, partly extended and revised by data of the <i>Statistische Bundesamt</i> ; data only appropriate to descriptive statistics; income groups are distinguished by socio-economic categories	Decomposed Gini coefficients; measures of the generalized class of entropy measures for different inequality aversion sensitivity	Both the measures belonging to the generalized class of entropy measures and Gini coefficients disclose a decrease in overall income inequality in the form of a secular trend; except for farmers, social benefits recipients and civil servants, there was unambiguously decreasing within-group inequality

order to attach importance to changes in a certain range of the income distribution. Second, as is very rarely done, he applied the decomposition properties of the Gini coefficient, going back to Pyatt (1976).

Apart from the entropy measures I^T and I^1 , Figure 10.3 depicts the values of the T^{-1} -measure that is most sensitive at the bottom of the income distribution. In comparison, this measure's values are generally lower and exhibit a downward trend, especially during the seventies and the eighties. At first glance, findings show what one would expect under the German welfare state with strong preferences in favour of distributional justice. Moreover, one could speculate whether the increased wage compression at the bottom of the income distribution also contributed to this

Figure 10.3

Household Income Inequality in Germany – Selected Measures



Source: Schmid, 1992, pp. 142.

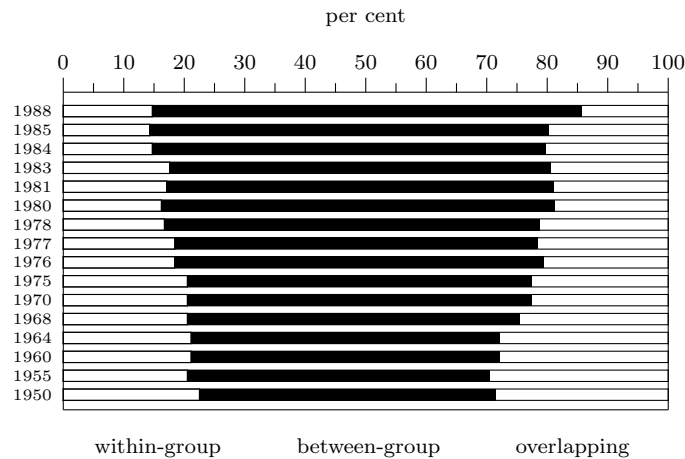
change. However, this remains speculation because of insufficient empirical evidence on the interaction of both income distributions.

Albeit the values of the Gini coefficients calculated by Schmid (1992) are shown with the values of measures belonging to the generalized class of entropy measures in Figure 10.3, their values can not be directly compared to the entropy measures' values. The reason is that the Gini coefficient is an index normalized to the interval zero to one. Nevertheless, over the entire period under consideration all four measures show a trend towards decreased personal income inequality. In addition, Figure 10.4 reviews Schmid's (1992) Gini coefficient decomposition results. Certainly, as shown in Figure 10.3, overall income inequality seems to have fallen. But inequality between different household groups seems to have risen. This might hint at increased household income polarization. Once again, one could speculate whether different labour market rationing has contributed to this change. However, against the background of important structural changes such a hypothesis would have to be critically tested as to robustness. For example, there is the already mentioned

absolute rise in the number of households. In addition, socio-economic changes in the number of households goes together with changing household composition.

Figure 10.4

Household Income Inequality in Germany – Gini Coefficient Decomposition Results



Source: Schmid, 1992, p. 145.

By and large, personal income inequality seems to have been widely stable during the eighties in contrast to the U.S. However, superficial inspection shows rising relative income poverty during the eighties for Germany too, cf., for example Hauser (1997). Hauser (1997) used EVS data and GSOEP data as cross-sections. Poverty is measured as half of the average household equivalence income on the basis of net equivalence income, with values for 40 and 60 percent to control for the measure's sensitivity.

An increase in relative income poverty might hint at the distributional effects of involuntary unemployment, since it can be supposed to mainly concern households supplying low-skilled and unskilled labour. The majority of these households is found in the lower range of the income distribution, in so far as inequality would have increased in the sense of increased relative income poverty. Yet Ludwig-Mayerhofer (1992, p. 379) hinted at the problem that arises out of cross-section data like that from the EVs: *Nicht nur in inhaltlicher, sondern auch in methodischer Sicht wurde der transitorische Charakter der Arbeitslosigkeit nicht zureichend berücksichtigt.* Cross-section data give point in time impressions, but they do not allow analysis of the duration of unemployment spells and their link to the probability of a worsening relative income position. In particular, the probability of households with incomes in the lower range of the personal income distribution to be affected by relative income poverty caused by supply side rationing on labour markets is neglected. Income poverty analysis is in part simply a specific research program that

focuses on the income distribution's lower range. Logically, Ludwig-Mayerhofer's (1992) criticism also applies to Hauser's contribution (1997).

Only consideration of the link between unemployment duration and cumulated unemployment duration on the one hand, and poverty risk on the other, can really disclose whether poverty is highly correlated with the involuntary unemployment of one or several household members in the longer run, and whether always the same workers suffered regularly from labour market rationing. Therefore Ludwig-Mayerhofer (1992) proposed to fall back on longitudinal data. His study was based on GSOEP data for the years 1983 to 1989. Yet, even the GSOEP data are only partly suitable for investigation of the link between poverty and unemployment, due to the income amount being only collected by yearly average. Hence, problems arise when changes in income as a consequence of changes in employment status are to be analysed.

Ludwig-Mayerhofer's (1992) analysis showed that in the period under consideration unemployment spells more than two were rather exceptional. As the total unemployment spells of those with more than two spells only increased slightly, this can be read as evidence that of more frequent unemployment does not necessarily mean to get out of the labour market. Naturally, as outlined above, there is not necessarily a significant link between unemployment and risk of poverty. In this connection, the distributional effects of unemployment insurance premiums are of interest. For example, Mavromaras und Rudolph (1998) analysed redistribution effect induced by unemployment insurance. They do not distinguish workers by skill, but to the problems outlined so far, they offer an approach of principal interest because their study shows unemployment insurance's significant redistribution effect that is not clearly *a priori*.

10.4 Confronting the Flip-Side Hypothesis with Stylised Facts – a Critical Revision

At first glance, a stylized description of the U.S. and German cases' distributional characteristics seems to reveal increasing income dispersion in skill dimensions on the one hand and a more equal distribution of income on the other. As an implication, in the case of Germany distributional effects are mainly expected in the form of involuntary unemployment. It must not be forgotten that most studies of the functional distribution of labour income in Germany deal with the income distribution within the group of employed factors, neglecting the distributional effects of unemployment. Despite unemployment insurance benefits, unemployment naturally changes both the functional and the personal distribution of income. This line of reasoning is the essence of the flip-side hypothesis. It is this flip-side hypothesis that suggests differences in involuntary unemployment as the main difference between the U.S. and German scenario in a world of increasingly open international markets.

From a descriptive point of view, the last sections showed a far more complex distributional reality than the flip-side hypothesis suggests. The following points should be kept in mind:

1. There are indeed important differences between the German and the U.S. cases, but there are also similar trends. And, despite different experiences with unemployment, especially with respect to the labour market, the employment structure shifted at the expense of low-skilled and unskilled labour for both cases. Hence, in summarising the two main changes for Germany, a close analogy with the U.S. can be drawn.
 - (a) First, employment has also shifted from manufacturing towards the service sector both in Germany and the U.S., despite manufacturing's continuing significance in total employment. For example, Fitzenberger (1999a, 1999b) points out to this broadly confirmed secular structural change.
 - (b) Second, the distribution of the highest formal educational level has changed dramatically, illustrated by Figures 4.1 and 10.2. While in the fifties the dominant educational level was *Hauptschule* in Germany, today most students at least finish *Realschule* so the share of unskilled labour is still falling by a secular trend. The distributional reality is also far more complex in the sense that findings do not allow one to speak of a clearcut trend towards overall wage compression in Germany, cf. for example Möller (1999). Basic variants of a theoretical treatment of the flip-side hypothesis with only two different labour factors thus have to be interpreted very cautiously.
2. As well, the analysis of the German case brings to light complex problems emerging from data set selection. On the one hand, cross-section data like that from the EVs for personal income distribution analysis and from the IABS data set for functional labour income distribution analysis provide important information. On the other hand, there are not only data set specific problems but also problems due to their cross-sectional nature. By contrast, panel data exhibit the advantage of rendering changes in the distribution units' characteristics observable. Naturally, intertemporal cross-section comparison does not principally solve this problem. For example, the intertemporal character of the Steiner and Wagner (1998) study stems only from the intertemporal comparison of cross-section estimates and intertemporal comparison of inequality measures based on cross-section data.
3. Methodologically, the decomposition analysis of Steiner and Wagner (1998) offers advantages because changes in inequality in different parts of the income distribution can be taken into consideration without to have to rely on summary measures and their decomposition properties. The constraints of these measures make finding alternative methods of gaining deeper insight into the nature of inequality desirable. Fitzenberger (1999a, 1999b) revealed further significant methodological problems of income inequality measurement, showing the limits of purely descriptive approaches. In order to control for composition and selection effects, that is, for the German case, for effects of involuntary unemployment, he analysed age-earnings profiles and their determinants by means of quantile estimations.
4. As already discussed in Section 2.4, problems also arise out of different concepts of skill measurement. These problems are closely linked to group skills.

Between Germany and the U.S., differences in the relative importance of skill categories have been reflected in different pragmatic approaches to stylizing qualificatory labour supply groupings. While inequality analyses and trade and wages studies focusing on the U.S. often distinguish two different labour skills to analyse changes in their relative income position, studies that deal with the German case often tend to distinguish three different skill groups: low-skilled labour, medium-skilled labour and high-skilled labour. This is partly due to the specific medium-skilled group of *Facharbeiter*, which still constitutes the bulk of employment.

5. Irrespective of whether two or three labour skills are distinguished, often the main characteristic distinguishing skill is the highest attained degree of formal education. However, type and extent of work experience is another category reflecting important qualification characteristics. Apart from increasing rewards due to incentive-compatible remuneration patterns and other effects on earnings over the life-cycle, increasing age-earnings profiles represent the reward of skill accumulation in the form of increasing labour market experience. Fitzenberger's (1999b) analysis of inequality through age-earnings profiles reconciles the trade-offs that constitute a decision in favour of a certain concept to measure skill.

Nevertheless, despite Germany's complex distributional reality, both labour income inequality and personal income inequality were by and large lower and more stable in the period under consideration, in comparison to the U.S. This finding especially applies to the eighties. Naturally, against the background of empirical evidence this stability has to be interpreted very cautiously. In general, deeper insights into the distributional issues of the German case seem to confirm the stylized fact of a more equal income distribution, also due to the German welfare state system. Yet, complex changes among skill groups in Germany suggest that at least three different skill groups should be used to derive stylized facts. Undoubtedly, this means a burden on the following analysis, since the analysis above showed problems inherent in theoretical modelling with more than two different labour factors.

Without doubt, there were significant differences between the two scenarios with respect to both trend and duration of involuntary unemployment. Linking this finding to the stylized fact that roughly half of the measured involuntary unemployment has occurred among low-skilled and unskilled workers since involuntary unemployment began to persist, the decrease of equilibrium employment of workers with no or low formal qualification suggests looking for supply and demand effects. These effects lead back to the debate on economic internationalisation and technological progress. In this connection, one has to be aware that any finding of stability does not necessarily mean that there have not been opposing effects at work, since the potential labour market effects of factors underlying more or less stable educational wage differentials might be of a different nature. Such factors may include institutional conditions, e.g. welfare state institutions; market driven changes in relative goods prices due to changes in the number of traded goods; and exogenously driven labour supply shifts, to name only a few. Such potential effects open a broad field of repercussions and questions of causality comprising manifold demand as well as supply effects. Labour supply shifts of skill upgrading of younger cohorts in the

U.S. during the seventies serves as an example. This skill upgrading had to be taken into consideration when changes in factor demand were analysed in order to identify factors having induced changes in relative labour income positions during that decade, cf. Section 4.3. The debate will come back to these points later.

For the early nineties, the long-term finding of more or less stable inequality of the personal income distribution was confirmed by Schwarze (1996) and others. The dramatic socio-economic changes of the first half of the nineties resulting from German unification did not cause any clear-cut trend towards either higher or lower personal income inequality in the *Bundesländer* of the former West Germany. By contrast, the degree of income inequality in Eastern Germany seems to have converged, that is personal income inequality increased. Against the background of household composition and selection effects, naturally these and other results are questionable in the sense of correct inequality identification because they are mainly based on summary measures.

Income mobility analysis has also shown that a more or less stable degree of inequality found on the basis of summary measures could be misleading. Exploring PSID and GSOEP data, for the personal income distribution, Trede (1998) found higher long-run income mobility for lower incomes in Germany than in the U.S. Furthermore, during the eighties income mobility seems to have increased in the former West Germany. If one considers the particular relevance of labour income in total household income in the lower range of the income distribution, such a finding might conflict with suppositions on the grounds of an international comparison of labour market institutions. On the other hand, households with significant shares of transfer income can also be found at the bottom of the personal income distribution. If labour market performance improves, in a welfare state context incentives to supply labour might strongly increase with the implication of upward mobility.

In the next section, important aspects of a theoretical trade, wages and unemployment debate shall be summarized. Then the analysis will return to empirical evidence of effects on the distribution of labour income distinguished by skill in a world of economic internationalisation.

The German Labour Market Reality – Theoretical Perspectives

Giles et al. (1998) emphasises that even a roughly stable degree of wage inequality does not mean that the forces of the process of economic internationalisation have not been at work, since there might have been opposite effects. If summary measures show only small changes in income inequality, this is not necessarily a sign of strong market forces and exogenous forces not having affected the distribution of income. Opposite effects could have affected the labour income distribution in such a way that the measured overall degree of labour income inequality remained roughly unchanged when purely descriptive measurement concepts are applied.

Moreover, despite institutional differences there is no a priori evidence why economic internationalisation or technological progress should have affected the U.S. economy in form of larger changes in relative labour income positions than in the German economy. Naturally, as emphasised by Giles et al. (1998), not only compared to the U.S. case but also compared to the case of the U.K., there are important arguments in favour of expecting for Germany effects mitigating the labour-demand effects to the detriment of low-skilled and unskilled labour caused by economic internationalisation and technological progress. The highly centralized wage bargaining process tends to secure the relative position of those at the lower end of the earnings distributions; that is, the *Untere Tarifgruppen* restricts wage flexibility, for example. Another example for the restriction of wage flexibility is the German welfare state institutions.

For Germany, the preceding chapter showed a secular trend towards a decreasing share of low-skilled and unskilled jobs in total employment. In international comparison, the average skill level in Germany is relatively high. Specifically, there is a high and almost constant share of *Facharbeiter* in total employment, cf. Figure 10.2. A condition of the high average skill level of labour supply is that most non-academically educated workers receive a combination of practical and theoretical training called *Berufsausbildung* by the *Duale Bildungssystem*. The latter aims at further education in combination with in-house training.

As the analysis of the U.S. case showed, many approaches simply used demand and

supply frameworks to approach the causes of the increasing qualificatory wage gap in the U.S. Similarly, analysing the German case could also simply return to partial equilibrium approaches looking for shifts of demand and supply. *Ceteris paribus*, increased supply of higher education lets firms substitute unskilled labour and capital by skilled labour depending on the elasticities of substitution. In Germany, there were supply-side effects due to increased supply of education, training opportunities or further education, for example. In the former West Germany particularly, the sixties and the seventies brought an expansion of the education system, with respect to the number and capacity of universities and schools and with respect to the apprenticeship system. In particular female labour market participation increased accompanied by a significant skill-upgrading. cf. for example Mohr and Steiner (1998) for the 70s and 80s. Concerning educational policy, the late 50s/early 60s became known as the period of *Bildungsexpansion*. These changes in the qualificatory structure of labour supply by the increased supply of educational capital were partly endogenous. Amongst other things, in the late fifties and the early sixties expected sectoral shifts and international comparisons of the qualificatory structure of labour supply pushed the political system to encourage higher education, cf. Buttler (1993) and OECD (1962, 1973). Against the background of sectoral changes and human capital considerations the economic debate was led by the fear of diminishing competitiveness. Furthermore, this is another example for a debate on competitiveness where countries are taken as firms.

However, the following sections will not argue by partial equilibrium in order to develop a framework to analyse the effects of labour demand and labour supply shifts, such as the ones outlined in the preceding section, but will give general equilibrium perspectives on trade, wages and unemployment as a basis for a theoretical understanding of the German case. Such perspective requires becoming aware of the properties of a rationing equilibrium. Analysing the U.S. case by means of a perfect competitive goods and factor market model implies only one quantity signal, that is the quantity signal in equilibrium. By contrast, as the German case is characterised by involuntary unemployment, there are additional quantity signals.

11.1 Wage Rigidities, Minimum Wages and Unskilled Workers

Up to now the analysis has concentrated on models with both goods and factor markets assumed to be distortion-free, that is, all relevant signals were price signals. It was argued that this kind of model provides an appropriate approximation at least of the long-term characteristics of U.S. labour markets. Yet the perfect competition scenario does not seem to be realistic for all U.S. goods and service markets. As shown in Chapter 7, the empirical trade and wages literature has not really become aware of this problem, one of the few exceptions being the study by Borjas and Ramey (1994) whose results can be found in Table 7.1. By contrast, the monopolistic competition approach played an important role in analysing multinational firms and wages issues. Modelling imperfect goods markets is indispensable

when multinational activities are to be modelled.¹ But empirical testing of this approach in the trade and wages context has also remained incomplete. Nevertheless, this section will deal with distortions in labour markets neglecting goods market distortions. While under perfect competitive goods and factor markets economic internationalisation induces changes in the qualificatory wage gap, in the case of factor price rigidities economic internationalisation induces quantity adjustment in some markets.

The flip-side hypothesis outlined in Section 3.3 builds on the idea that largely undistorted U.S. labour markets were contrasted by the main Continental European labour markets characterised by involuntary unemployment due to factor price rigidities, amongst other things determined by different institutional settings and different social norms. The most important of these determinants is a binding minimum wage on the market for unskilled labour. Apart from institutional settings like protection against unlawful dismissal, minimum wage legislation or trade union bargaining power supposed to bring about non-market clearing wages especially for the *Untere Tarifgruppen* on the German labour market, efficiency wages founded sociologically and by incentive effects due to adverse selection served as another theoretical explanation for downward rigidities of wages. Which explanation fits remains an empirical question and whether efficiency wage theories really explain differences in unexplained wage differentials is a question that has to be left open, cf. Huang et al. (1998). This prominent line of reasoning was promoted by Krugman (1995) and Freeman (1995). While the former started from a trade theoretical point of view, the latter started from a labour economics point of view. With respect to the trade and wages problem the important result of such scenario distinction is different distributional outcomes of economic internationalisation.

Section 3.2 reviewed a benchmark for treating the trade and wages issue in the general equilibrium tradition of international trade theory. This general equilibrium benchmark started from perfect competitive goods and factor markets. The subsequent application to the U.S. case then deviated from the case with the number of factors m equal to the number of goods n by assuming only two goods and factors for example, or by assuming more factors than goods. One of the main advantages of this methodology is the broad consensus on how signals in the form of price signals work. Yet, in contrast to perfect competitive equilibrium modelling in the Arrow-Debreu tradition, there is no comparable consensus on how to model economies with imperfect labour markets in the sense of non-market clearing wages for some labour qualities. Two well-known general equilibrium concepts 'compatible' with imperfect competition are the fix-price concept, cf. Benassy (1993), and the one proposed by Phelps (1994).

In what follows, influential attempts to model imperfect labour markets within an open economy framework shall be traced back. An early and influential approach to modelling involuntary unemployment in open economies was developed by Brecher (1974a, 1974b), who integrated a binding minimum wage into a standard Heckscher-Ohlin model. In the tradition of the Heckscher-Ohlin model's basic interpretation,

¹Phelps (1994) gives a theoretical framework of modelling general equilibrium under imperfect competition. However, his approach does not disaggregate labour.

Brecher (1974a, 1974b) worked with the two factors labour and physical capital under standard assumptions as to technology and preferences. Following the concept of simple reinterpretation of the two factors as skilled and unskilled labour, the formulation of Brecher's (1974a, 1974b) factor market equilibrium conditions become

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \leq \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}, \quad (11.1)$$

where v_1 denotes skilled labour and v_2 denotes unskilled labour. If in equation (11.1) inequality held for unskilled labour, this would mean a binding minimum wage of unskilled labour v_2 with the implication of involuntary unemployment. By contrast, if equality held for skilled labour v_1 , this factor would be fully employed. Depending on the degree to which the minimum wage is binding, involuntary unskilled labour unemployment emerges to the amount of $v_{2u} = v_2 - \bar{v}_2$ with \bar{v}_2 as effective unskilled labour employment in equilibrium. This allows (11.1) to be rewritten:

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 - v_{2u} \end{bmatrix}. \quad (11.2)$$

Brecher (1974a, 1974b) chose good x_1 as the numeraire. Hence, p_2 becomes the relative price of good x_2 . In the reinterpreted model with two factors labour unskilled labour is subject to a real wage floor $\frac{\bar{w}_2}{p_2}$ with the wage floor expressed in terms of good x_2 . Because of the linear-homogenous production functions $x_1 = v_{21}f_1(\frac{v_{11}}{v_{21}})$ and $x_2 = v_{21}f_2(\frac{v_{21}}{v_{22}})$ and perfect intersectoral factor mobility the marginal product² of unskilled labour becomes

$$\frac{\bar{w}_2}{p_2} = MP_2^1(a_{11}, a_{21}) = MP_2^2(a_{21}, a_{22}). \quad (11.3)$$

Clearly, total goods output measured in output units is less than in the first best equilibrium, so that the production possibility set now has to lie below the perfect competitive one. In (11.3), \bar{w}_2 stands for the exogenously set minimum wage. Furthermore, the new transformation locus is linear in sections. The reason is that there exists a kind of Rybczynski line that can be imagined as follows: in the case of a just binding wage floor production, allocation is indeterminate because there are several output combinations compatible with the relative goods price at this wage floor.

As an implication, the marginal productivity condition is always satisfied for both factors. This can easily be seen from equation (11.3). There exist several factor input combinations that represent the same relative input combination satisfying the marginal productivity condition of both unskilled and skilled labour. Naturally, the full employment equilibrium serves as the unemployment benchmark, assuming that there is no factor price rigidity. If only good x_1 were produced, unskilled labour unemployment would be maximal at the binding wage floor $\frac{\bar{w}_2}{p_2}$ because this good's production is intensive in skilled labour. By contrast, if only good x_2 were produced, unskilled labour unemployment would be minimal at the binding wage

²When the marginal product of a factor is denoted MP_i^j the superscript stands for goods and the subscript stands for factors.

floor $\frac{\bar{w}_2}{p_2}$ because this good's production is intensive in unskilled labour. Consequently, moving from specialization in x_1 to specialization in x_2 unskilled labour unemployment has to increase. This relationship thus explains why there is a kind of Rybczynski line depicting changes in unskilled labour employment, cf. Mundell (1968). Moving along this Rybczynski line could be interpreted as moving within a diversification cone determined by the relative goods price at the binding wage floor and at a relative factor price ensuring skilled labour to be always fully employed. By the way, it is this idea of the existence of a Rybczynski line in a model world with a rigid unskilled labour wage from which Krugman (1995) started.

To sum up, the real wage paid to unskilled labour cannot react because of the binding wage floor. Changes in this factor's employment substitute downward flexibility of the unskilled labour wage. If one additionally looks at the zero profit conditions, the idea becomes clear:

$$\begin{bmatrix} v_{11} & v_{21} \\ v_{12} & v_{22} \end{bmatrix} \begin{bmatrix} w_1 \\ \bar{w}_2 \end{bmatrix} = \begin{bmatrix} p_1 \\ p_2 \end{bmatrix}. \quad (11.4)$$

The binding minimum wage diminishes the degrees of freedom. Additionally, if the case of a small open economy is assumed, (11.4) allows the determination of w_1 . Therefore, in (11.2) v_{2u} has to adapt. Together with (11.2), (11.4) thus constitutes an equation system of four equations with four unknown variables.

But how is equilibrium unambiguously determined when the production side no longer provides an unambiguous solution in regard to the functional distribution of income? Now, with the wage floor binding and perfect elastic unskilled labour supply, the demand side determines equilibrium involuntary unskilled labour unemployment by determining the product mix. With the utmost caution, this feature can be called the Keynesian dimension of integrating a binding wage floor in a formerly perfectly competitive scenario. Caution is recommended because one must emphasize that speaking of equilibrium in this context requires this equilibrium concept with factor price rigidities to be precisely distinguished from the unrestricted equilibrium concept.

What can, at this early stage of theoretical reasoning, be concluded with respect to trade and wages with a focus on inter-industry trade. Again, as a starting point assume a small open economy and let the wage floor be binding. The highly developed country, that is Germany, exports the skilled labour intensive good x_1 . Now, let the relative goods price of good x_1 increase because it becomes more and more worthwhile to import good x_2 because of falling transport costs, for example. Compared to the original trade equilibrium with the binding wage floor $\frac{\bar{w}_2}{p_2}$, the relative price of good x_2 falls and thus induces the wage floor to become more binding in terms of good x_2 . Yet, in terms of good x_1 it becomes cheaper to employ factor v_2 . As production of good x_2 is no longer profitable, specialization in good x_1 results.

Simultaneously, due to good x_1 being intensive in skilled labour and due to this factor being fully employed, more and more unskilled labour moves into this sector. Therefore, unskilled labour's relative wage falls, recall the assumption of decreasing marginal productivity. While the wage gap between the two factors of labour

increases, involuntary unskilled labour unemployment decreases. Obviously, this is the two-by-two version of the flip-side hypothesis: unskilled labour 'has to pay a price' for the wage floor, that implies, *ceteris paribus*, a higher relative factor price on the one hand and involuntary unskilled labour unemployment on the other.

From a distributional point of view, when neglecting compensation systems like benefits from unemployment insurance, the distributional effects are clear-cut. However, rationing due to a binding minimum wage leaves open the question of how workers are rationed. If workers were rationed by head, the unemployed workers would receive no income, while the employed unskilled workers' wages would be higher, compared to the perfect competitive scenario. The costs of economic internationalisation would thus be unequally distributed in the sense that there are winners and losers among unskilled workers. If unskilled labour is assumed to be homogenous, it can easily be aggregated. As an implication, if one assumes rationing by head it remains stochastic which exactly of the workers is concerned by involuntary unemployment and thus exactly who wins and loses. Another kind of rationing would be proportional rationing. From an empirical point of view, in the shorter run firms can be expected to react to economic problems by proportional rationing, that is, short-time working. Yet in the longer run they will lay off workers, so that workers are rationed by head.

In this simplified world, in the case of rationing by head, any inequality measure assessing changes in income distances like those introduced in Section 2.2, would show increasing inequality within the group of unskilled workers. In addition, the prediction of the direction of structural change is also straightforward: specialization in the production of the skilled labour intensive good emerges, that is, in goods production intensive in the factor in which the highly developed economy is richly-endowed. In so far Brecher (1974a, 1974b) provides a theory of structural change in an open economy taking involuntary unskilled labour unemployment in consideration.

The obvious structure of distributional effects inherent in Brecher's (1974a, 1974b) two-by-two analysis suggests some additional words with respect to the costs of involuntary unemployment. Beyond a systematic treatment, there is a broad spectrum of costs that involuntary unemployment induces. The Brecher (1974a, 1974b) approach unambiguously shows that unemployment wastes resources that could otherwise increase total output. Beyond the rigidity lowering degrees of freedom, this output loss lowers welfare, too. If the unrealistic assumption of missing unemployment insurance is dropped, there are costs in the form of unemployment benefits and subsequent subsidiary transfers. As a rule, financing these transfers is not distortion-free, so that there are obvious additional welfare costs. Finally, depreciation of human capital has to be expected, apart from the social and psychological costs of involuntary unemployment, cf. Goldsmith, Veum and Darity (1996), Winkelmann and Winkelmann (1995, 1998) or Clark and Oswald (1994).

Costs of involuntary unemployment and their distribution raise issues of justice. Without awareness of the importance of norms of justice and the problems of finding any consensus on them, the debate on increasing wage inequality must be reduced to efficiency considerations as the analysis' motivation. As the debate on U.S. trade

and wages has shown, however, fairness issues in particular dominated the public debate, cf. Section 3.1. Naturally, from an economics point of view changes in relative income positions induced by international trade are not only of interest because of their justice implications. In the perfect competitive benchmark model serving as a standard approach in classical trade theory, net welfare gains from trade could be derived. Yet, due to distributional effects induced by inter-industry trade between differently endowed economies, these net gains must be partly redistributed to make all earners better off. Distributional implications of economic internationalisation would thus become a problem of redistribution policies. Looking at the German case, the costs of involuntary unemployment were actually distributed very unequally. Low-skilled and unskilled labour has borne most of this burden.

Up to now, the focus has been on the functional distribution of labour income. Again, the assumption of several households makes no sense in a model with only two labour factors because the functional distribution of income would simply be translated into the personal distribution of income. Which households would be rationed if there were not only two different households? For example, if many households supplied homogenous unskilled labour they would be rationed proportionally, contradicting the aim of deeper insights into a meaningful household distinction. Actually, while some households mainly supplying low-skilled and unskilled labour are rationed, others are not. In this connection, the problem of skill classification returns when the analysis concentrates on average skill for subgroup distinction. Additionally, important unobservable skill characteristics might contribute to whether workers are rationed or not.

Of course, severe criticism has been passed on Brecher's (1974a, 1974b) approach. The application of a Heckscher-Ohlin framework, even if it does offer precise and unambiguous hypotheses, is not the only point of criticism; criticism is also due to his understanding of how the wage floor works, which has been an important point made by Schweinberger (1978). Another point of criticism results from Schweinberger's (1978) model framework with many goods and factors. Again reinterpreting the Heckscher-Ohlin model by denominating the two factors as skilled and unskilled labour is subject to the already mentioned fundamental criticism with respect to the limited number of modelled factors. In this connection, Schweinberger (1978) also emphasises that whenever the number of fully employed factors is smaller than the number of produced goods, the supply functions are no longer unique. As a consequence, multiple equilibria result with the well known consequences. Nevertheless, Brecher's (1974a, 1974b) work influenced subsequent analyses of repercussions between trade and involuntary unemployment that led to attempts to found the trade and wages debate theoretically. Therefore, in the following section some important stepping stones in the direction of a deeper analysis of trade and involuntary unemployment shall be introduced. Any trade, wages and unemployment debate is thus given a benchmark for introducing labour market rationing into a structural model.

In principle, Brecher's (1974a, 1974b) model is suitable for modelling trade between highly developed countries and countries well endowed with unskilled labour, that is inter-industry trade. Calling to mind the scenarios of international economic inter-

action outlined in Section 1.1, applications of the Brecher (1974a, 1974b) approach point towards a more structured analysis of trade between countries representing the German scenario and countries mainly exporting unskilled labour intensive goods.

11.2 Trade, Wages and Involuntary Unemployment – the Case of Trade Between Similar Countries

11.2.1 Attempts at a Problem Integration

Referring to Brecher (1974a, 1974b), Davis (1998) proposes how to analyse trade, wages and unemployment in an integrated framework of German-U.S. trade. Trade between the two high-income countries is trade between two highly developed economies. Highly developed stands for available technologies, innovation dynamic, highly developed infrastructure, and a highly developed educational system. As an implication both countries are richly endowed with high-skilled labour. The preferred framework to model trade between this type of countries has been intra-industry trade based on monopolistic competition approaches. By contrast, Davis (1998) chooses the Heckscher-Ohlin model, focusing on inter-industry trade with unskilled labour and skilled labour as factors and two goods sectors. Again, one goods production is assumed to be intensive in unskilled labour and the other intensive in skilled labour. Against the background of the dominant country characteristics, it would not make sense modelling either Germany or the U.S. as abundant in unskilled labour relative to the other economy to make the Heckscher-Ohlin framework suitable. Therefore, Davis (1998) assumes both countries to be identically endowed with the two factors skilled and unskilled labour, that is,

$$v_1^U = v_2^G \quad \text{and} \quad v_2^U = v_2^G, \quad (11.5)$$

where U again stands for the U.S. and G for Germany.

Unlike in the standard model, in order to meaningfully distinguish the two scenarios the author started from different institutional settings. On the U.S. labour market factor prices are assumed to be perfectly flexible in the sense of unrestricted price signals. The labour market condition for unskilled labour thus becomes

$$a_{21}^U v_2 + a_{22}^U v_2 = v_2^U. \quad (11.6)$$

According to Davis' (1998) terminology, in Europe an exogenously set minimum wage is binding on the market for unskilled labour. Because of the stylized description of Europe, as a working hypothesis his approach is directly transferable to the German case. Consequently the labour market condition for unskilled labour on the German labour market becomes

$$a_{21}^G v_2^G + a_{22}^G v_2 + v_{2u}^G = v_2^G \quad (11.7)$$

with v_{2u}^G as the extent of the rationing of unskilled workers on the German labour market. Naturally, without any factor price rigidity in both countries, labour market conditions always show factor market clearing for skilled workers.

Compared to the equivalently endowed U.S., the idea is that in Germany rationing of unskilled labour caused by a binding minimum wage makes this factor relatively expensive. As a consequence, if the analysis starts from autarky the skilled intensive good x_1 's relative price would be higher in Germany than in the U.S., that is $p_1^G/p_2^G > p_1^U/p_2^U$. To repeat: now, involuntary unemployment caused by a binding minimum wage on the market for unskilled labour is responsible for this factor's relative scarcity, not the a priori given factor endowment. When the two countries open up to international inter-industry trade or move from one trade equilibrium to another due to sinking transportation costs or removal of trade barriers, for example, in the U.S. there would be excess demand for the skilled labour intensive good. In order to reach the new equilibrium, employment of unskilled labour on the labour market in Germany has to adapt. The extent of U.S.'s excess demand will determine the extent to which involuntary unemployment has to rise in Germany. Leading back to Brecher (1974a, 1974b), again determination of involuntary unskilled labour unemployment by excess demand is a Keynesian-like element in this neoclassical model type. The message is clear-cut: trade might increase involuntary unemployment as a consequence of a binding domestic minimum wage that hinders relative factor prices from adjusting, so that full employment would emerge. Instead, unskilled labour unemployment has to adapt to rendering this factor as scarce as necessary for labour market and goods market conditions to hold in trade equilibrium.

As the U.S. imports the skilled labour intensive good x_1 , the relative price of the factor intensively used in this sector would have to decrease. This is the well-known Stolper-Samuelson effect. Under the frictionless U.S. scenario, a Stolper-Samuelson analysis explains the direction of change of the functional distribution of labour income, cf. Section 5.1. However, the Stolper-Samuelson result of a decrease in the qualificatory wage gap is at odds with the stylised fact of an increase in the U.S. qualificatory wage gap. Aiming at a model of trade between Germany and the U.S., the Davis (1998) approach might contribute to the explanation of increasing unskilled labour unemployment in Germany because the equal endowment assumption serves as a reasonable starting point. On the other hand, the increased U.S. qualificatory wage gap remains unexplained. This is particularly serious, because the two-country model predicts effects on the functional distribution of labour income contrary to those empirically observed.

Furthermore, from a more general point of view, the applicability of the Heckscher-Ohlin model to trade between Germany and the U.S. has to be questioned in principal:

1. Sectoral comparison shows that both economies produce similar tradable goods with more or less high substitution elasticities. In principal, the predicted higher skill intensity of the German exports to the U.S. compared to those of the U.S. to Germany is a testable hypothesis. Yet recurring to the Heckscher-Ohlin model seems to be driven by the simplicity of an integration of Brecher's (1974a, 1974b) approach, since models based on the monopolistic competition approach are far more appropriate to catch the main issues of trade between the two countries.

2. Naturally, the problems inherent in the Brecher (1974a, 1974b) approach also apply to Davis (1998). This especially concerns the understanding of how rationing works in general equilibrium. As another implication of the application of Brecher's (1974a, 1974b) model, Davis (1998) reduces his analysis to only two factors of labour.

Obviously, a theoretical perspective on trade, wages, and unemployment faces several unresolved problems. These problems are partly of a fundamental nature. In order to look for a solution of the basic misprediction problem induced by this synthesis of the Heckscher-Ohlin framework and the Brecher (1974a, 1974b) approach, the analysis will return to the Findlay and Kierzkowski (1983) approach. This seminal approach also allows a line to be drawn from the perfect competitive benchmark to a scenario with unskilled labour unemployment with endogenous supply of different labour qualities.

11.2.2 Trade, Wages, Involuntary Unemployment, and Endogenous Labour Supply

In the Heckscher-Ohlin model the assumption of exogenous factor supplies constitutes an important element of its long-term orientation. There, factor supplies are long-term factor stocks. As discussed in chapter 3 this assumption was abandoned by Findlay and Kierzkowski (1983). Putting aside the more principal problem of explaining endogenous human capital supply in a framework that inherently postulates stable long-run stocks of factor endowments, the interesting point is how the Findlay and Kierzkowski (1983) model core has been picked up: Flug and Galor (1986) applied the Findlay and Kierzkowski (1983) approach to a world with a factor price rigidity on the market for unskilled labour. The authors thus integrated endogenous human capital supply into the Brecher (1974a, 1974b) framework. Following Findlay and Kierzkowski (1983), Flug and Galor (1986) also assumed short-term exogenous factor supply. By contrast, in the long run relative factor supply is assumed to adjust, modelled by integration of the Findlay and Kierzkowski (1983) approach. That is, compared to Brecher (1974a, 1974b) Flug and Galor (1986) choose a kind of dynamic setting.

Although one has to consider the possibility of inconsistency arising when distinguishing the short-term exogenous qualification structure of labour endowment from an endogenous long-term labour supply composition in a Heckscher-Ohlin framework, this procedure reveals interesting perspectives on trade and wages issues. A possibility to meaningfully reinterpret this scenario would be the comparison of two equilibria distinguished by different long-term labour endowments. That is, labour supply decisions would adjust to changing relative goods prices by human capital accumulation. In order to model endogenous human capital supply and thus to relate relative factor prices to the supply of different labour qualities, the authors draw on equation (6.21). Unlike Brecher's (1974a, 1974b) relationship between relative factor supplies and relative factor prices, now its graphical exposition has to be negatively sloped as an implication of equation (6.21), because changes of relative factor prices induce changes in relative factor supply quantities.

Involuntary unemployment is depicted by employment probabilities. As skilled labour is always fully employed, its employment probability is equal to unity. Not so for unskilled labour: its employment probability is equal to or less than unity, determined by whether and to which extent the wage floor is binding. If the wage floor is binding, demand determines employment as the short side of the market. Again, the Keynesian-like element of this approach becomes obvious. While superscript d denotes labour demand, superscript s denotes factor supply. Hence, for high-skilled labour the employment probability becomes

$$\rho_1 = \frac{v_1^d}{v_1^s} = 1 \quad \text{and} \quad \rho_2 = \frac{v_2^d}{v_2^s} \leq 1 \quad (11.8)$$

represents the employment probability of unskilled labour. In equation (11.8) inequality holds in the case of a binding wage floor, since a binding wage floor $\bar{w}_2 > w_2$ implies $v_2^d < v_2^s$, where w_2 is the unrestricted market clearing unskilled labour wage. By means of this probability, unemployment is introduced into (6.21), which becomes

$$\frac{\partial Q}{\partial E} \equiv \lambda = \frac{\rho_2 w_2}{\rho_1 w_1} \frac{(1 - e^{-rT})}{(e^{-r\theta} - e^{-rT})} = \frac{v_2^d w_2}{v_2 w_1} \frac{(1 - e^{-rT})}{(e^{-r\theta} - e^{-rT})}. \quad (11.9)$$

Naturally, the employment probability of unskilled labour equals one minus the unemployment rate u of unskilled labour, so that

$$\lambda = \frac{(1 - u)w_2}{w_1} \frac{(1 - e^{-rT})}{(e^{-r\theta} - e^{-rT})}. \quad (11.10)$$

The larger the unskilled labour unemployment, the smaller ρ_2 , and the smaller the right-hand side of equation (11.9). This implies a smaller λ because more workers demand education with a smaller marginal contribution to the education of the last worker becoming educated. In this connection, recall the assumption of decreasing marginal productivity in (6.15).

Again, the nature of such a procedure becomes obvious: the factor price rigidity is directly translated into a quantity effect. Now, a quantity signal implied by the factor price rigidity has to ensure equilibrium. Unskilled labour therefore suffers from involuntary unemployment. If the minimum wage is binding, in equation (11.10) the term on the right-hand side has to be smaller than in the case of a perfect flexible unskilled labour wage. When the unskilled labour wage is binding, *ceteris paribus*, less unskilled labour becomes employed, so that relative employment of skilled labour is higher with a lower marginal productivity.

In the standard model all factor endowment compositions lying inside the diversification cone ensure diversification. Flug and Galor (1986) outline a scenario with a binding wage floor for unskilled labour in terms of the unskilled labour-intensive goods price p_2 with production and utility functions assumed to be of the Cobb-Douglas type. Under the assumption of a small open economy with relative goods prices treated parametrically, there is a binding minimum wage floor at which either there is specialisation or the economy produces both goods. The composition of goods production then depends on the goods demand side. If relative goods price p_2 increases and the economy was diversified before, specialisation in the unskilled

labour-intensive good x_2 would emerge. In the long run, at a goods price where the wage floor x_2 is just binding, the lower the unskilled labour unemployment the higher the goods production x_2 , and vice versa. Higher goods production of x_1 increases involuntary unemployment because this goods production is intensive in skilled labour. Now, with endogenous skilled labour supply, the long-term skill composition of labour can adapt. Hence, the higher the unemployment rate u , the lower is λ , and the share of unskilled labour in total employment in the long run. As in the diversification cone relative factor prices remain unchanged, the income distribution shifts in favour of unskilled labour if unemployment decreases.

Equation (11.9) showed Flug and Galor's (1986) concept of how involuntary unemployment works in the context of endogenous labour supply decisions. After reformulation, this equation turns out to be the arbitrage condition used by Davis and Reeve (1997):

$$\frac{w_1}{w_2} = \frac{1-u}{\lambda} \quad \text{with} \quad \Delta \equiv \frac{(1-e^{-rT})}{(e^{-r\theta} - e^{-rT})}. \quad (11.11)$$

The benchmark is equation (6.21), from which equation (11.11) only differs by the employment probability of unskilled labour. In equation (6.21), the employment probability of unskilled labour v_2 equals unity because both labour markets are cleared by perfect flexible wages. Davis and Reeve (1997) recall that in a model of unrestricted trade between two countries with endogenous human capital supply and without any factor price rigidities, an integrated world equilibrium also emerges.

Compared to the U.S., now let a lower educational capital stock relative to the population size characterise Germany, with all other parameters being equal. In consequence, the U.S. will be the economy abundant in human capital and will thus export the relative skill-intensive good x_1 , so that

$$\frac{v_2^G}{v_1^G} - \frac{v_2^U}{v_1^U} = \frac{kT}{q(T-\theta)} \left[\frac{N^G}{v_3^G} - \frac{N^U}{v_3^U} \right] > 0. \quad (11.12)$$

Again, this is only a modification of the well-known factor endowment approach. Yet, the endowment differences are no longer due to differences in physical capital relative to labour or human capital relative to unskilled labour but due to differences in educational capital relative to the population size. As in the standard model, the integrated world equilibrium is characterised by factor price equalisation.

If Germany and the U.S. are assumed to be completely identical except for an institutionally set binding minimum wage in Germany, the latter will produce more of the skill-intensive good x_1 . As shown, Davis (1998) also uses this more realistic assumption in the face of the two economies' similar development stages, cf. Section 11.2. In contrast to Davis (1998), Davis and Reeve (1997) additionally integrate not only the Findlay and Kierzkowski (1983) approach but the Flug and Galor (1986) extension. Opening to free trade will let Germany export the skilled-intensive good x_1 and import unskilled labour-intensive good x_2 . As in the benchmark model, factor price equalisation emerges. In free trade, Germany will suffer from higher unskilled labour unemployment, because under free trade the relative goods price of the skilled labour intensive good x_1 rises, so that more of this good is produced. At

the same time, in the U.S. unskilled labour's relative wage increases because there unskilled labour is fully employed, implying that the unskilled labour-intensive good x_2 is exported. This results in a higher λ because of a lower incentive to invest in human capital, cf. equation (6.21). On the other hand, the relative wage of skilled labour must be lower in Germany than in the U.S., cf. equation (11.11). There are two effects: first, the expected wage of unskilled labour is lower because of involuntary unemployment induced by the binding minimum wage. Second, due to the higher wage of unskilled labour the incentive to become educated is lower with an implied higher λ . If the two countries trade with each other, like in Davis (1998), involuntary unemployment increases. However, the qualificatory structure of labour supply adjusts: for unskilled workers, higher unemployment means a lower expected wage, thus raising the incentive to become educated; that is, λ decreases. In summary, with labour supply adjustment, the negative effects of trade on the relative position of unskilled workers are reduced.

11.2.3 Searching for Deeper Insights into the Causes of Involuntary Unemployment in Germany

The studies analysed so far took a binding minimum wage of unskilled labour as exogenously given when modelling the German case. In particular institutional reasons were given for the existence of binding minimum wages. Amongst other things, minimum wages were an expected result of collective bargaining, determined by German trade unions' bargaining power. Other reasoning emphasised the role of the German welfare state. Recalling Esping-Andersen's (1990) categorization, compared to the U.S. the German welfare state tends far more to smooth distributional market outcomes. Moreover, the more egalitarian German welfare state builds on social norms differing from those determining the basic consensus in the U.S. In this connection, Sen (1997) emphasises the differences of the concepts of freedom as an important element of the system of social norms in the two countries, cf. Section 2.3.

Thinking about the role of the welfare state when dealing with trade, wages, and involuntary unemployment thus requires distributional norms to be rendered tractable. The introduction of fairness considerations expressing how relative income positions are judged socially serve as an approach. On the one hand, fairness considerations affect the formation of institutional settings like the transfer systems of the German welfare state. On the other, such fairness considerations directly affect economic interaction on an individual level. A microeconomic foundation of how fairness considerations might cause involuntary unemployment was given by the seminal paper by Akerlof and Yellen (1990). Based on sociological and psychological considerations, they provide an explanation of why wages do not adjust to their market clearing level, despite involuntary unemployment. Their model assumes two types of labour. If the wage of unskilled labour is not increased in the case of a rise in skilled labour's wage with the two factors being complementary, unskilled workers will reduce their effort. Akerlof and Yellen (1990) start from a normative system of interpersonal comparison where unskilled workers take skilled workers' wages as the reference of their justice considerations. Hence the firm will

pay 'just' wages, that is, wages implying an effort level that minimizes costs, even if they lie above the market clearing level. This approach stands in the tradition of efficiency wage models.

However, in contrast to the shirking approach of Shapiro and Stiglitz (1984), for example, now not the problem of monitoring workers but social norms explain why efficiency wages are paid. Effort is thus no longer bad *per se*. Efficiency wage models explain in general why wages above the market clearing level are efficient in the sense of ensuring stable equilibria. Unlike the underlying unrestricted neoclassical model, now an efficient wage as a bundle of effort and the observable market wage clear the labour market, providing a mechanism that reconciles explanations of involuntary unemployment with the neoclassical framework.

Agell and Lundborg (1995) use the fair wage-effort approach to model normative issues in the wage formation process of small open economies. Their model framework is a Heckscher-Ohlin model with two goods and two factors. The wage setting process differs from standard neoclassical wage setting by relative fairness considerations in the form of effort and fairness bundles entering the utility function. Agell and Lundborg (1995) work with two production factors that can be interpreted as skilled and unskilled labour. At this point, one could again argue that by such reinterpretation of a two factor Heckscher-Ohlin model, all the problems discussed in Sections 5.4, 5.5 and 6.4 return. Undoubtedly, these problems have turned out to be severe. But the two factors and two goods framework is appropriate to gain deeper insights into how social norms might affect the wage formation process. Furthermore, as emphasised by Agell and Lundborg (1995), their model additionally shows how standard results break down in the face of efficiency wage setting.

Reinterpreting the effort function of Agell and Lundborg (1995) with the two factors skilled and unskilled labour, it becomes

$$e_j^* = e(w_{2j}/w_2, w_{2j}/w_1, u). \quad (11.13)$$

Let e_j be unskilled workers' labour effort in firm j . Effort positively depends on the unskilled labour wage paid in firm j , i.e. w_{2j} , relative to the average wage earned by unskilled labour. Furthermore, effort is the higher the higher the wage of unskilled labour relative to the average wage of unskilled workers which serves as the benchmark group. As both types of labour are homogenous, in equilibrium the effort function (11.13) simplifies to

$$e_j^* = e(1, w_{2j}/w_1, u). \quad (11.14)$$

Hence, there are two different norms: one norm expresses intra skill group considerations, and the other expresses between-group fairness considerations. The latter becomes irrelevant when all workers belonging to a skill group are identical. The firm minimises costs per efficient unit of labour. And unskilled workers minimize their effort as a function of their distributional norms, that is

$$\min_{w_{2j}} e_j^* = e(w_{2j}/w_2, w_{2j}/w_1, u). \quad (11.15)$$

From this, a modified Solow-condition can be derived. The basic Solow-condition says that under cost minimization effort's elasticity with respect to the cost minimizing wage becomes unity. Because there are two types of norms inherent in the

effort function (11.13), that is, between-group and intra-group fairness considerations, the modified Solow condition becomes

$$e_j - w_{2j} \left(\frac{\partial e_{2j}}{\partial w_{2j}} \frac{1}{w_1} + \frac{\partial e_{2j}}{\partial w_{2j}} \frac{1}{w_2} \right) = 0 \quad \text{or} \quad \epsilon_{w_1} + \epsilon_{w_2} = 1. \quad (11.16)$$

Under the consideration of (11.13) and a positive unemployment rate of unskilled labour, the factor market equilibrium conditions are

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} v_1 \\ ev_2(1-u) \end{bmatrix}. \quad (11.17)$$

Furthermore, the zero profit conditions are

$$p_1 = c_1 \left(w_1, \frac{w_2}{e} \right) \quad \text{and} \quad p_2 = c_2 \left(w_1, \frac{w_2}{e} \right). \quad (11.18)$$

Under the assumption of a small open economy, equations (11.14), (11.16), (11.17) and (11.18) form an equilibrium system of six equations with six unknown variables. As the authors state, because of the model's similarity to the standard model the magnification effect in (5.2) still applies, now holding in the effective wage of unskilled labour:

$$\hat{w}_1 > \hat{p}_1 > \hat{p}_2 > \hat{w}_2^e, \quad (11.19)$$

with $\hat{w}_2^e \equiv \left(\frac{\hat{w}_2}{e} \right)$. Changes in the effective wage of unskilled labour, that is \hat{w}_2^e , can be decomposed into consistent changes in the observable market wage, that is \hat{w}_2 , and changes in unskilled labour's effort, \hat{e} . Using (11.14) and (11.16), Agell and Lundborg (1995) derive a condition for changes in market wages under consideration of the effort function:

$$\begin{aligned} \hat{w}_2 - \hat{w}_1 &= \frac{b}{\theta} (\hat{p}_2 - \hat{p}_1) \\ \text{with} \quad b &\equiv \frac{1}{1 + \epsilon_{w_2} \left(-\frac{w_2}{w_1} \left(\frac{\partial e_{2j}}{\partial w_{2j} \partial w_{2j}} / \frac{\partial e_{2j}}{\partial w_{2j}} \right) - 1 \right)} \\ \text{and} \quad \theta &\equiv \frac{w_2 a_{21}}{ep_2} - \frac{w_2 a_{22}}{ep_1}. \end{aligned} \quad (11.20)$$

From (11.20) it becomes obvious that the extent to which a goods price change affects factor prices now also depends on the change in workers' effort. Again, let x_1 be the goods production intensive in skilled labour and x_2 be intensive in unskilled labour, that is $\frac{a_{11}}{a_{12}} > \frac{a_{21}}{a_{22}}$. Hence, θ becomes positive, because the relative cost share of unskilled labour in producing the unskilled labour-intensive good is higher than the relative cost share in producing the skilled labour-intensive good. As the effort function is assumed to be concave in the unskilled labour wage, so that the first term in brackets in the definition of b is positive, and $\epsilon_{w_2} > 0$, b becomes positive. However, there are two different influences on effort: first, the decrease in the relative wage of unskilled labour reduces worker effort. Second, unemployment increases due to falling effort. Amongst other things, the net effect critically depends on the effort's function concavity.

As stated elsewhere, the U.S. also suffered from involuntary unemployment, cf. in particular Section 3.3. Thanks to the integration of the efficiency wage approach modelling the U.S. case does not necessarily need the assumption of labour markets cleared by factor prices to form a benchmark. To distinguish the U.S. and Germany meaningfully, Agell and Lundborg (1995) have only to assume different effort functions: while in the German effort function a relative norm assesses between-group labour income fairness, such a norm is not a factor in the U.S. effort function, that is

$$e_j^* = e(w_{2j}/w_2, u) \quad \text{and} \quad e_j^* = e(1, u) \quad (11.21)$$

in the case of homogenous unskilled labour, so that for the U.S. b is unity. As a consequence, for the U.S. standard results apply. Trade with unskilled labour abundant economies leads to a falling real wage of unskilled workers because the unskilled labour-intensive goods price falls, cf. (5.2). The qualificatory wage gap unambiguously increases. By contrast, in Germany unemployment rises. Because the relative price of unskilled labour decreases, according to equation (11.13), workers diminish their effort. Reconciliation of the terms of trade with German factor prices requires effort-enhancing unemployment to rise. From equation (11.20) it can be seen that the change in real wages depends on the reaction of the effort function to changes in relative wages. Hence, compared to the U.S. real wages might change in Germany to a greater extent than in the U.S., depending on the concavity of the German effort function. This contradicts the flip-side hypothesis. Unskilled workers in Germany might not only lose due to involuntary unemployment but also due to increasing wage inequality. Formally, this is the case when the German b exceeds unity. Consequently, factor price equalisation no longer necessarily results from free trade.

Earlier in this chapter, a binding minimum wage on the German market of unskilled labour was assumed. Under certain conditions, this minimum wage became more binding in the presence of goods trade. The minimum wage was founded *ad hoc* by considerations with respect to trade union bargaining power, for example. Another expected reason was social norms, affecting the formation of welfare state institutions. Implications of these social norms were treated more rigorously by the model of Agell and Lundborg (1995), introduced above. However, according to equation (11.21) the latter approach implies that for the U.S., international trade does not change involuntary unemployment. In the face of the characteristics of the time-series of involuntary unemployment in the U.S., cf. Figure 3.1, Şener (2001) looks for an economic foundation of involuntary unemployment in the U.S. Following Davis and Reeve (1997), who introduced involuntary unemployment into the model of Findlay and Kierzkowski (1983), Şener (2001) works with equation (11.10). The latter is a modification of equation (6.21) for the case of unskilled labour facing involuntary unemployment due to a binding minimum wage.

Such a procedure simply corresponds to Dinopoulos and Segerstrom (1999), cf. Section 7.2. From the Heckscher-Ohlin model, narrowly restricted due to its underlying assumptions, up to the higher-dimensional generalisation of the Stolper-Samuelson theorem, the approaches concentrated on trade between countries of different development stages, reflected in different factor endowments. By contrast Dinopoulos

and Segerstrom (1999) concentrate on trade between countries of similar structure, based on imperfect competition on goods markets. Şener (2001) goes beyond this approach by additionally considering involuntary unemployment on the market for unskilled labour. Involuntary unemployment is established by a matching process, thus providing a framework to analyse involuntary unemployment on U.S. labour markets in the context of technological progress on goods markets. While unskilled workers are assumed to be job searching irrespective of whether they are employed or unemployed, skilled workers are always fully employed. Let $V(t)$ be the job vacancies at time t for unskilled workers. The matching process can thus be described by a function $M(V(t), v_2(t))$ where again $v_2(t)$ stands for unskilled labour supply at time t . Because the matching function is assumed to be linear homogenous, the aggregate job-finding rate and the aggregate recruiting success rate can be written as

$$p(v(t)) = m(v(t), 1) \quad \text{and} \quad q(v(t)) = m\left(1, \frac{1}{v(t)}\right) \quad (11.22)$$

with $v(t) = V(t)/v_2(t)$. In Şener's (2001) model, creation of new jobs depends on innovation. As in the Dinopoulos and Segerstrom (1999) approach, product markets are characterised by an innovation race. If innovators are successful, state of the art products are replaced by innovations that are assumed to be intensive in skilled labour. The innovation-induced changes in production imply that labour moves into the production of innovations. However, in Şener (2001) this movement is no longer frictionless. When innovators are successful, it takes time y to recruit workers. These workers are either workers who are employed and searching for a new job or workers who were laid off by the ex-quality leaders. The second reason for unemployment in Şener (2001) is population growth, growing by rate ζ . That is, permanent labour supply shifts dependent on population growth can be integrated into the analysis, in order to search for their distributional effects. The debate on the qualificatory change of labour supply, particularly in the sixties and seventies in Germany and the U.S., unambiguously shows the importance of being able to also consider supply shifts in an integrated model framework, cf. Section 4.3 and the introduction to this chapter.

To derive an equation that allows the determination of unemployment, the steady state flows of vacancies and unemployment are modelled. The first is the difference of vacancy inflows due to innovations and vacancies in manufacturing firms, which expect to still produce after $t + y$, on the one hand, and successful matches on the other. The unemployment flow is equal to the inflow due to innovators replacing state of the art products plus net expansion of unemployment caused by biological turnover minus successful job matches. In equilibrium, both the growth rate of vacancies and the growth of the unemployment rate are equal to the population growth rate ζ , which equals birth rate β minus death rate δ . The author shows that unemployment depends on the intensity of the innovation activity I , that is its unit costs, the aggregate steady state job finding rate $p(v^*)$ and the exogenous population growth rate:

$$u = 1 - \frac{p(v^*)}{(2I + \beta)}. \quad (11.23)$$

An increase in the population's growth rate as well as an increase in the intensity of

the innovation activity implies an increase in involuntary unemployment of unskilled labour. As in Dinopoulos and Segerstrom (1999), the equilibrium system consists of an equilibrium condition showing that the relative price of innovation equals its marginal cost and a labour market equilibrium condition in the three unknown variables innovation activity, the difficulty of innovating, and the share of skilled labour in equilibrium, so that an additional equation is required. Again the two concepts of temporary and permanent effects of technological progress on growth are used to fill this gap, cf. equations (7.13) and (7.14).

Economic internationalisation is modelled as changes in tariffs. For a tariff decrease, Şener (2001) shows that in the case of permanent effects of technological progress on growth, the relative wage of skilled labour rises. The reason is straightforward, since a tariff decrease increases the innovators' profits with innovation intensive in skilled labour, as already explained in Section 7.2. Hence, because of equation (11.10) the share of workers who decide to become skilled increases, since the higher skilled labour wage increases the incentive to demand education. At the same time, in the face of permanent innovation, unskilled labour unemployment also increases, cf. equation (11.23). From a distributional point of view, when the U.S. becomes more open in the presence of permanent effects of technological progress on growth unskilled workers do not only lose because of their sinking relative wages, but also due to increasing unemployment. By contrast, in the case of only temporary effects of technological progress on growth, the long-run unskilled labour unemployment rate remains unchanged. As the the two trading countries are assumed to be structurally identical, the same results apply to Germany. These theoretical results do not necessarily conflict with stylised facts in Germany, since there have also been changing relative income positions of low-skilled and unskilled workers suffering from increasing involuntary unemployment at the same time. In any case Şener (2001) extends the trade and wages debate by suggesting an important cause of involuntary unemployment, and impressively shows that increasing income inequality might go hand in hand with increasing involuntary unemployment. Against the background of this theoretical result and the complex distributional reality both with respect to relative income positions and involuntary unemployment, the flip-side hypothesis runs into trouble as an appropriate approach to characterise a basic distributional conflict inherent in the economic internationalisation that Germany and the U.S. are facing.

Evidence on Trade, Wages and Unemployment in Germany

Looking for the reasons of the degree of income inequality in Germany in the presence of severe long-term rationing particularly of low-skilled and unskilled workers leads back to Bellmann and Möller (1996, p. 30), who preliminarily concluded:

Given the disagreement on the purely empirical question whether earnings inequality in Germany has increased, remained constant or has even decreased, it comes as no surprise that very little is known about the underlying economic factors of the development of German earnings in the 1980's.

By contrast, as shown in Part II of this study, a broad empirical literature deals with the causes of the changes in U.S. wage inequality. As economic internationalisation and skill-biased technological progress are analysed in most cases as competing hypotheses, many studies among those reviewed in Section 6.3 do not only test for effects of economic internationalisation but also for effects of technological progress on the distribution of labour income. Meanwhile, further empirical contributions also analyse wages, international trade and technological progress for the case of Germany, cf. for example Mohr and Steiner (1998) and Kaiser (2001). However, by and large the statement by Bellmann and Möller (1996) still applies.

Naturally, the significant increase in the degree of labour income inequality in the U.S. provided an impressive motivation to think about its reasons. Yet, even if the degree of income inequality among different skill groups of labour in Germany should have actually been more or less stable in the long run, this does not mean that neither technological change nor economic internationalisation affected the distribution of wages. As already stated in the introduction to Chapter 11, opposite effects might have been at work. By the way, in the face of more egalitarian distribution norms, the formation of institutions can also be expected as a result of trying to mitigate market outcome that is affected by economic internationalisation in the form of international trade and outsourcing. Such reasoning underlies the flip-side hypothesis, particularly with respect to the consideration of different distributional norms in the two countries, since minimum wages are expected to prevent low-skilled and unskilled workers from losing to an unwished extent rela-

tive to skilled workers. On the other hand, the welfare state guards those who lose because of being laid off by means of claims to the social security system or by income support. Furthermore, it should be recalled that the flip-side hypothesis, as an influential idea to organize thinking about economic internationalisation and the distribution of labour income, postulates that these forces influence Germany and the U.S. similarly. Against this background, the lack of empirical evidence becomes the more incomprehensible.

Mohr and Steiner (1998) start from demand-side considerations. Wages are from the IABS data set and sectoral outputs stem from national account data, covering the period from 1975 to 1990. The intensity of international competition faced by a sector is measured by the share of imports in overall output. For the analysis of the whole economy, manufacturing industries are aggregated into five subsectors and non-manufacturing industries are aggregated into 18 service industries plus one sector for mining and agriculture. In order to distinguish industries by the intensity of import competition and technological progress, they are subdivided by import intensity as a measure of economic internationalisation and the rate of productivity growth as a measure of technological progress according to the categories low, middle, and high. Moreover, the manufacturing sector is analysed separately, being disaggregated into thirty industries.

Like Bound and Johnson (1992), for example, Mohr and Steiner (1998) recur to the partial equilibrium approach of modelling labour demand and labour supply. With respect to labour supply, instead of the more plausible division of workers into three different skill groups, the authors distinguish skilled, that is workers with a vocational degree and/or university entry level; and unskilled labour, that is workers with neither a vocational qualification nor a degree. The reason for this is data restrictions because of the top-coding inherent in the IABS data. Wages of highly skilled labour thus must be neglected. In order to consider intra-group differences in qualification, too, workers are additionally distinguished by experience. The authors assume no substitution across experience groups within the two skill groups. Finally, the authors distinguish workers by gender, emphasising the stylised fact of a stronger skill upgrading of female labour supply in the period of interest and the implied qualificatory labour supply effects.

Under the assumption of strong separability of production between factors, of aggregation of production across firms, and the plausibility of the use of a constant-returns-to-scale production function, total costs of sectoral outputs are modelled. By means of Shepard's Lemma labour demand can be easily derived. Dividing the labour demand of the two different labour skills and taking the logarithm yields log-linear relative demand. Extending this relative demand equation by an error term provides the estimation approach. Hence, elasticities of substitution can be established measuring the proportional change of the relative input of the two different factors of labour when their relative wages change by one per cent. Graphically spoken, the elasticity of substitution measures the slope of the relative demand curve.

Mohr and Steiner (1998) interpret lower elasticities of substitution as evidence in favour of wage rigidities. The argument is as follows: if there were wage rigidi-

ties, it would be more expensive to substitute skilled labour by unskilled labour in the case of changing relative factor prices due to international trade. That is, the elasticities of substitution would be lower. From a theoretical point of view, this arguing ignores the changing properties of demand and supply functions in the presence of price rigidities. The approach of Mohr and Steiner (1998), which searches for evidence on elasticities of substitution and for whether they are uniform across industries, is based on the partial equilibrium standard approach widely used in labour economics. As an implication, the standard objections apply. This particularly concerns the deficits inherent in partial equilibrium approaches when effects of economic internationalisation on wages and employment are analysed, cf. Section 6.3.

Mohr and Steiner (1998) find the dominant results confirmed. While they find a more or less overall stable degree of wage inequality, with respect to the changes in the qualificatory structure of employment they find for both men and women the strongest decline in unskilled labour employment in the manufacturing sector. Examining a time trend for all industries, which represents factors that affected all industries, confirms the stylised fact of a relative employment decrease of unskilled labour across all industries. While the decrease in employment of unskilled workers characterised all sectors irrespective of whether belonging to services or manufacturing, skilled labour employment increased especially in services. Because the uniformity of the trend in the qualificatory employment shift is also confirmed when sectors are distinguished by the share of imports in overall output, Mohr and Steiner (1998) conclude that international trade is not the primary candidate to explain this shift. The almost double trend coefficient for women compared to men is interpreted as additional evidence in favour of unskilled-labour biased technological change.

While substitution elasticities for high aggregation levels are low, disaggregation shows higher elasticities of substitution for some of the industries. Mohr and Steiner (1998) therefore conclude that less binding rigidities allowed relative wages to adjust only in some of the sectors thus reducing the extent to which employment shifted to the detriment of unskilled labour. Even if the authors' focus is on demand side shifts, they emphasise that demand-sided explanations do not suffice. Hence, what remains unexplained is ascribed to supply side effects, the most important effect being the aforementioned skill-upgrading by women.

In the sense of studies that recur to the factor content approach or to the concept of factor price dependence based on international trade theory, with respect to causality the Mohr and Steiner (1998) approach does not really try to test for the effects of economic internationalisation on relative income positions of different labour skills. Following this partial equilibrium tradition of labour market economics, Mohr and Steiner (1998) calculate substitution elasticities for sectors distinguished by the *ad hoc* measure of the share of imports as an approximation of the intensity to which a sector faces international competition. The underlying hypothesis is that uniformity of the trend in employment shifts provides evidence in favour of skilled-biased technological progress.

On the basis of Jones (1965), Lücke (1997) links international goods trade, tech-

Table 12.1

International Trade and the Distribution of Labour Income – General Equilibrium Considerations

Study	Data	Procedure	Findings
Fitzenberger (1999a)	National account data from 1970 to 1990 for former West Germany at the 2- and 3-digit industry level comprising data on value added, production (shipment) value, net capital stock, total employment, wage bill, exports and imports, and appropriate price deflators; data are subdivided into 36 industries whose products are tradeable, mainly covering manufacturing; wage data from the IABS divided according to the three skill groups low-skilled, medium-skilled and high-skilled	Heckscher-Ohlin-Samuelson trade theory; descriptive analysis; analysis of changes in relative prices of goods that are intensive in the three different factors of labour or physical capital; analysis of changes in relative wages of the three factors of labour; in order to get evidence on price trends, regression of relative price indices on year dummies	Relatively unfavourable price trends for capital-intensive goods, for goods intensive in unskilled labour and goods intensive in high-skilled labour; according to the Stolper-Samuelson theorem relative wages of medium-skilled labour should have risen relative to unskilled and high-skilled labour; furthermore average wages should have increased relative to capital; the results for factor earnings of capital relative to average wages correspond to the Stolper-Samuelson predictions; however, neither for unskilled labour nor for skilled labour does the worsening relative position to medium-skilled labour according to the Stolper-Samuelson prediction hold; while for skilled labour this indicates skilled-biased technological progress as an explanation, the employment shift to the detriment of unskilled labour hints at wage rigidities as an explanation for this factor's unchanged relative earnings position, so that the international trade explanation gains plausibility
Lücke (1997)	National account data for Germany for the 70s and the 80s; data for 30 industries; classification of human capital covers both formal education and vocational experience; unskilled wage is proxied by two-thirds of the wage earned by a worker only minimally trained; output defined as gross value added; gross value added less proxied unskilled labour remuneration and human capital remuneration, that is, total compensation of all workers minus hypothetical compensation of the unskilled (all workers times proxied earnings), equals capital remuneration	Broadly defined manufactures, including food processing and metallurgy; output is measured by gross value added; unskilled labour, skilled labour and physical capital as production factors; zero-profit conditions are formulated for each industry to find changes consistent with changes in product prices and TFP; outsourcing is measured by material inputs bought externally at the end of the observation period, which had been part of the value added chain at the beginning of the period	Germany seems to have specialized away from industries whose production is intensive in human capital; only for the period 1980 to 1985 is there some evidence in favour of trade competition affecting relative wages of different labour skills; relative to the rest of the world, Germany's human capital stock declined, contradicting the trade impact hypothesis

nological progress, and factor prices by the link between output quantities and factor endowments. Modelling intensified competition by countries richly endowed with unskilled and low-skilled labour, the analysed trade structure between Germany and the rest of the world is as follows: the high-income country Germany exports human capital intensive goods. By contrast, the low-income country that is richly endowed with low-skilled and unskilled labour exports products intensive in these factors as intermediate inputs for the high income country industries' production.

Lücke (1997) emphasises that because of the high aggregation of sectoral production data, necessary when the benchmark effects of a model with two factors and two goods are to be analysed, trade flows might appear as intra-industry trade, even if they were actually of the inter-industry type. This could cause fallacies as to production intensities. Once again, the author also addresses the question of which changes in intensities should be observable in a two-sector and two factors model when moving from one trade equilibrium to another under the assumption of a small open economy. In the highly developed country richly endowed with human capital the relative goods price of the skilled labour intensive product decreases. As an implication production will decrease, thus diminishing this sector's skill intensity. Because of low-skilled labour moving disproportionately to the low-skilled labour intensive sector, both sectors become more intensive in skilled labour. Lücke (1997) argues that if there were an inter-industry trade impact implying a decreased relative factor reward of unskilled labour, in all sectors an increase in low-skilled labour intensity should be observable. Germany thus should have specialised towards human capital intensive goods. Yet for Germany he finds a shift away from human capital and physical capital intensive industries.

Fitzenberger (1999a), whose results can be found together with the results of Lücke (1997) in Table 12.1, also builds his analysis on general equilibrium considerations. In order to look for Stolper-Samuelson effects, Fitzenberger (1999a) recurs to the Heckscher-Ohlin framework, extending the analysis of Fitzenberger (1997) to the first half of the seventies. Following Leamer (1996a), Fitzenberger (1997) tried to disentangle the contribution of changes in TFP on changes in relative goods prices and changes in relative factor prices. He considers the four factors unskilled labour, medium-skilled labour, high-skilled labour and physical capital. Assuming like Leamer (1996a) a constant pass-through rate of technological progress, cf. Section 8.3, a first regression of goods price changes on factor price changes provides the coefficients consistent with zero profits, that is the Stolper-Samuelson effects. Under the zero profit conditions according to (3.19), changes in TFP may either decrease goods prices because of factor-saving technological progress or increase factor prices. Both would be consistent with changes in A^t induced by technological progress. The change of TFP that is not absorbed by a change in factor prices has to be absorbed by the change of factor prices. Therefore, in a second step, the TFP-change is regressed on changes in the factors' income shares providing coefficients that are again consistent with zero profits. Such procedure allows to identify to which extent changes in TFP contributed to changes in relative factor prices. Fitzenberger (1997) finds the goods price changes only favouring medium skilled labour. By contrast, changes in TFP primarily favoured high-skilled labour, in the second place unskilled labour, then medium-skilled labour, and to the lowest extent

physical capital.

As an implication of the Heckscher-Ohlin framework, Fitzenberger (1999a) uses the concept of factor price dependence to give causality considerations a trade theoretical basis. Fitzenberger (1999a) analyses the trends in relative prices of goods that are intensive in the four different production factors. In order to be able to analyse changes of the wages earned by medium-skilled workers relative to unskilled labour and high-skilled labour, Fitzenberger (1999a) assumes only weak complementarities between the three different labour skills. Because Fitzenberger (1999a) recurs to the Stolper-Samuelson link, his hypotheses with respect to the repercussions between changes in relative goods prices and changes in relative factor prices are straightforward, cf. Chapter 5. The results of the Heckscher-Ohlin model critically depend on linear-homogenous production functions and a perfect flexible factor price mechanism that ensure market clearing. Yet the German case is characterised by downward rigidities of wages. Compared to his earlier study Fitzenberger (1999a) extends his theoretical basis by explicitly referring to Davis (1998) who argued that employment changes substitute changes in relative wages when there are downward wage rigidities, cf. Section 11.2. As there is evidence of a decreasing relative price of goods intensive in unskilled labour, but no evidence of a decreasing relative wage of unskilled labour, contradicting the Stolper-Samuelson prediction, again this could be interpreted as evidence against the international trade explanation, cf. the studies dealing with the U.S. case reviewed in Chapter 6. However, Fitzenberger (1999a) also finds a change in employment at the expense of unskilled labour, interpreting this change in employment following the above argument of Davis (1998). This brings back international trade as an explanatory approach, because the change in relative goods prices is consistent with the trade pattern between Germany and countries richly endowed with unskilled labour as predicted by endowment theories.

Review and Outlook

A major problem when income inequality is to be compared internationally is how to render qualification categories comparable. If the comparison builds on formal education as is done so often, the comparability of country-specific studies dealing with the U.S. and Germany is questioned because the two education systems exhibit important differences. A remedy was the definition of more general categories, classifying labour by means of only two categories, as for example blue-collar and white-collar. The advantage of this kind of classification lies in also considering labour market experience, even if this classification is misleading in some cases, cf. Leamer (1994). In the case of Germany, working with three different labour skills is more adequate because of the specific skill structure of the German labour supply, since medium-skilled labour characterised by general training and on-the-job training is an important category, cf. the share of *Facharbeiter* in total employment depicted in Figure 10.2. This division of labour into three different skill categories showed that the distributional reality in Germany is rather complex, so that Giles et al. (1998, p. 71) conclude:

The results presented ... suggest quite clearly that none of the 'stylised facts' of the ... U.S. experience – namely, an increase in the return to education ... and an increase in inequality within groups of workers of the same age and education – is a feature of West Germany.

In particular Fitzenberger (1999b) and Möller (1998) unambiguously found an U-shaped change of income inequality when analysing the distribution of labour income during the last three decades. While income compression fell from the mid-seventies until the beginning of the eighties, afterwards it began to rise again.

Obviously, the stylised facts describing the distribution of labour income in Germany differ from the more or less clear-cut evidence of an increasing qualificatory wage gap in the U.S., which is by and large robust to the choice of different income and inequality measurement concepts, cf. Chapter 4. These findings provided by distributional analysis raise doubts whether the stylised facts of labour income inequality and involuntary unemployment in Germany really do allow the establishment of the simply-constructed flip-side hypothesis. With respect to its causality content, the flip-side hypothesis was also heavily challenged by Nickell and Bell (1995, 1996). What are these authors' objections to the hypothesis' deceptively simple structure,

suggesting a clear-cut research programme? In light of both neutral and nonneutral shocks during the eighties, the authors build on the findings of a relatively high substitution elasticity between unskilled and high-skilled labour, cf. Hammermesh (1993), constant elasticity labour demand curves and relatively stable inflow rates for both qualifications of labour, but increasing unemployment duration in most countries. From these findings, the authors conclude equiproportionate shifts in labour demand as a result of neutral labour demand shocks.

By contrast, the trade and wages debate searched for causes of nonneutral shocks at the expense of unskilled labour induced by economic internationalisation, competing with the alternative hypothesis of low-skilled labour biased technological progress as the driving force. The key point made by Nickell and Bell (1995, p. 46) is that *a rise in the unskilled rate which is proportionately greater than a rise in the skilled rate . . . implies that the relative decline in the demand for unskilled workers had played a significant role* if such asymmetric shocks had really superimposed the effects resulting from the stated neutral shocks. In order to gain further evidence, this conclusion thus demands a detailed analysis of the change in relative unemployment rates. Obviously, a more sophisticated debate on unemployment in the face of different kinds of labour demand shocks affecting unemployment duration sheds critical light on the flip-side hypothesis' clear-cut research message.

While Leamer (1993) points to the U.S. trade deficit as being an unstable equilibrium from the long-run perfect competitive equilibrium point of view, Fitzenberger (1999b) points to the symmetric - in a way - finding of a trade surplus in Germany in the eighties. Fitzenberger (1999b) also emphasises that employment in Germany was steadily increasing during this decade. The flip-side hypothesis is critically based on increasing qualification-specific unemployment in the lower range of labour skills. If the observed increase in involuntary unskilled and low-skilled unemployment under the German scenario and the increase in the qualificatory wage gap in the U.S. should have emerged while qualificatory employment shares and overall employment remained stable, such a hypothesis would be a plausible starting point for theoretical reasoning.

Yet, if this were not the case, and evidence for this assumption is not negligible according to Bell and Nickell (1995), things become different. Above all, long-run oriented models working with the assumption of fixed long-run stocks of different labour qualities would fail in contributing to the analysis of this hypothesis. Hence, the question is whether the changing skill structure of employment is due to changing qualification-specific unemployment rates or due to changing qualification supply, a point stressed by Fitzenberger (1999b). In any case, a sound income distribution analysis always requires the consideration of employment effects. Against this background, once again the importance of relating the Findlay and Kierzkowski (1983) approach to studies that introduce rationing of labour supply is confirmed as an essential component of a debate on trade, wages, and involuntary unemployment.

On the other hand, the results of Fitzenberger (1999a) seem to support the flip-side hypothesis. Because of a binding wage floor for unskilled labour in Germany, this factor becomes increasingly rationed when changes in relative goods prices induced by the movement from one trade equilibrium to another cause changes in relative

factor prices. According to Davis (1998), increased quantity rationing substitutes factor price adjustment. The results of Davis (1998), however, are derived by a model with only two different labour skills. As Fitzenberger (1999a) works with three different labour skills, the three production factors of the approach with two different factors of labour and a factor of physical capital in Section 6.4 could be reinterpreted as three different labour skills. Irrespective of the fact that Fitzenberger (1999a) analyses four different production factors by including physical capital, Section 6.4 unambiguously showed that changes in relative factor prices in the case of goods price changes are far from being straightforward when the number of factors exceeds two. Hence, the identification problems of higher-dimensional models discussed in Subsection 6.3.2 reappear.

From a distributional point of view, when a factor reward changes in a perfect competitive long-run framework induced by international trade, international trade leaves overall employment unchanged because perfect flexible factor prices ensure full employment. This simplifies the distributional analysis, because only changes in relative factor prices change the distribution of labour income. If employment additionally changes because of binding minimum wages, for example, these changes in employment also have to be analysed with respect to their distributional implications. Furthermore, analysing involuntary unemployment theoretically recalls the problem of the lack of a generally accepted model framework of labour market rationing. In this connection, an important issue concerns market spillover effects in the case of binding minimum wages. In order to exclude the problem of market spillover effects by changing goods prices in the case of quantity rationing of labour, the assumption of a small open economy also gains significance. Under this assumption a country can export as much as it wishes due to perfect elastic world market goods demand without affecting goods prices. If all goods were tradeable, this assumption would exclude spillover effects on goods markets, avoiding complications due to factor price rigidities. However, at least some sectors of the German and the U.S. economy have to be expected to be large country sectors and the majority of domestic production is still nontraded.

The German case impressively showed the importance of institutions in analysing the effects of economic internationalisation on the functional distribution of income. Even if a rigorous analysis of the distributional effects of welfare state institutions in the form of income support and the social security system is beyond the scope of this study, both clearly affect the distributional outcomes of economic internationalisation. Institutional settings also affect involuntary unemployment, for example, by the analysed binding minimum wage of unskilled labour, and thus the functional distribution of labour income. It is straightforward that institutions are also a result of prevailing social norms. For Germany, preferences in favour of a more egalitarian distribution of income are supposed to have caused downward wage rigidities that, for example, might have compensated wage losses due to market effects. Agell and Lundborg (1995) provide an approach to model the effects of inequality norms on the functional distribution of labour income in a world of opening economies. Methodologically, these authors use an efficiency wage approach to map normative

effects on wage formation.¹ If such norm-induced rigidities caused involuntary unemployment, the latter would be directly linked to the distribution of income in the sense of a trade-off between higher labour income inequality and involuntary unemployment. This again specifies the content of the flip-side hypothesis.

The Agell and Lundborg (1995) approach gives the analysis of internationally different social norms with more egalitarian distribution norms in Germany an appropriate framework. Different norms might also have contributed to different labour market legislation. For example, in Germany protection against unlawful dismissal is far stronger than in the U.S. Comparison of the educational systems in the two countries reveals further important institutional differences. While a large share of the U.S. educational system including universities is privately financed, the German system is mainly under public law. As already explained, important differences are also due to the German system of vocational training. The German system is partly financed by employers. Training within firms is complemented by obligatory vocational school attendance. With respect to the finding of a higher wage compression among unskilled and low-skilled worker wages, cf. for example Fitzenberger (1999b), Acemoglu and Pischke (1998) argued that the lower wage compression in higher skill groups serves as an incentive for firms in Germany to contribute to financing the *Duales Bildungssystem*. Obviously, the German vocational training system is not only characterised by its specific financing in the form of a mix of public financing and private contributions by firms, but also by trainees not only accumulating firm specific-human capital but also general human capital.

Thinking about institutions also sheds light on the trade-off of market versus hierarchy and, in the context of the trade, wages, and involuntary unemployment debate, on multinational firms and their activities. The two issues can be related if one becomes aware that both institutions and firms are linked to the existence of fixed costs. By contrast, in the perfect equilibrium framework firms do not exist in an institutional sense, because firms are of atomistic size in equilibrium. As Section 8.2 showed, at least some studies try to treat the U.S. case of multinational firm activities and the distribution of labour income both theoretically and empirically. However, for Germany a sophisticated economic debate on the role of multinationals on wages and involuntary unemployment does not yet seem to have started. This is the more astonishing recalling Siebert's (1996) contribution to the lively debate on locational competition in Germany, emphasising expected production shifts abroad as a consequence of economic internationalisation and their employment effects, cf. Section 1.1.

¹Besides, there are efficiency wage models that give up the assumption of perfect competitive goods markets by modelling monopolistic competition. However, such approaches like Matusz (1996) normally do not disaggregate labour.

The Returns of a German-U.S. Comparison

Taking Involuntary Unemployment as a Serious Problem

From a theoretical point of view, this study has tried to draw a line from the seminal paper of Findlay and Kierzkowski (1983) to further applications of their endogenous labour supply model in an open economy. The authors try to understand how the skill structure of labour supply changes in a world of economic internationalisation. It has been worthwhile pursuing this model's impact, which was a basic input into subsequent approaches analysing repercussions between trade, wages, and involuntary unemployment. The interesting point with this approach is not only its attempt to reconcile partial equilibrium labour market issues established by human capital theory with the general equilibrium-led debate on trade and the functional distribution of income, but also its implementation in models that try to adequately consider the European case by modelling involuntary unemployment, thus applicable to the German case.

As was shown in Subsection 11.2.3, Findlay and Kierzkowski's (1983) approach to model endogenous human capital supply was also integrated into frameworks of a dynamic nature starting from concepts developed by growth theory. An important contribution of this kind is Dinopoulos and Segerstrom (1999), recently extended by Şener (2001). The latter approach is of special importance because it additionally deals with the problem of involuntary unemployment in the context of Schumpeterian innovation, being theoretically aware that economic internationalisation might have also contributed to involuntary unemployment in the U.S. Clearly, searching for changes in relative wages implies also addressing the question of shifts in employment, since changes in relative wages imply the sectoral reallocation of employment. The studies referring to perfect competition frameworks are able to analyse changes in employment. Yet they necessarily cannot analyse changes in involuntary unemployment, since under the dominant perfect competitive equilibrium approach, in particular in the form of the still popular Heckscher-Ohlin model, all factors are always fully employed. This had to be kept in mind when reading the empirical contributions to the trade and wages debate.

The debate on trade and U.S. wages started from the stylised fact of increasing inequality of the functional distribution of labour income earned by workers who supply different labour skills. Rising wage inequality is expected to bear the majority of effects caused by economic internationalisation or technological progress, or both factors affecting each other. Nevertheless, the U.S. case is also characterised by unemployment, shown in Figure 3.1. In the face of the characteristics of involuntary unemployment in the U.S., that is, long-term fluctuation around a mean in particular, Şener (2001) uses a matching approach to explain the contribution

of innovation and economic internationalisation to involuntary unemployment. In this approach economic internationalisation is due to the reduction of tariffs, which increases profits thus providing incentives to innovate. Skilled labour-intensive innovation again induces involuntary unemployment. Such an integrated perspective on U.S. trade, wages, and employment is remarkable, since the flip-side hypothesis as the main hypothesis inspiring the comparative trade and wages and involuntary unemployment debate expected an increase in the qualificatory wage gap in the U.S. on the one hand, and an increase in low-skilled and unskilled labour unemployment induced by economic internationalisation under the European scenario, that is with respect to this study's focus in Germany, on the other. As the review of empirical contributions to the causality analysis of changing U.S. wage inequality in Part II explained, economic internationalisation seems not to have been the first candidate in explaining the worsening relative position of low-skilled and unskilled labour. If repercussions between economic internationalisation and innovation are treated in a more sophisticated manner under a more realistic scenario that also takes involuntary unemployment in the U.S. into consideration, the economic internationalisation explanation might return with interesting distributional effects approximating distributional reality more closely. In any case, for the U.S. it is a too simple of a long-run perspective to totally neglect the question of repercussions between economic internationalisation and involuntary unemployment.

Şener's (2001) foundation of involuntary unemployment in an open economy is also applicable to the German case, since labour markets are also characterised by regional and qualificatory mismatches that are reflected in time-consuming search processes. However, frictional unemployment induced by time-consuming mismatches is only part of the German story. In contrast to U.S. labour markets, unemployment in Germany in the 80s and 90s was especially characterised by persistence, strongly concerning low-skilled and unskilled labour, cf. Figure 10.1. Moreover, the persistence of unemployment was accompanied by high shares of long-term unemployment. As Part III of this study showed, involuntary unemployment in Germany is mainly ascribed to downward rigidities of low-skilled and unskilled labour wages, where the systems of collective bargaining and income support were suggested as causes of the too high wage compression, for example.

In the presence of the problems of how to render income operational and of how to measure income and income inequality, the complex distributional reality both in the U.S. and Germany requires the aggregation of skills and incomes. With respect to the theoretical analysis of the trade and wages puzzle focusing on involuntary unemployment, the dominant strategy is the aggregation of two different labour skills. This kind of approach was inspired by the early contributions of Brecher (1974a/b). Besides, despite severe conceptual problems it might have been the reduction of this problem to a world with two labour skills that rehabilitated the use of quantile distances in inequality measurement to search for stylised distributional facts. Yet the review of the changes in the functional distribution of labour income in Chapter 10 explained that this reduction raises severe problems in the German case, because the German labour supply is characterised by a large share of medium-skilled workers.

Another weakness of the Brecher (1974a/b) and related approaches is that only one factor of labour is concerned by involuntary unemployment. These approaches concentrate on involuntary unemployment of unskilled labour. However, not only unskilled and low-skilled workers suffer from involuntary unemployment. Medium-skilled and high-skilled workers are also temporarily concerned by higher involuntary unemployment with distributional implications. Consequently, a trade, wages, and involuntary unemployment debate should always be aware of the complex reality of labour market rationing and its distributional implications, recalling Nickell and Bell's (1995, 1996) criticism of the flip-side hypothesis. Again, this also concerns the case of the U.S., where at least in the shorter run unemployment always reappears, even if labour market characteristics differ from those of the German labour markets concerned by persistence.

Changes in involuntary unemployment are not only interesting with respect to their effects on the functional distribution of income but particularly with respect to their effects on the personal distribution of income. These effects strongly depend on the existing transfer and social security systems. Even if the distributional and welfare effects of such systems were beyond the scope of this study, it is obvious that these systems affect market outcomes and welfare themselves. Hence, the effects of economic internationalisation are not only closely linked to the specific labour market institutions but also to the scope of the welfare state, being either liberal as in the U.S. or deeply interventionist in the distribution of income as in Germany. Indeed, the description of the changes of the personal income distribution in the two countries showed that income disparity among households changed, with a significant increase in the U.S. during the recent two and a half decades. However, there is a lack of theoretical models dealing convincingly with the personal distribution of income in a world of economic internationalisation, an exception being Das (2000) who, however, does not disaggregate labour. In consequence, because the personal distribution of income is of outstanding socio-economic and political relevance, the positive analysis of the functional distribution of labour income must be extended by theoretical analyses of the repercussions between the functional distribution of wages and capital income and the distribution of income among households.

Concluding Remarks

This study compared the effects of economic internationalisation on the functional distribution of labour income in the U.S. and Germany. Therefore, empirical evidence on the distribution of labour income in the two countries was reviewed. The benchmark for assessing these analyses theoretically was the general equilibrium framework of international trade theory. Focusing on general equilibrium frameworks stems from the insight that economic internationalisation in the form of international trade is a general equilibrium phenomenon and not only an exogenous shock that can be analysed by means of partial equilibrium approaches, cf. Dearnorff's words cited in Section 6.3. Even if this study concentrated on the positive analysis of the trade and wages puzzle, the general equilibrium perspective of international trade theory calls to mind the welfare implications of economic inter-

nationalisation. Trade theory unambiguously showed conditions under which there are gains from trade. These gains from trade are essential for the debate on trade and wages. *Ceteris paribus*, only gains from trade create a basis for redistributive policies to compensate those who lose from economic internationalisation.

The theoretical analysis of the effects of economic internationalisation on wages based on international trade theory mainly focused on comparative static analysis of different trade equilibria with an inherent long-term orientation, even if the specific-factors model opens the door for shorter run issues. This procedure means comparing equilibria without taking adjustment dynamics into consideration. The trade and wages debate, however, is confronted with the problem of how to distinguish long-term effects from short-term effects of economic internationalisation on the functional distribution of labour income. Against this background, this study showed the importance of the question whether increasing income inequality is really a relevant long-term issue. In this connection it was particularly interesting to recall the Kuznets hypothesis that predicts an U-shaped long-run change in income inequality. As shown in Chapter 4, while the shape of the changes in income inequality in the decades after World War II inspired the Kuznets hypothesis, the significant changes in income inequality starting from the mid-seventies challenge the expected U-shape. Hence, labour income inequality not only increased over a period of more than twenty years, but might have also reversed a former long-run trend of decreasing wage inequality.

When the analysis turned to the German case, the picture of income inequality became different. For the case of Germany, in the last three decades clear-cut changes in the distribution of labour income distinguished by skill are far from obvious, cf. Chapter 10. Nevertheless, a temporarily more or less stable degree of income inequality found by descriptive measurement concepts does not mean that there were no changes in the distribution of wages. First there were labour demand and labour supply effects working in the opposite direction. The detailed analysis of changes in income inequality within and between skill groups confirmed this complex distributional reality. Second, labour market rationing, particularly of low-skilled and unskilled workers who no longer earn functional labour incomes, changed the distribution of employment and consequently the wage distribution.

Thinking about long-term trends leads back to the problem of the periods that are to be analysed. This problem became obvious when the concepts of how to distinguish and to measure transitory and permanent income inequality were discussed. With respect to the measurement of inequality, this study also emphasised the normative implications of the decision in favour of the chosen measurement concept. Especially when summary measures are used, the normative implications of the chosen measure must be disclosed, because measures differently assess inequality in different ranges of the income distribution. Whether changing income inequality will induce compensating policies will also depend on a society's normative attitudes towards income inequality. In consequence, the choice of a measurement concept allows the consideration of different preferences. This had to be kept in mind when reviewing changes in the distribution of income in the U.S. and Germany.

Another important inequality measurement problem concerns the less-developed

trading partners of Germany and the U.S. that are richly endowed with low-skilled and unskilled labour, in this study referred to as the South, following the dominant convention. For the South, the Stolper-Samuelson theorem, as discussed in Section 5.1, predicts changes in relative wages to the disadvantage of skilled workers. Modelling the trade of Germany and the U.S. with countries richly endowed with low-skilled and unskilled labour requires the aggregation of factors and products in the two highly developed economies as well as the aggregation of the products and factors in the trading partner economies. These countries are very heterogeneous. Despite the attempts to gain insights into the wage distribution of the South, as done for example by Wood (1994), the evidence on the functional distribution of labour income has to be treated very cautiously and thus also the conclusions of models that necessarily imply a worsening relative income position of skilled workers. If the relative income position of skilled labour should actually have not worsened in the South, those endowment theories of international trade predicting labour income losses of skilled workers relative to unskilled workers like the Heckscher-Ohlin trade theory and its implied factor price equalisation would become inappropriate.

By contrast to this uncertain perspective, this study emphasised that the concept of factor price dependence, far more general than factor price equalisation, would still apply as an appropriate analysis framework for the repercussions between economic internationalisation and the functional distribution of labour income. However, it is this transmission mechanism that continues to be controversial both theoretically and empirically. In Lawrence's (1994) opinion, for example, the transmission mechanism is only of secondary importance. Decisive would be the reasons of the changes in the qualificatory wage gap in the U.S. Yet the theoretical considerations Parts II and III showed that the transmission mechanism is important, because only a consistent formulation of the transmission mechanism allows to consistently analyse the link of trade, wages, and involuntary unemployment. From a theoretical point of view the identification of causes of distributional effects is only possible in a consistent and meaningful way if the transmission mechanism can be identified. Empirically, for the U.S. with respect to factor price dependence it remains an open question whether relative prices of goods that are intensive in skilled labour rose or fell, cf. also Murshed (1997). As discussed in Section 6.3, in contrast to Sachs and Shatz (1994), Lawrence and Slaughter (1993) found decreasing relative prices of skilled-labour intensive goods, contradicting Stolper-Samuelson effects as an explanation of the increased qualificatory wage gap.

The empirical studies that try to disentangle the trade, wages and involuntary unemployment puzzle for Germany also showed the importance of institutional settings. Social security systems, minimum wage legislation, and the system of income support affect the effects of economic internationalisation on the functional distribution of labour income. Institutional settings also affect the power of the trade unions. For Great Britain, for example, Gosling and Machin (1995) found a significant contribution of decreasing trade union bargaining power to the increased disparity of the functional distribution of income, ensuring less wage compression and thus the reduction of unemployment. In the face of trade union bargaining power and labour market legislation in Germany, a too-high wage compression at the lower end of the functional distribution of income is particularly expected as

an important cause of the increasing involuntary unemployment of low-skilled and unskilled workers in Germany, cf. for example Fitzenberger und Franz (1997). On the other hand, institutional explanations themselves compete with economic internationalisation and technological progress as a potential explanation of changes in the distribution of labour income.

Income distribution topics are so relevant because social interaction also rests on interindividual or intergroup comparison. In the globalisation debate it is often spoken of how to retain social stability in a world of economic internationalisation. Unlike technological progress that is by and large accepted as inevitable by a broad majority in the highly industrialized economies, attitudes towards economic internationalisation seem to be different. Albeit there have been large controversies on the remaining scope of national policies, it is economic internationalisation whose effects have been perceived as if they could be influenced. Again, the controversy on the establishment of NAFTA serves as an example, cf. Section 3.1. Such institutional systems also show that the choice of the regional dimension to consider distributional effects remains a critical question. If nations are taken as analytical units, as in this study, in a sense this is a heritage of nineteenth century traditions. On the one hand, arguments in favour of this procedure are pragmatic, since the prevailing category to organize data sources is still the category of nation. Only making data sources comparable as attempted by the LIS gives a basis for regional grouping of data in order to analyse regions instead of nations. On the other hand there are well-founded problem-oriented reasons for taking nations as analytical units. Despite regional integration in the context of NAFTA or the European Union, significant parts of the legal system and of infrastructure with distributional relevance are national in their scope, for example. Nevertheless, in the future regional distributional changes should additionally be considered as a basis for the analysis of the links between trade and wages, where regions also range beyond national borders.

Appendix

A

Inequality Measures

A.1 Gini Coefficient

The Gini coefficient can be defined as follows:

$$I^g = 1 - 2 \int_0^{\infty} \Phi dF. \quad (\text{A.1})$$

Φ is the distribution's Lorenz curve. The Lorenz curve belonging to the logarithm of the standard normal distribution is $\Phi = N(N^{-1}(F(y)) - \sigma)$ with N as the standard normal distribution and σ as its variance. In this case $F(y)$ is the share of the population with income less than and equal to y . According to equation (A.1) the Gini coefficient is $0 \leq I^g \leq 1$ with $I^g = 1$ in the case of a perfect equal distribution. An overview of the Lorenz curves of important distribution functions is offered by Cowell (1995).

Pyatt (1976) has pointed to interpersonal comparisons as a foundation of the Gini coefficient. That means that for all individuals i the average expected gain when each one is comparing her own income with a randomly selected income from the totality of incomes is

$$\frac{1}{n} \sum_{j=1}^n \max(0, y_j - y_i) \geq 0 \quad \forall i. \quad (\text{A.2})$$

The expected gain becomes zero if the randomly chosen income is lower than i 's income and the expected gain becomes positive if the randomly chosen income is higher than i 's income. This foundation serves as a basis for the decomposition of the standard overall Gini coefficient, now reformulated in a discrete style as

$$I^g = \frac{\mathbf{p}^t E_1 \mathbf{p}}{\mathbf{\Phi}^t \mathbf{p}} \quad (\text{A.3})$$

with $\mathbf{p} = [p_s]$ as the vector of the probabilities belonging to income subgroups s whose mean incomes are $\mathbf{\Phi} = [\mu_s]$. $E_1 = [e_{ij}]$ is the matrix of potential cumulated average gains from interpersonal comparison by each subgroup member i with each

subgroup member j according to (A.2). With $\pi = [\pi_s]$, where $\pi_s = \frac{p_s \mu_s}{\mu}$, and $E_2 = \hat{\Phi}^{-1} E_1$, where $\hat{\Phi}$ is a matrix with the elements of vector Φ as diagonal elements and all other elements zero, (A.3) becomes

$$I^g = \pi^t E_2 \mathbf{p}. \tag{A.4}$$

That is, the diagonal elements of E_2 show nothing but the Gini coefficients of each individual subgroup s .

First, I_w^g shows the degree of within subgroup inequality:

$$I_w^g = \pi^t E_2^w \mathbf{p}. \tag{A.5}$$

Matrix E_2^w equals E_2 except that all off-diagonal elements become zero. By means of matrix M , where all elements below the diagonal and on the diagonal become unit and all other elements become zero and under the assumption that the elements of Φ , \mathbf{p} and π are ordered from smallest to largest, we get $E_3 = \hat{\Phi}^{-1} M^t \hat{\Phi} - M^t$. Therefore

$$I_b^g = \pi^t E_3 \mathbf{p} \tag{A.6}$$

describes the degree of between group inequality. Finally,

$$I_o^g = \pi^t E_4^o \mathbf{p} \tag{A.7}$$

shows inequality due to the overlapping of the subgroup income distributions where E_4^o is $E_4 = \hat{\Phi}^{-1} [E_1 - (M^t \hat{\Phi} - \hat{\Phi} M^t)]$ except that all diagonal elements become zero. Hence:

$$\begin{aligned} I^g &= I_w^g + I_b^g + I_o^g \\ &= \pi^t E_2^w \mathbf{p} + \pi^t E_3 \mathbf{p} + \pi^t E_4^o \mathbf{p}. \end{aligned} \tag{A.8}$$

Now, let s be an index for income sources instead of income recipient subgroups. Lerman and Yitzhaki (1985) show how to decompose the standard Gini coefficient into the contributions of the different income sources to overall inequality:

$$I^g = \sum_{s=1}^S \left[\frac{\text{cov}(y_s, F)}{\text{cov}(y_s, F_s)} \right] \left[\frac{2\text{cov}(y_s, F_s)}{\mu_s} \right] \left[\frac{\mu_s}{\mu} \right], \tag{A.9}$$

where F_s stands for the cumulative distribution of income source s .

A.2 Dominance Analysis

Three forms of dominance analysis can be distinguished. First-degree dominance means: if two distributions A and B are compared to each other a smaller share of the population of one of the two distributions always earns a smaller share of the population's total income independently from the chosen income level, i.e.,

$$H_1(y) \equiv F^B(y) - F^A(y) \leq 0 \quad \text{for all } y \in [0, y^{max}]. \tag{A.10}$$

The subscript at H stands for the degree of dominance, y for income and F^j for the income distribution functions of income groups $j = A, B$.

Second degree dominance says: if both the same population size and the same average income underlie the two distributions A and B , distribution B is preferred for all concave social welfare functions non-decreasing in income if and only if B can be derived from A by a sequence of compensating meanpreserving transfers:

$$H_2 \equiv \int_0^y H_1(y)dy \leq 0 \quad \text{for all } y \in [0, y^{max}]. \quad (\text{A.11})$$

A third form of dominance is Lorenz dominance: If both the same population size and the same average income underlie the two distributions A and B and the Lorenz curve of distribution B either lies above or is congruent to that of distribution A at all points, then distribution B is preferred to distribution A for all social welfare functions belonging to the class of concave welfare functions non decreasing in income.

A.3 Atkinson Measure

The Atkinson measure takes a social welfare function represented by

$$u(y) = \begin{cases} \frac{y_i^{1-\epsilon}}{1-\epsilon} & \text{for } \epsilon \geq 0, \epsilon \neq 1 \\ \ln y & \text{for } \epsilon = 1 \end{cases} \quad (\text{A.12})$$

as a starting point. While u stands for the social welfare function ϵ represents the degree of inequality aversion. The social welfare function meets standard assumptions, i.e. concavity, separability, symmetry and constant elasticity. Assuming symmetry means that the value of the inequality measure is independent of the person who earns a certain income, thus the assumption of symmetry takes the assumption of identical needs of all individuals as a basis. The Atkinson measure can be formalized as follows:

$$I_\epsilon^A = 1 - \frac{\tilde{y}}{\mu}, \quad (\text{A.13})$$

where

$$u(\tilde{y}) = \frac{\tilde{y}^{1-\epsilon}}{1-\epsilon} = \int \frac{y_i^{1-\epsilon}}{1-\epsilon} dF(y).$$

The larger the chosen value of ϵ , the larger the aversion to inequality and the larger the sensitivity to changes in inequality in the lower tail of the income distribution.

A.4 Theil measure

Cowell (1980) shows that the concept of entropy

$$\text{entropy} \equiv \sum_{i=1}^n p_i h(p_i) = - \sum_{i=1}^n p_i \ln(p_i).$$

underlies the Theil measure. This expression is the weighted sum of all events h with the probability p_i . Subtracting actual entropy from the entropy of a hypothetical equal distribution of incomes yields the Theil measure:

$$I^T = \sum_{i=1}^n \frac{1}{n} h\left(\frac{1}{n}\right) - \sum_{i=1}^n s_i h(s_i) = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{\mu} \ln\left(\frac{y_i}{\mu}\right). \quad (\text{A.14})$$

Note that $p_i \equiv s_i = \frac{y_i}{n\mu}$ with $\sum_{i=1}^n s_i = 1$, where y_i is the income of income recipient unit i . Thus the probability of an event h is interpreted as a person's or household's income share of the population's total income.

The logarithmic function goes back to the functional class

$$h(s_i) = -\frac{s_i^\epsilon}{\epsilon}.$$

Hence one gets a class of inequality measures

$$I^\epsilon = \frac{1}{n\epsilon(\epsilon + 1)} \sum_{i=1}^n \left[\left(\frac{y_i}{\mu}\right)^{1+\epsilon} - 1 \right] \quad \text{for } \epsilon \neq 0, -1 \quad (\text{A.15})$$

according to the above procedure above considering the sensitivity coefficient ϵ . For the inequality aversion coefficient 0 one gets the Theil measure in (A.14) where inequality sensitivity is lowest but equally distributed among the whole income distribution.

Furthermore, for the inequality aversion coefficient 1 the measure I^ϵ becomes

$$I^1 = \frac{1}{2n} \sum_{i=1}^n \left[\left(\frac{y_i}{\mu}\right)^2 - 1 \right] \quad (\text{A.16})$$

which is nothing but a linear transformation of the coefficient of variation for a large number of observations. I^1 exhibits high sensitivity in the upper tail of the income distribution. Finally, for the inequality aversion coefficient -1 , the inequality measure I^ϵ becomes

$$I^{-1} = \frac{1}{n} \sum_{i=1}^n \ln\left(\frac{\mu}{y_i}\right) \quad (\text{A.17})$$

with high sensitivity to changes in inequality in the lower tail of the income distribution. A further advantage of the generalized class of entropy measures lies in their exhaustive decomposability into within-subgroup and between-subgroup inequality:

$$I_d^\epsilon = \frac{1}{\epsilon(\epsilon + 1)} \sum_{s=1}^l \frac{n_s}{n} \left[\left(\frac{\mu_s}{\mu}\right)^{\epsilon+1} - 1 \right] + \sum_{s=1}^l \frac{n_s}{n} \left(\frac{\mu_s}{\mu}\right)^{\epsilon+1} I_s^\epsilon \quad (\text{A.18})$$

where μ_s stands for the average income of subgroup s with $s = i, \dots, k$ and n_s for the incomes belonging to each subgroup. While the first term on the right side of equation (A.18) describes between-subgroup inequality, the second term identifies within-subgroup inequality.

A.5 Decomposing Income Inequality by Different Income Sources

In the measures described above, income inequality has been decomposed with regard to the interaction of different socio-economic subgroups to overall inequality. Additionally, Shorrocks (1982) has proposed the decomposition of income inequality contributions stemming from different income sources such as capital income, earnings and so on, i.e., the former decomposition category subgroups are now re-defined as different income sources. The contribution of income source s to overall income inequality can be decomposed into two elements:

$$I_s = \text{cov}(\mathbf{y}_s, \mathbf{y}) = \frac{1}{2}(C_s^A + C_s^B) \quad (\text{A.19})$$

with $I^{CV^2} = \sum_{s=1}^l I_s$. The first term in brackets is

$$C_s^A = \frac{\sigma^2(\mathbf{y}_s)}{\mu^2} \quad (\text{A.20})$$

which measures income inequality as if observed inequality were only caused by income source s , i.e., the rest of income would be equally distributed. The second term in brackets is

$$C_s^B = \frac{\sigma^2(\mathbf{y}_s) + 2 \text{cov}(\mathbf{y}_s, \mathbf{y} - \mathbf{y}_s)}{\mu^2} \quad (\text{A.21})$$

which measures the amount by which inequality would either fall or rise if there were no inequality due to income source s , i.e., if income source s were equally distributed.

B

General Equilibrium

B.1 Production Side

Written in detail the matrix in equation (3.24) becomes

$$\begin{bmatrix} S & A \\ A^t & 0 \end{bmatrix} = \begin{bmatrix} \sum_{j=1}^n \frac{\partial a_{1j}}{\partial w_1} x_j & \cdots & \sum_{j=1}^n \frac{\partial a_{1j}}{\partial w_m} x_j & a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \sum_{j=1}^n \frac{\partial a_{mj}}{\partial w_1} x_j & \cdots & \sum_{j=1}^n \frac{\partial a_{mj}}{\partial w_m} x_j & a_{m1} & \cdots & a_{mn} \\ a_{11} & \cdots & a_{m1} & 0 & \cdots & 0 \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ a_{1n} & \cdots & a_{mn} & 0 & \cdots & 0 \end{bmatrix}. \quad (\text{B.1})$$

Substitution matrix S results from total differentiation of factor market equilibrium conditions (3.20) considering cost minimizing input coefficients. Following Jones and Scheinkmann (1977), matrix (B.1) can also be written in the form of distributional shares by means of substitution matrix $S = \left[\sum_{j=1}^n \frac{\partial a_{ij}}{\partial w_i} x_j \right]$ with $i = 1, \dots, m$:

$$\begin{bmatrix} E & B \\ F & 0 \end{bmatrix} = \begin{bmatrix} \frac{w_1 s_{11}}{v_1} & \cdots & \frac{w_1 s_{1m}}{v_1} & \frac{a_{11}}{v_1} & \cdots & \frac{a_{1n}}{v_1} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \frac{w_m s_{m1}}{v_m} & \cdots & \frac{w_m s_{mm}}{v_m} & \frac{a_{m1}}{v_m} & \cdots & \frac{a_{mn}}{v_m} \\ \frac{w_1 a_{11}}{p_1} & \cdots & \frac{w_m a_{m1}}{p_1} & 0 & \cdots & 0 \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \frac{w_1 a_{1n}}{p_n} & \cdots & \frac{w_m a_{mn}}{p_n} & 0 & \cdots & 0 \end{bmatrix}. \quad (\text{B.2})$$

Finally, let vectors in (3.25) denote

$$\begin{bmatrix} \hat{\mathbf{w}} \\ \hat{\mathbf{x}} \end{bmatrix} = \begin{bmatrix} \frac{dw_i}{w_i} \\ \frac{dx_j}{x_j} \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} \hat{\mathbf{v}} \\ \hat{\mathbf{p}} \end{bmatrix} = \begin{bmatrix} \frac{dv_i}{v_i} \\ \frac{dp_j}{p_j} \end{bmatrix}. \quad (\text{B.3})$$

B.2 The Stolper-Samuelson Effect

For the case of two factors and two goods the national product function (3.2) can be derived with respect to goods prices of goods x_1 and x_2 :

$$\frac{\partial R}{\partial p_j} dp_j = \frac{\partial x_1}{\partial p_j} p_1 dp_j + \frac{\partial x_2}{\partial p_j} p_2 dp_j + x_j dp_j \quad \text{for } j = 1, 2. \quad (\text{B.4})$$

Because of (3.32)

$$\frac{\partial x_1}{\partial p_1} p_1 + \frac{\partial x_2}{\partial p_1} p_2 = 0 \quad \text{and} \quad \frac{\partial x_1}{\partial p_2} p_1 + \frac{\partial x_2}{\partial p_2} p_2 = 0. \quad (\text{B.5})$$

Since the supply functions of the two goods are non-decreasing in respective goods prices, (B.5) firstly results in an increase in p_1 implying an increase in goods supply of x_1 and consequently a decrease in goods supply x_2 . Secondly, decreasing p_2 implies both decreasing goods supply of x_2 and increasing goods supply of x_1 .

B.3 Proof of the Magnification Effect

The factor price functions in the case of a model with two goods and two factors are $w_1 = w(v_1, v_2, p_1, p_2)$ and $w_2 = w(v_1, v_2, p_1, p_2)$. Total differentiation shows

$$dw_i = \frac{\partial w_i}{\partial p_1} dp_1 + \frac{\partial w_i}{\partial p_2} dp_2 + \underbrace{\frac{\partial w_j}{\partial v_1} dv_1 + \frac{\partial w_i}{\partial v_1} dv_2}_{=0} \quad \text{for } i = 1, 2. \quad (\text{B.6})$$

Now, these terms can be expressed as growth rates. Let the growth rate of dw_i be

$$\hat{w}_i = \frac{dw_i}{w_i} = \frac{\partial \ln w_i}{\partial \ln p_1} \hat{p}_1 + \frac{\partial \ln w_i}{\partial \ln p_2} \hat{p}_2 \quad \text{for } i = 1, 2. \quad (\text{B.7})$$

Because of

$$\frac{\partial \ln w_i}{\partial \ln p_1} \hat{p}_1 + \frac{\partial \ln w_i}{\partial \ln p_2} \hat{p}_2 = 1 \quad \text{for } i = 1, 2. \quad (\text{B.8})$$

one gets

$$\hat{w}_i = \left[1 - \frac{\partial \ln w_i}{\partial \ln p_2} \right] \hat{p}_1 + \frac{\partial \ln w_i}{\partial \ln p_2} \hat{p}_2 = \hat{p}_1 - \frac{\partial \ln w_i}{\partial \ln p_2} (\hat{p}_1 - \hat{p}_2) \quad \text{for } i = 1, 2. \quad (\text{B.9})$$

Hence, if $\hat{p}_1 > \hat{p}_2$, (5.2) follows.

B.4 A Model with Two Goods and Three Factors

For an economy with three goods and two factors, the matrix of (3.24) becomes

$$\begin{bmatrix} S & A \\ A^t & 0 \end{bmatrix} = \begin{bmatrix} \sum_{j=1}^2 \frac{\partial a_{1j}}{\partial w_1} x_j & \cdots & \sum_{j=1}^2 \frac{\partial a_{1j}}{\partial w_3} x_j & a_{11} & a_{12} \\ \vdots & \ddots & \vdots & a_{21} & a_{22} \\ \sum_{j=1}^2 \frac{\partial a_{3j}}{\partial w_1} x_j & \cdots & \sum_{j=1}^2 \frac{\partial a_{3j}}{\partial w_3} x_j & a_{31} & a_{32} \\ a_{11} & a_{21} & a_{31} & 0 & 0 \\ a_{12} & a_{22} & a_{32} & 0 & 0 \end{bmatrix}. \quad (\text{B.10})$$

Taking into consideration determinant

$$\det A = \delta > 0$$

and assuming $a_{ij} > 0$, the Stolper-Samuelson matrix can be derived:

$$\frac{1}{\delta} \begin{bmatrix} a_{32}\beta_2 - a_{22}\beta_3 & a_{12}\beta_3 - a_{32}\beta_1 & a_{22}\beta_1 - a_{12}\beta_2 \\ a_{21}\beta_3 - a_{31}\beta_2 & a_{31}\beta_1 - a_{12}\beta_3 & a_{11}\beta_2 - a_{21}\beta_1 \end{bmatrix} \quad (\text{B.11})$$

with

$$\begin{aligned} \beta_i &\equiv s_{i1}(a_{31}a_{22} - a_{32}a_{21}) \\ &+ s_{i2}(a_{11}a_{32} - a_{12}a_{31}) + s_{i3}(a_{12}a_{21} - a_{11}a_{22}). \end{aligned}$$

An unambiguous determination of the signs of this matrix obviously can only be done by further assumptions to the factors' relationship with each other.

B.5 The Specific-Factors Model

A special case of the model with two goods and three factors is the specific-factors model. According to the first scenario in Section 6.4, let factor v_1 be only employed in goods x_1 production and let factor v_2 be only employed in goods x_2 production, i.e.,

$$a_{12} = 0 \quad \text{and} \quad a_{21} = 0.$$

Let physical capital v_3 be the mobile factor being a substitute of the two immobile factors v_1 and v_2 :

$$\frac{\partial a_{11}}{\partial w_3} > 0 \quad \text{and} \quad \frac{\partial a_{22}}{\partial w_3} > 0.$$

Compared to (B.10), the following modifications result:

$$\begin{bmatrix} S & A \\ A^t & 0 \end{bmatrix} = \begin{bmatrix} \frac{\partial a_{11}}{\partial w_1} x_1 & 0 & \frac{\partial a_{11}}{\partial w_3} x_1 & a_{11} & 0 \\ 0 & \frac{\partial a_{22}}{\partial w_2} x_2 & \frac{\partial a_{22}}{\partial w_3} x_2 & 0 & a_{22} \\ \sum_{j=1}^2 \frac{\partial a_{3j}}{\partial w_1} x_j & \sum_{j=1}^2 \frac{\partial a_{3j}}{\partial w_2} x_j & \sum_{j=1}^2 \frac{\partial a_{3j}}{\partial w_3} x_j & a_{31} & a_{32} \\ a_{11} & 0 & a_{31} & 0 & 0 \\ 0 & a_{22} & a_{32} & 0 & 0 \end{bmatrix}. \quad (\text{B.12})$$

Under the additional assumption of the mobile factor capital being an aggregate substitute for labour, the signs of the substitution matrix read as follows:

$$\begin{bmatrix} s_{11} & 0 & s_{13} \\ 0 & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{bmatrix} = \begin{bmatrix} - & 0 & + \\ 0 & - & + \\ + & + & - \end{bmatrix}. \quad (\text{B.13})$$

One speaks of aggregate substitutes, if

$$\frac{\partial a_{31}}{\partial w_1} > 0, \frac{\partial a_{32}}{\partial w_1} > 0 \quad \text{and} \quad \frac{\partial a_{31}}{\partial w_2} < 0, \frac{\partial a_{32}}{\partial w_2} < 0.$$

In the case of the specific-factors model, the Stolper-Samuelson matrix becomes

$$\frac{1}{\bar{\delta}} \begin{bmatrix} a_{32}\beta_2 - a_{22}\beta_3 & -a_{32}\beta_1 & a_{22}\beta_1 \\ -a_{31}\beta_2 & a_{31}\beta_1 & a_{11}\beta_2 \end{bmatrix}. \quad (\text{B.14})$$

Furthermore

$$\begin{aligned} \beta_1 &\equiv s_{11}(a_{31}a_{22}) + s_{13}(-a_{11}a_{22}) < 0 \\ \beta_2 &\equiv s_{22}(a_{11}a_{32}) + s_{23}(-a_{11}a_{22}) < 0 \\ \beta_3 &\equiv s_{31}(a_{31}a_{22}) + s_{32}(a_{11}a_{32}) + s_{33}(-a_{11}a_{22}) > 0. \end{aligned}$$

Finally, the Stolper-Samuelson signs in (6.14) follow.

Literature

- Abraham, K. and S. Houseman* (1995): Earnings inequality in Germany, in *R. Freeman and L. Katz* [Ed.]: Differences and Changes in Wage Structures, Chicago
- Acemoglu, D.* (1998): Why do technologies complement skills? Directed technical change and wage inequality, *QUARTERLY JOURNAL OF ECONOMICS* 113(4), 1055-1090
- Acemoglu, D. and J. Pischke* (1998): The structure of wages and investment in general training, CEPR Discussion Paper No. 1833, London
- Adams, J.* (1997): Technology, trade, and wages, NBER Working Paper Series, Working Paper 5940, Cambridge
- Agell, J. and P. Lundborg* (1995): Fair wages in the open economy, *ECONOMICA* 62, 335-351
- Aitken, B., A. Harrison and R. Lipsey* (1996): Wages and foreign ownership. A comparative study of Mexico, Venezuela, and the United States, *JOURNAL OF INTERNATIONAL ECONOMICS* 40(3/4), 345-372
- Akerlof, G. and J. Yellen* (1990): The fair wage-effort hypothesis and unemployment, *QUARTERLY JOURNAL OF ECONOMICS* 105, 255-283
- Anderson, J. and J. Neary* (1994): Measuring the restrictiveness of trade policy, *WORLD BANK ECONOMIC REVIEW* 8, 151-169
- Arrow, K.* (1994): General economic theory and income inequality, in *J. Bergstrand et al.* [Ed.]: The Changing Distribution of Income in an Open U.S. Economy, Amsterdam
- Atkinson, A.* (1970): On the measurement of inequality, *JOURNAL OF ECONOMIC THEORY* 2, 244-263
- Atkinson, A.* (1983): The Economics of Inequality, Second Edition, Oxford
- Atkinson, A.* (1992): Measuring inequality and differing social judgments, *RESEARCH ON ECONOMIC INEQUALITY* 3, 29-56
- Atkinson, A.* (1997): Bringing income distribution from the cold, *ECONOMIC JOURNAL* 107, 297-321
- Autor, D., L. Katz and A. Krueger* (1998): Computing inequality: have computers changed the labor market?, *QUARTERLY JOURNAL OF ECONOMICS* 113(4), 1169-1214
- Baier, S. and J. Bergstrand* (2001): The growth of world trade: tariffs, transport costs, and income similarity, *JOURNAL OF INTERNATIONAL ECONOMICS* 53(1), 1-27
- Baldwin, R. and G. Cain* (1997): Shifts in U.S. relative wages: the role of trade, technology and factor endowments, NBER Working Paper Series, Working Paper 5934, Cambridge
- Bauer, T.* (1997): Do immigrants reduce natives' wages? Evidence from Germany, *Münchener Wirtschaftswissenschaftliche Beiträge*, 97-05, München
- Beck, U.* (1996): Die Subpolitik der Globalisierung. Die neue Macht der multinationalen Unternehmen, *GEWERKSCHAFTLICHE MONATSFESTEN* 11-12, 673-679
- Becker, G.* (1965): A theory of the allocation of time, *ECONOMIC JOURNAL* 75(299), 492-517
- Becker, I.* (1996): Did earnings inequality in the Federal Republic of Germany increase from the 1960s to the 1980s?, *EVS-Projekt Arbeitspapier Nr. 8*, Frankfurt am Main
- Becker, I. und R. Hauser* (1995): Die Entwicklung der Einkommensverteilung in der Bundesrepublik Deutschland in den siebziger und achtziger Jahren, *KONJUNKTURPOLITIK* 41(4), 308-344

- Becker, I. und R. Hauser* (1998): Polarisierungstendenzen der Einkommensverteilung, in *Statistisches Bundesamt* [Ed.]: *Einkommen und Vermögen in Deutschland - Messung und Analyse*, Stuttgart
- Bedau, K.-D.* (1990): Die Entwicklung der Einkommensverteilung in der Bundesrepublik Deutschland (ohne neue Bundesländer) seit 1970 nach Einkommensarten und nach Haushaltsgruppen, *VIERTELJAHRESHEFTE ZUR WIRTSCHAFTSFORSCHUNG* 4, 295-309
- Benassy, J.-P.* (1993): Nonclearing markets: microeconomic concepts and macroeconomic policy, *JOURNAL OF ECONOMIC LITERATURE* 31, 732-761
- Berman, E., J. Bound and Z. Griliches* (1994): Changes in the demand for skilled labor within U.S. manufacturing industries: evidence from the Annual Survey of Manufactures, *QUARTERLY JOURNAL OF ECONOMICS* 109(2), 367-397
- Berman, E., J. Bound and S. Machin* (1998): Implications of skill-biased technological change: international evidence, *QUARTERLY JOURNAL OF ECONOMICS* 113(4), 1245-1280
- Bernard, A. and J. Jensen* (1997): Exporters, skill upgrading, and the wage gap, *JOURNAL OF INTERNATIONAL ECONOMICS* 42, 3-31
- Bishop, J. and J. Formby* (1994): A dominance evaluation of distributions of income and the benefits of economic growth, in *J. Bergstrand et al.* [Ed.]: *The Changing Distribution of Income in an Open U.S. Economy*, Amsterdam
- Bishop, J., J. Formby and W. Smith* (1991): Lorenz dominance and welfare: changes in the U.S. distribution of income, 1967-1986, *REVIEW OF ECONOMICS AND STATISTICS* 73, 134-139
- Blackburn, M., D. Bloom and R. Freeman* (1993): Changes in earnings differentials in the 1980s: concordance, convergence, causes, and consequences, in *D. Papadimitriou and E. Wolff* [Ed.]: *Poverty and Prosperity in the USA in the Late Twentieth Century*, London
- Blackorby, C. and R. Russell* (1989): Will the real elasticity of substitution please stand up?, *AMERICAN ECONOMIC REVIEW* 79(4), 882-888
- Blanchard, O. and L. Summers* (1988): Hysteresis and the European unemployment problem, in *R. Cross* [Ed.]: *Unemployment, Hysteresis & the Natural Rate Hypothesis*, Oxford
- Blank, R.* (1991): Why were poverty rates so high in the 1980s?, NBER Working Paper Series, Working Paper 3878, Cambridge
- Blank, R. and D. Card* (1994): Poverty, income distribution and growth: are they still connected?, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 2, 285-339
- Bonturi, M. and K. Fukasaku* (1993): Globalisation and intra-firm trade: an empirical note, *OECD ECONOMIC STUDIES* 20, 145-159
- Borjas, G.* (1994): The economics of immigration, *JOURNAL OF ECONOMIC LITERATURE* 32, 1667-1717
- Borjas, G., R. Freeman and L. Katz* (1992): On the labor market effects of immigration and trade, in *G. Borjas and R. Freeman* [Ed.]: *Immigration and the Workforce: Economic Consequences for the United States and Source Areas*, Chicago
- Borjas, G., R. Freeman and L. Katz* (1996): Searching for the effect of immigration on the labor market, *AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS* 86(2), 246-251

- Borjas, G. and V. Ramey* (1994): The relationship between wage inequality and international trade, in *J. Bergstrand et al.* [Ed.]: *The Changing Distribution of Income in an Open U.S. Economy*, Amsterdam
- Borsook, I.* (1987): Earnings, ability and international trade, *JOURNAL OF INTERNATIONAL ECONOMICS* 22(3/4), 281-295
- Bound, J. and G. Johnson* (1992): Changes in the structure of wages in the 1980's: an evaluation of alternative explanations, *AMERICAN ECONOMIC REVIEW* 82(3), 371-392
- Brainard, S.* (1993): An empirical assessment of the proximity-concentration tradeoff between multinational sales and trade, NBER Working Paper Series, Working Paper 4580, Cambridge
- Brainard, S. and D. Riker* (1997): U.S. multinationals and competition from low wage countries, NBER Working Paper Series, Working Paper 5959, Cambridge
- Brecher, R.* (1974): Minimum wage rates and the pure theory of international trade, *QUARTERLY JOURNAL OF ECONOMICS* 88(1), 98-116
- Brecher, R.* (1974): Optimal commercial policy for a minimum-wage economy, *JOURNAL OF INTERNATIONAL ECONOMICS* 4(2), 139-149
- Brown, C. and J. Medoff* (1989): The employer size-wage effect, *JOURNAL OF POLITICAL ECONOMY* 97(5), 1027-1059
- Brülhart, M.* (1999): Marginal intra-industry trade and trade-induced adjustment: a survey, in *M. Brülhart and R. Hine* [Ed.]: *Intra-Industry Trade and Adjustment. The European Experience*, Basingstoke
- Brülhart, M. and R. Elliott* (1999): A survey of intra-industry trade in the European Union, in *M. Brülhart and R. Hine* [Ed.]: *Intra-Industry Trade and Adjustment. The European Experience*, Basingstoke
- Buchinsky, M. and J. Hunt* (1999): Wage mobility in the United States, *REVIEW OF ECONOMICS AND STATISTICS* 81(3), 351-368
- Burkhauser, R., D. Holtz-Eakin and S. Rhody* (1997): Labor earnings mobility and inequality in the United States and Germany during the growth years of the 1980s, *INTERNATIONAL ECONOMIC REVIEW* 38(4), 775-794
- Burkhauser, R. and J. Poupore* (1997): A cross-national comparison of permanent inequality in the united states and germany, *REVIEW OF ECONOMICS AND STATISTICS* 79(1), 10-17
- Burkhauser, R., T. Smeeding and J. Merz* (1996): Relative inequality and poverty in Germany and the United States using alternative equivalence scales, *REVIEW OF INCOME AND WEALTH* 42(4), 381-400
- Buttler, F.* (1995): Bildungs- und Beschäftigungssystem: Parallelen, Widersprüche, Lösungsvorschläge, in *G. Kleinhenz* [Ed.]: *Soziale Ausgestaltung der Marktwirtschaft*, Berlin
- Cancian, M., S. Danziger and P. Gottschalk* (1993): The changing contributions of men and women to the level and distribution of family income, 1968-88, in *D. Papadimitriou and E. Wolff* [Ed.]: *Poverty and Prosperity in the USA in the Late Twentieth Century*, London
- Champernowne, D.* (1953): A model of income distribution, *ECONOMIC JOURNAL* 63, 318-351
- Champernowne, D. and F. Cowell* (1998): *Economic Inequality and Income Distribution*, Cambridge

- Clark, A. and A. Oswald* (1994): Unhappiness and unemployment, *ECONOMIC JOURNAL* 104, 648-659
- Cline, W.* (1997): Trade and Income Distribution, Washington
- Coe, D., E. Helpman and A. Hoffmaister* (1997): North-south R&D spillovers, *ECONOMIC JOURNAL* 107, 134-149
- Coleman, M.* (1993): Movement in the earnings-schooling relationship, *JOURNAL OF HUMAN RESOURCES* 28, 660-680
- Cooper, R.* (1994): Foreign trade, wages, and unemployment, Harvard Institute of Economic Research, Discussion Paper No. 1701, Cambridge
- Cowell, F.* (1980): Generalized entropy and the measurement of distributional change, *EUROPEAN ECONOMIC REVIEW* 13, 147-159
- Cowell, F.* (1995): Measuring Inequality, Second Edition, Hemel Hempstead
- Cutler, D. and L. Katz* (1991): Macroeconomic performance and the disadvantaged, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 2, 1-74
- Danziger, S. and M. Taussig* (1979): The income unit and the anatomy of income distribution, *REVIEW OF INCOME AND WEALTH* 25(4), 365-75
- Das, S.* (2000): Trade among similar countries and the personal distribution of income and wealth, *ECONOMICA* 67(266), 265-281
- Davis, D.* (1998): Technology, unemployment, and relative wages in a global economy, *EUROPEAN ECONOMIC REVIEW* 42, 1613-1633
- Davis, D. and T. Reeve* (1997): Human capital, unemployment, and relative wages in a global economy, NBER Working Paper Series, Working Paper 6133, Cambridge
- Davis, S.* (1992): Cross-country patterns of change in relative wages, in *O. Blanchard and S. Fischer* [Ed.]: NBER Macroeconomics Annual, Cambridge
- Davis, S. and J. Haltiwanger* (1991): Wage dispersion between and within U.S. manufacturing plants, 1963-86, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY, MICROECONOMICS*, 115-200
- Deardorff, A.* (1993): Overview of the Stolper-Samuelson theorem, in *A. Deardorff and R. Stern* [Ed.]: The Stolper-Samuelson Theorem: A Golden Jubilee, Ann Arbor
- Deardorff, A. and R. Staiger* (1988): An interpretation of the factor content of trade, *JOURNAL OF INTERNATIONAL ECONOMICS* 24, 93-107
- Deutsch, J. and J. Silber* (1999): Inequality decomposition by population subgroups and the analysis of interdistributional inequality, in *J. Silber* [Ed.]: Handbook on Income Inequality Measurement, Norwell
- DiNardo, J. and J.-S. Pischke* (1996): The returns to computer use revisited: have pencils changed the wage structure too?, NBER Working Paper Series, Working Paper 5606, Cambridge
- Dinopoulos, E. and P. Segerstrom* (1999): A Schumpeterian model of protection and relative wages, *AMERICAN ECONOMIC REVIEW* 89(3), 450-472
- Dixit, A. and V. Norman* (1980): Theory of International Trade, Welwyn
- Dornbusch, R.* (1992): The case for trade liberalization in developing countries, *JOURNAL OF ECONOMIC PERSPECTIVES* 6(1), 69-85
- Dornbusch, R., S. Fischer and P. Samuelson* (1980): The Heckscher-Ohlin trade model with a continuum of goods, *QUARTERLY JOURNAL OF ECONOMICS* 95(2), 203-224

- Dumke, R.* (1991): Income inequality and industrialization in Germany 1850-1913: the Kuznets hypothesis re-examined, in *Y. Brenner, H. Kaelble and M. Thomas* [Ed.]: *Income Distribution in Historical Perspective*, Cambridge
- Esping-Andersen, G.* (1990): *The Three Worlds of Welfare Capitalism*, Cambridge
- Ethier, W.* (1982): National and international returns to scale in the modern theory of international trade, *AMERICAN ECONOMIC REVIEW* 72(3), 389-405
- Ethier, W.* (1994): Multinational firms in the theory of international trade, in *E. Bacha* [Ed.]: *Economics in a Changing World, Vol. 4: Development, Trade and the Environment*, London
- Ethier, W. and H. Horn* (1991): Services in international trade, in *H. Helpman and A. Razin* [Ed.]: *International Trade and Trade Policy*, Cambridge
- Feenstra, R. and G. Hanson* (1996): Foreign investment, outsourcing, and relative wages, in *R. Feenstra et al.* [Ed.]: *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati*, Chicago
- Feenstra, R. and G. Hanson* (1997): Foreign direct investment and relative wages: evidence from Mexico's maquiladoras, *JOURNAL OF INTERNATIONAL ECONOMICS* 42, 371-393
- Feenstra, R. and G. Hanson* (1999): The impact of outsourcing and high-technology capital on wages: estimates for the United States, 1979-1990, *QUARTERLY JOURNAL OF ECONOMICS* 114(3), 907-940
- Findlay, R.* (1991): Wage Dispersion, international trade and the services sector, Columbia University, Discussion Paper Series No. 556, New York
- Findlay, R.* (1994): The philosophy of locational competition, Columbia University, Department of Economics Working Paper, No 700, New York
- Findlay, R. and H. Kierzkowski* (1983): International trade and human capital: a simple general equilibrium model, *JOURNAL OF POLITICAL ECONOMY* 91(6), 957-978
- Finger, M.* (1991): Development economics and the General Agreement on Tariffs and Trade, in *J. de Melo and A. Sapir* [Ed.]: *Trade Theory and Economic Reform. Essays in Honor of Bela Balassa*, Cambridge
- Fitzenberger, B.* (1997): Außenhandel, technischer Fortschritt und Arbeitsmarkt in Westdeutschland von 1975 bis 1990, *MITTEILUNGEN AUS DER ARBEITSMARKT UND BERUFSFORSCHUNG* 30(3), 642-651
- Fitzenberger, B.* (1999a): International trade and the skill structure of wages and employment in West Germany, *JAHRBÜCHER FÜR NATIONALÖKONOMIE UND STATISTIK* 219(1/2), 67-89
- Fitzenberger, B.* (1999b): Wages and Employment Across Skill Groups: an Analysis for West Germany, Heidelberg
- Fitzenberger, B. und W. Franz* (1997): Flexibilität der qualifikatorischen Lohnstruktur und Lastverteilung der Arbeitslosigkeit: Eine ökonometrische Analyse für Westdeutschland, Centre for European Economic Research, Discussion Paper No. 97-32, Mannheim
- Flug, K. and O. Galor* (1986): Minimum wage in a general equilibrium model of international trade and human capital, *INTERNATIONAL ECONOMIC REVIEW* 27(1), 149-164
- Fortin, N. and T. Lemieux* (1997): Institutional changes and rising wage inequality: is there a linkage?, *JOURNAL OF ECONOMIC PERSPECTIVES* 11(2), 75-96
- Freeman, R.* (1991): How much has de-unionization contributed to the rise in male earnings inequality?, NBER Working Paper Series, No. 3826, Cambridge

- Freeman, R.* (1995): Are your wages set in Beijing?, *JOURNAL OF ECONOMIC PERSPECTIVES* 9(3), 15-32
- Freeman, R.* (1996): The minimum wage as a redistributive tool, *ECONOMIC JOURNAL* 106, 639-649
- Freeman, R.* (1996): Why do so many young American men commit crimes and what might we do about it?, NBER Working Paper Series, Working Paper 5451, Cambridge
- Gerlach, K. und E. Schmidt* (1989): Unternehmensgröße und Entlohnung, *MITTEILUNGEN AUS DER ARBEITSMARKT- UND BERUFSFORSCHUNG* 22(3), 355-373
- Giddens, A.* (1994): Beyond Left and Right. The Future of Radical Politics, Cambridge
- Giles, C. et al.* (1998): The Distribution of Income and Wages in the UK and West Germany, 1984-92, London
- Goldin, C. and L. Katz* (1996): Technology, skill, and the wage structure: insights from the past, *AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS* 86(2), 252-257
- Goldin, C. and L. Katz* (1998): The origins of technology-skill complementarity, *QUARTERLY JOURNAL OF ECONOMICS* 113(3), 693-732
- Goldsmith, A., J. Veum and W. Darity* (1996): The psychological impact of unemployment and joblessness, *JOURNAL OF SOCIO-ECONOMICS* 25(3), 333-358
- Gosling, A. and S. Machin* (1995): Trade unions and the dispersion of earnings in British establishments, 1980-90, *OXFORD BULLETIN OF ECONOMICS AND STATISTICS* 57(2), 167-184
- Gottschalk, P. and M. Joyce* (1995): The impact of technological change, deindustrialization, and internationalization of trade on earnings inequality: an international perspective, in *R. Lawson, K. McFate and W. Wilson* [Ed.]: Poverty, Inequality, and the Future of Social Policy. Western States in the New World Order, New York
- Gottschalk, P. and M. Joyce* (1998): Cross-national differences in the rise in earnings inequality: market and institutional factors, *REVIEW OF ECONOMICS AND STATISTICS* 80(4), 489-502
- Gottschalk, P. and R. Moffitt* (1994): The growth of earnings instability in the U.S. labor market, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 2, 217-272
- Gottschalk, P. and T. Smeeding* (1997): Cross-national comparisons of earnings and income inequality, *JOURNAL OF ECONOMIC LITERATURE* 35, 633-687
- Greenwood, Michael J., Gary L. Hunt and Ulrich Kohli* (1997): The factor-market consequences of unskilled immigration to the United States, *LABOUR ECONOMICS* 4, 1-28
- Griliches, Z.* (1969): Capital-skill complementarity, *REVIEW OF ECONOMICS AND STATISTICS* 51, 465-468
- Grossman, G. and E. Helpman* (1995): Technology and trade, in *G. Grossman and K. Rogoff* [Ed.]: Handbook of International Economics, Amsterdam
- Grund, C.* (1998): Zur Verteilung der Arbeitseinkommen in Westdeutschland, *VIERTELJAHRESHEFT ZUR WIRTSCHAFTSFORSCHUNG* 67(1), 30-39
- Hagel, J.* (1993): Effizienz und Gerechtigkeit: Ein Beitrag zur Diskussion der ethischen Aspekte in der neoklassischen Wohlfahrtstheorie, Baden-Baden
- Hagen, A.* (1997): Deutsche Direktinvestitionen in Großbritannien, 1871-1918, Stuttgart
- Hagenaars, A., K. de Vos and M. Zaidi* (1995): Armutsstatistik Ende der 80er Jahre. Untersuchung auf der Basis von Mikrodaten, Brüssel, Luxemburg

- Hamermesh, D.* (1993): Labour Demand, New York
- Hanesch, W., R. Martens, U. Schneider und M. Wißkirchen* (1995): 'Armut im Umbruch' im vereinten Deutschland, in *W. Hanesch* [Ed.]: Sozialpolitische Strategien gegen Armut, Opladen
- Hanratty, M. and R. Blank* (1992): Down and out in North America: recent trends in poverty rates in the United States and Canada, *QUARTERLY JOURNAL OF ECONOMICS* 107(1), 233-254
- Harrigan, J.* (1998): International trade and american wages in general equilibrium, 1967-1995, NBER Working Paper Series, Working Paper 6609, Cambridge
- Harris, R.* (1993): Globalization, trade, and income, *CANADIAN JOURNAL OF ECONOMICS* 26(4), 755-776
- Hauser, R.* (1997): Armut, Armutsgefährdung und Armutsbekämpfung in der Bundesrepublik Deutschland, *JAHRBÜCHER FÜR NATIONALÖKONOMIE UND STATISTIK* 216 (4+5), 524-548
- Hauser, R. und G. Wagner* (1997): Die Einkommensverteilung in Ostdeutschland: Darstellung der Determinanten im Vergleich zu Westdeutschland für die Jahre 1990 bis 1994, in *W. Glatzer und G. Kleinhenz* [Ed.]: Wohlstand für alle?, Opladen
- Helpman, E.* (1984): A simple theory of international trade with multinational corporations, *JOURNAL OF POLITICAL ECONOMY* 92(3), 451-471
- Henkel, H.-O.* (1996): Zur Rolle Deutschlands in Europa – Perspektiven der deutschen und europäischen Wettbewerbsfähigkeit, Festvortrag anlässlich des 10jährigen Jubiläums der Deutsch-Norwegischen Industrie- und Handelskammer 23. Mai 1996 Oslo, Mimeo, Köln
- Henschel, R.* (1987): Einflüsse öffentlicher Meinungsbildung auf die Einkommensverteilung, *IFO-STUDIEN* 33(1-4), 1-26
- Howell, D. and E. Wolff* (1991): Trends in the growth and distribution of skills in the U.S. workplace, 1960-85, *INDUSTRIAL AND LABOR RELATIONS REVIEW* 44(3), 486-502
- Huang, T.-L., A. Hallam, P. Orazem and E. Paterno* (1998): Empirical tests of efficiency wage models, *ECONOMICA* 65(257), 125-144
- Hummels, D., D. Rapoport and K.-M. Yi* (1998): Vertical specialization and the changing nature of world trade, *ECONOMIC POLICY REVIEW* 4(2), 79-99
- Jenkins, S.* (1994): The within-household distribution and why it matters: an economist's perspective, in *C. Badelt* [Ed.]: Familien zwischen Gerechtigkeitsidealen und Benachteiligungen, Wien
- Jenkins, S.* (1995a): Accounting for inequality trends: decomposition analysis for the U.K., 1971-86, *ECONOMICA* 62(245), 29-63
- Jenkins, S.* (1995b): Did the middle class shrink during the 1980s? UK evidence from kernel density estimates, *ECONOMICS LETTERS* 49, 407-413
- Johnson, D. and S. Shipp* (1997): Trends in inequality using consumption-expenditures: the U.S. from 1960 to 1993, *REVIEW OF INCOME AND WEALTH* 43(2), 133-152
- Johnson, P. and S. Webb* (1993): Explaining the growth in UK income inequality, *ECONOMIC JOURNAL* 103, 429-443
- Jones, R.* (1965): The structure of simple general equilibrium models, *JOURNAL OF POLITICAL ECONOMY* 73, 557-572
- Jones, R. and J. Scheinkman* (1977): The relevance of the two-sector production model in trade theory, *JOURNAL OF POLITICAL ECONOMY* 85(5), 909-935

- Juhn, C. and K. Murphy* (1997): Wage inequality and family labor supply, *JOURNAL OF LABOR ECONOMICS* 15(1), 72-97
- Juhn, C., K. Murphy and B. Pierce* (1993): Wage inequality and the rise in returns to skill, *JOURNAL OF POLITICAL ECONOMY* 101(3), 410-442
- Kaiser, U.* (2001): The impact of foreign competition and new technologies on the demand for heterogeneous labor, *REVIEW OF INDUSTRIAL ORGANIZATION* 19, 109-120
- Kapstein, E.* (1996): Workers and the world economy, *FOREIGN AFFAIRS* 75(3), 16-37
- Karoly, L.* (1993): The trend in inequality among families, individuals and workers in the United States: a twenty-five year perspective, in *S. Danziger and P. Gottschalk* [Ed.]: *Uneven Tides: Rising Inequality in America*, New York
- Karoly, L. and G. Burtless* (1995): Demographic change, rising earnings inequality and the distribution of personal well-being, 1959-1989, *DEMOGRAPHY* 32(3), 379-405
- Katz, L. and K. Murphy* (1992): Changes in relative wages 1963-1987: supply and demand factors, *QUARTERLY JOURNAL OF ECONOMICS* 107(1), 35-78
- Katz, L. and A. Revenga* (1989): Changes in the structure of wages: the United States vs Japan, *JOURNAL OF THE JAPANESE AND INTERNATIONAL ECONOMIES* 3, 522-553
- Kohli, U.* (1991): *Technology, Duality and Foreign Trade: The GNP Function Approach to Modeling Imports and Exports*, Ann Arbor
- Kohli, U.* (1993): US technology and the specific-factors model, *JOURNAL OF INTERNATIONAL ECONOMICS* 34(1/2), 115-136
- Kösters, W. und A. Belke* (1992): Arbeitslosigkeit in Westeuropa - Ein Hysteresis-Phänomen?, in *E. Kantzenbach und O. Mayer* [Ed.]: *Beschäftigungspolitik und Arbeitsmarktpolitik*, 219, Berlin
- Krämer, H.* (1996): *Bowley's Law, Technischer Fortschritt und Einkommensverteilung*, Marburg
- Krueger, A.* (1993): How computers have changed the wage structure: evidence from microdata, 1984-1989, *THE QUARTERLY JOURNAL OF ECONOMICS* 108, 33-60
- Krueger, A.* (1997): Labor market shifts and the price puzzle revisited, NBER Working Paper Series, Working Paper 5924, Cambridge
- Krugman, P.* (1993): What do undergraduates need to know about trade, *AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS* 83, 23-26
- Krugman, P.* (1995): Growing world trade: causes and consequences, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 1, 327-362
- Kuznets, S.* (1955): Economic growth and income inequality, *AMERICAN ECONOMIC REVIEW* 45(1), 1-28
- Lawrence, R.* (1994): Trade, multinationals, & labor, NBER Working Paper Series, Working Paper 4836, Cambridge
- Lawrence, R.* (1997): *Single World, Divided Nations? International Trade and OECD Labor Markets*, Paris
- Lawrence, R. and M. Slaughter* (1993): International trade and American wages in the 1980s: giant sucking sound or small hiccup?, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 2, 161-226
- Leamer, E.* (1993): Wage effects of a U.S.-Mexican free trade agreement, in *P. Garber* [Ed.]: *The Mexico-U.S. Free Trade Agreement*, Cambridge
- Leamer, E.* (1994): Trade, wages and revolving door ideas, NBER Working Paper Series, Working Paper 4716, Cambridge

- Leamer, E.* (1996a): In search of Stolper-Samuelson effects on U.S. wages, NBER Working Paper Series, Working Paper 5427, Cambridge
- Leamer, E.* (1996b): Wage inequality from international competition and technological change, theory and country experience, *AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS* 86(2), 309-314
- Leamer, E. and J. Levinsohn* (1995): International trade theory: the evidence, in *G. Grossman and K. Rogoff* [Ed.]: *Handbook of International Economics*, Vol. 3, Amsterdam
- Lee, D.* (1999): Wage inequality in the United States during the 1980s: rising dispersion or falling minimum wage?, *QUARTERLY JOURNAL OF ECONOMICS* 114(3), 977-1023
- Lerman, R. and S. Yitzhaki* (1985): Income inequality effects by income source: a new approach and applications to the United States, *REVIEW OF ECONOMICS AND STATISTICS* 67(1), 151-156
- Levitan, S., F. Gallo and I. Shapiro* (1993): *Working but Poor: America's Contradiction*, Baltimore
- Levy, F.* (1995): Incomes and income inequality, in *R. Farley* [Ed.]: *State of the Union: America in the 1990s*, Volume 1: Economic trends, New York
- Levy, F. and R. Murnane* (1992): U.S. earnings levels and earnings inequality: a review of recent trends and proposed explanations, *JOURNAL OF ECONOMIC LITERATURE* 30(3), 1333-1381
- Lewis, A.* (1981): The role of growth of world trade, 1830-1973, in *S. Grassman and E. Lundberg* [Ed.]: *The World Economic Order: Past and Prospects*, London
- Lindbeck, A.* (1988): Individual freedom and welfare state policy, *EUROPEAN ECONOMIC REVIEW* 32(2/3), 295-318
- Lloyd, P. and A. Schweinberger* (1997): Conflict generating product price changes: the imputed output approach, *EUROPEAN ECONOMIC REVIEW* 41(8), 1569-1587
- Ludwig-Mayerhofer, W.* (1992): Arbeitslosigkeit, Erwerbsarbeit und Armut, *SONDERHEFT DER KÖLNER ZEITSCHRIFT FR SOZIOLOGIE UND SOZIALPSYCHOLOGIE, ARMUT IM MODERNEN WOHLFAHRTSSTAAT* 33), 378-402
- Lücke, M.* (1997): European trade with lower-income countries and the relative wages of the unskilled - an explanatory analysis for West Germany and the UK, Working Paper, Kiel Institute of World Economics, 819, Kiel
- Machin, S. and J. van Reenen* (1998): Technology and changes in skill structure: evidence from seven OECD countries, *QUARTERLY JOURNAL OF ECONOMICS* 113(4), 1215-1244
- Markusen, J.* (1995): The boundaries of multinational enterprises and the theory of international trade, *JOURNAL OF ECONOMIC PERSPECTIVES* 9(2), 169-189
- Mayer, S. and C. Jencks* (1993): Recent trends in income inequality in the United States: income versus expenditures versus material well-being, in *D. Papadimitriou and E. Wolff* [Ed.]: *Poverty and Prosperity in the USA in the Late Twentieth Century*, London
- Matusz, S.* (1996): International trade, the division of labor, and unemployment, *INTERNATIONAL ECONOMIC REVIEW* 37(1), 71-84
- Mavromaras, K. und H. Rudolph* (1998): Verteilungseffekte der Arbeitslosenversicherung in Deutschland in den 80er Jahren, *MITTEILUNGEN AUS DER ARBEITSMARKT- UND BERUFSFORSCHUNG* 31, 93-107

- Möller, J. und L. Bellmann* (1996): Qualifikations- und industriespezifische Lohnunterschiede in der Bundesrepublik Deutschland, IFO STUDIEN 42, 235-272
- Möller, J.* (1998): Die Entwicklung der Lohnungleichheit in Deutschland, in *Statistisches Bundesamt* [Ed.]: Einkommen und Vermögen in Deutschland - Messung und Analyse, Stuttgart
- Möller, J.* (1999): Die Entwicklung der qualifikatorischen Lohn- und Beschäftigungsstruktur in Deutschland, JAHRBÜCHER FÜR NATIONALÖKONOMIE UND STATISTIK 219(1/2), 8-31
- Mohr, R. and V. Steiner* (1998): Industrial Change, Stability of Relative Earnings, and Substitution of Unskilled Labour in West-Germany, Discussion Paper, Centre for European Economic Research (ZEW), 22, Mannheim
- Molina, D. and S. Cobb* (1992): The effect of maquiladoras on income distribution on the Texas-Mexican border, RESEARCH ON ECONOMIC INEQUALITY 2, 169-181
- Mundell, R.* (1968): International Economics, New York
- Murphy, K. and F. Welch* (1991): The role of international trade in wage differentials, in *M. Koster* [Ed.]: Workers and their Wages: Changing Patterns in the United States, Washington, D.C.
- Murphy, K. and F. Welch* (1992): The structure of wages, QUARTERLY JOURNAL OF ECONOMICS 107, 285-326
- Murphy, K. and F. Welch* (1993): Industrial change and the rising importance of skill, in *S. Danziger and P. Gottschalk* [Ed.]: Uneven Tides: Rising Inequality in America, New York
- Murshed, S.* (1997): Does trade with the South disadvantage unskilled workers in the North?, in *S. Gupta* [Ed.]: The Political Economy of Globalization, Boston
- Neary, J. and A. Schweinberger* (1986): Factor content functions and the theory of international trade, REVIEW OF ECONOMIC STUDIES 53, 421-432
- Nelson, C.* (1994): Levels of and changes in the distribution of U.S. income, in *J. Bergstrand et al.* [Ed.]: The Changing Distribution of Income in an Open U.S. Economy, Amsterdam
- Nelson, Richard R. and Gavin Wright* (1992): The rise and fall of American technological leadership: the postwar era in historical perspective, JOURNAL OF ECONOMIC LITERATURE 30, 1931-1964
- Nickell, S. and B. Bell* (1995): The collapse in demand for the unskilled and unemployment across the OECD, OXFORD REVIEW OF ECONOMIC POLICY 11(1), 40-62
- Nickell, S. and B. Bell* (1996): Changes in the distribution of wages and unemployment in the OECD countries, AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS 86(2), 302-308
- Nielsen, F. and A. Alderson* (1997): The Kuznets curve and the great U-turn: income inequality in U.S. counties, 1970 to 1990, AMERICAN SOCIOLOGICAL REVIEW 62(1), 12-33
- O'Connor, I. and T. Smeeding* (1993): Working but poor: a cross-national comparison of earnings adequacy, LIS Working Paper 94, Luxembourg
- OECD* (1962): Wirtschaftswachstum und Ausbau des Erziehungswesens: OECD-Konferenz in Washington, 16.-20. Oktober 1961: Deutsche Kurzfassung der Arbeitsunterlagen, Bonn
- OECD* (1973): Bildungswesen: mangelhaft. BRD-Bildungspolitik im OECD Länderexamen, Frankfurt am Main

- OECD* [Ed.] (volumes a): Economic Outlook, Paris
- OECD* [Ed.] (volumes b): Employment Outlook, Paris
- OECD* (1993): Intra-Firm Trade, Paris
- OECD* (1996): Globalization of Industry. Overview and Sector Reports, Paris
- Peter, G.* (1998): Gesetzlicher Mindestlohn für die Bundesrepublik?, *GEWERKSCHAFTLICHE MONATSFESTEN* 2, 90-97
- Phelps, E.* (1994): Structural Slumps. The Modern Equilibrium Theory of Unemployment, Interest, and Assets, Cambridge, Massachusetts
- Pierce, B. and F. Welch* (1994): Dimensions of inequality in labor income, in *J. Bergstrand et al.* [Ed.]: The Changing Distribution of Income in an Open U.S. Economy, Amsterdam
- Prebisch, R.* (1959): Commercial policy in the underdeveloped countries, *AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS* 49, 251-273
- Pritchett, L.* (1996): Measuring outward orientation LDCs: can it be done?, *JOURNAL OF DEVELOPMENT ECONOMICS* 49, 307-335
- Pyatt, G.* (1976): On the interpretation and disaggregation of Gini coefficients, *ECONOMIC JOURNAL* 86(342), 243-255
- Ramser, H.* (1987): Verteilungstheorie, Berlin
- Reinberg, A.* (1999): Der qualifikatorische Strukturwandel auf dem deutschen Arbeitsmarkt - Entwicklungen, Perspektiven und Bestimmungsgründe, *MITTEILUNGEN AUS DER ARBEITSMARKT- UND BERUFSFORSCHUNG* 32(4), 434-447
- Revenga, A.* (1992): Exporting jobs: the impact of import competition on employment and wages in US manufacturing, *QUARTERLY JOURNAL OF ECONOMICS* 107(1), 255-284
- Richardson, J.* (1995): Income inequality and trade: how to think, what to conclude, *JOURNAL OF ECONOMIC PERSPECTIVES* 9(3), 33-55
- Rodrik, D.* (1992): The rush to free trade in the developing world: why so late? Why now? Will it last?, NBER Working Paper Series, Working Paper 3947, Cambridge
- Rothschild, K.* (1993): Inequality: is income distribution an adequate measure?, in *K. Rothschild* [Ed.]: Employment, Wages and Income Distribution, New York
- Rybczynski, T.* (1955): Factor endowments and relative commodity prices, *ECONOMICA* 22, 336-341
- Ryscavage, P. and P. Henle* (1990): Earnings inequality accelerates in the 1980's, *MONTHLY LABOR REVIEW* 116, 3-16
- Sachs, J. and H. Shatz* (1994): Trade and jobs in U.S. manufacturing, *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 1, 1-84
- Schäfer, C.* (1995): Soziale Polarisierung bei Einkommen und Vermögen. Zur Entwicklung der Verteilung 1994, *WSI-MITTEILUNGEN* 10, 605-633
- Scharpf, F.* (1992): Die Handlungsfähigkeit des Staates am Ende des Zwanzigsten Jahrhunderts, in *B. Kohler-Koch* [Ed.]: Staat und Demokratie in Europa, Opladen
- Schmid, F.* (1992): Einkommensdisparität der privaten Haushalte in der Bundesrepublik Deutschland 1950-1988. Einige Ergebnisse der Auswertung von Daten des DIW, *VIERTELJAHRESHEFTE ZUR WIRTSCHAFTSFORSCHUNG* 3/4, 138-146
- Schmidt, C. and K. Zimmermann* (1991): Work characteristics, firm size and wages, *REVIEW OF ECONOMICS AND STATISTICS* 73, 705-710

- Schröter, H.* (1993): Aufstieg der Kleinen. Multinationale Unternehmen aus fünf kleinen Staaten vor 1914, Berlin
- Schwarze, J.* (1996): Der Einfluß von Einkommensunsicherheit auf die individuelle Wohlfahrt - eine Panelanalyse mit subjektiven und objektiven Indikatoren, in *J. Schupp, R. Habich und W. Zapf* [Ed.]: Lebenslagen im Wandel: Sozialberichterstattung im Längsschnitt, Frankfurt am Main
- Schwarze, J.* (1996): How income inequality changed in Germany following reunification: an empirical analysis using decomposable inequality Measures, *REVIEW OF INCOME AND WEALTH* 42(1), 1-11
- Schweinberger, A.* (1978): Employment Subsidies and the Theory of Minimum Wage Rates in General Equilibrium, *QUARTERLY JOURNAL OF ECONOMICS* 92(3), 361-374
- Schweinberger, A. G.* (1995): Factor market distortions, the gains from trade and comparative advantage, *SWISS JOURNAL OF ECONOMICS AND STATISTICS* 131(3), 361-376
- Sen, A.* (1997): Inequality, unemployment and contemporary Europe, London School of Economics and Political Science, The Development Economics Research Programme, No. 7, London
- Gener, F.* (2001): Schumpeterian unemployment, trade and wages, *JOURNAL OF INTERNATIONAL ECONOMICS* 54, 119-148
- Shapiro, C. and J. Stiglitz* (1984): Equilibrium unemployment as a worker discipline device, *AMERICAN ECONOMIC REVIEW* 74(3), 433-444
- Shorrocks, A.* (1982): Inequality decomposition by factor components, *ECONOMETRICA* 50(1), 193-211
- Siebert, H.* (1996): On the concept of locational competition, Kiel Working Paper No. 731, Kiel
- Siebert, H.* (1997): Disziplinierung der nationalen Wirtschaftspolitik durch die internationale Kapitalmobilität, Kiel Working Paper No. 832, Kiel
- Simons, H.* (1938): Personal Income Taxation, Chicago
- Singer, H.* (1950): The distribution of gains between investing and borrowing countries, *AMERICAN ECONOMIC REVIEW, PAPERS AND PROCEEDINGS* 40, 473-485
- Slaughter, M.* (1995): Multinational corporations, outsourcing, and American wage divergence, NBER Working Paper Series, Working Paper 5253, Cambridge
- Slaughter, M.* (2000): Production transfer within multinational enterprises and American wages, *JOURNAL OF INTERNATIONAL ECONOMICS* 50(2), 449-472
- Smeeding, T. and G. Schmaus* (1990): The LIS database: technical and methodological aspects, in *T. Smeeding, L. Rainwater and M. O'Higgins* [Ed.]: Poverty, Inequality and Income Distribution in Comparative Perspective, Hemel Hempstead
- Steiner, V. und K. Wagner* (1998): Has earnings inequality in Germany changed in the 1980's?, *ZEITSCHRIFT FÜR WIRTSCHAFTS- UND SOZIALWISSENSCHAFTEN* 118(1), 29-59
- Tessaring, M.* (1994): Langfristige Tendenzen des Arbeitskräftebedarfs nach Tätigkeiten und Qualifikationen in den alten Bundesländern bis zum Jahre 2010, *MITTEILUNGEN AUS DER ARBEITSMARKT- UND BERUFSFORSCHUNG* 1, 5-19
- Thompson, H.* (1997): Free trade and income redistribution across labor groups: comparative statics for the U.S. economy, *INTERNATIONAL REVIEW OF ECONOMICS AND FINANCE* 6(2), 181-192

- Trede, M.* (1998): Making mobility visible: a graphical device, *ECONOMICS LETTERS* 59(1), 77-82
- UNCTAD* (2000): World Investment Report. Cross-border Mergers and Acquisitions and Development, New York
- United Nations* [Ed.] (1999): Information Systems Architecture for National and International Statistical Offices: Guidelines and Recommendations, Geneva
- U.S. Census Bureau*: Current Population Reports, Series P60-204, Washington D.C.
- van der Gaag, J. and E. Smolensky* (1982): True household equivalence scales and characteristics of the poor in the United States, *REVIEW OF INCOME AND WEALTH* 28(1), 17-28
- Wagner, J.* (1991): Sektorlohndifferentiale in der Bundesrepublik Deutschland. Empirische Befunde und ökonometrische Analysen zur theoretischen Erklärung, *JAHRBUCH FÜR SOZIALWISSENSCHAFT* 42, 70-102
- Whitman, G.* (1996): Myth, measurement, and the minimum wage: sound and fury signifying what?, *CRITICAL REVIEW* 10(4), 607-619
- Wilkins, M.* (1988): The free-standing company, 1870-1914: an important type of British foreign direct investment, *ECONOMIC HISTORY REVIEW* 41, 259-282
- Williamson, J.* (1996): Globalization, convergence, and history, *JOURNAL OF ECONOMIC HISTORY* 56(2), 277-306
- Williamson, J.* (1998): Globalization, labor markets and policy backlash in the past, *JOURNAL OF ECONOMIC PERSPECTIVES* 12(4), 51-72
- Willis, R.* (1986): Wage determinants: a survey and reinterpretation of human capital earnings functions, in *O. Ashenfelter and R. Layard* [Ed.]: Handbook of Labor Economics, Volume 1, Amsterdam
- Winkelmann, L. and R. Winkelmann* (1995): Happiness and unemployment: a panel data analysis for Germany, *KONJUNKTURPOLITIK* 41(5), 293-307
- Winkelmann, L. and R. Winkelmann* (1998): Why are the unemployed so unhappy? Evidence from panel data, *ECONOMICA* 65(257), 1-16
- Wolfson, M.* (1997): Divergent inequalities: theory and empirical results, *REVIEW OF INCOME AND WEALTH* 43(4), 401-421
- Wood, A.* (1994): North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World, Oxford
- Wright, G.* (1997): Towards a more historical approach to technological change, *ECONOMIC JOURNAL* 107(444), 1559-1566
- WTO* (2000): International Trade Statistics 2000, Geneva