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Zusammenfassung:

In this paper I develop a theoretical model explaining optimal wage-tenure profiles for heterogeneous labor. My findings entail that high productive people have steeper profiles than low productive individuals. I find strong empirical evidence for these findings. At the end of my paper, I utilize the basic model to describe the labor market entry of college graduates.

JEL Klassifikation : J31, J44, I21

Schlüsselwörter : Wages, Seniority, Educational decisions

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Are US wages really determined by European Labor–Market Institutions?

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Abstract

This paper integrates institutionally determined wage rigidities into an otherwise standard Heckscher–Ohlin model of international trade. It accounts for individual heterogeneities with respect to innate abilities and analyzes their implications for individual wage incomes and for individual decisions about acquiring education. The model provides a foundation for the conjectures the development of wages and unemployment rates derived from comparative cross country studies that do not consistently account for the global general equilibrium links affecting factor prices. It does not support the view that global equilibrium links cause US wages to be determined by European wage rigidities or insulate the US economy from exogenous labor–supply shocks.

JEL Classification F11, J31

Keywords wage rigidities, international trade, education, skill–specific unemployment

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1 Introduction

Trade theorists still favor the classical Heckscher–Ohlin (HO) model as the appropriate framework for the analysis of the effects of increased international market integration on the national resource allocation. Especially in the recent debate about the impact of globalization on the development of wage inequality, analyses based on the HO model play a prominent role (cf. Wood, 1998, for an overview). One central argument in this literature is that the integration of newly industrialized countries into the system of world markets for goods and factors causes adjustments in the production structure of industrialized countries in such a way that sectors using skilled labor intensively should expand relative to sectors using unskilled labor intensively. As a result of the corresponding change in relative labor demand, we should observe considerable rise in wage inequality in countries with flexible wage rates (like America and the UK), while wage inequality should rise considerable less in countries with wage rigidities (like the European countries Germany, France, Italy and Spain) at cost of increased unskilled unemployment.

This “two sides of the same coin” hypothesis (cf. Krugman, 1995) has been challenged by Davis (1998) as being inconsistent with a global general–equilibrium approach. Davis argues that the simultaneous determination of equilibrium in all national factor markets provides results that differ fundamentally from those comparative (cross country) studies based on separate applications of the HO model’s logic to the different regimes of wage flexibility. Specifically, the global–equilibrium approach proposed by Davis provides some surprising results about the relation between global equilibrium effects working through integrated goods markets and national labor market performance. According to his argument, labor–market rigidities in Europe have two striking implications on American labor markets. First, European minimum wages completely determine American wages. Second, European wage rigidities wholly insulate American labor markets from specific exogenous shocks such as the immigration of unskilled labor from developing countries into American labor markets. Both result seem hard to swallow. Are American wages really determined exclusively by European labor–market rigidities?¹ Does the immigration of unskilled Mexicans into the

¹There seems to be some irritation about where on the world US wages are determined. According to Davis, they are determined by European institutions (minimum wages, unions, etc.). On the other extreme, Freeman (1995) asks whether US wages are set in Beijing. One may

US really have no effect on American wages, while at the same time it drives up European unemployment rates? With respect to the latter question, most economists would presumably agree on the opposite, namely that Mexican immigration into the US should drive down US wage and have at best little effect on European unemployment.

Davis results radically differ from that of former comparative studies because of one special feature that applies to his specific setting. In his two-factor, two-sector framework, an exogenously given national wage in one part of the world determines *all prices* for goods and factors all over the world. Therefore, adjustment to exogenous shocks must be accomplished by adjustments of production quantities that are consistent with the fixed prices. Since the only degree of freedom within this model is unskilled unemployment in Europe, all global excess demands are compensated at given prices by adjustment of this rate of unemployment.

The present paper argues that Davis' insulation hypothesis is not the inevitable outcome of wage rigidities in a HO-type model. We extend Davis' approach by allowing individuals with heterogeneous investment incentives (originating in differences in individual abilities) to acquire education thus endogenizing relative labor supply. Our model allows both for wage incomes to differ between skilled and unskilled labor and within each group of labor. When introducing a minimum-wage-income constraint into such a framework, a fraction of the unskilled become unproductive and therefore will not be employed. Wage incomes of employed workers, however, are not directly affected by the minimum wage. As a result, the present model preserves the results from the standard HO model in a qualitative sense, and it extends them for unemployment effects. Specifically, goods prices are determined by clearing of global goods markets, and factor prices are determined by goods prices as long as economies diversify in production. The minimum-wage-income constraint turns out to be a binding constraint for actually paid wage incomes, but it does not completely determine factor prices.

The paper proceeds as follows. Section 2 recapitulates the central argument of Davis' model which will be called "insulation hypothesis". Section 3 analyzes the effect of global market integration in a model with endogenous educational

wonder whether nowadays even US labor-market forces have lost control over US labor-market outcomes.

decisions of heterogeneous agents. The model is applied to analyze the effect of immigration in section 4. Section 5 concludes.

2 The insulation thesis

We briefly discuss the insulation thesis within the HO-type framework proposed by Davis. Davis considers two countries—Europe and America—sharing identical constant-returns-to-scale production technologies. Each country produces two goods (X and Y) that are freely traded. Production uses two types of labor inputs, unskilled and skilled labor. Both factors assumed to be indispensable in production. Factor supplies are assumed to be exogenously given in each country. The key difference between Europe and America is in terms of labor-market flexibility. Whereas the US market for unskilled labor is characterized by perfect wage flexibility, the unskilled in Europe are due to wage rigidities (caused by, e.g., unions or explicit minimum wages). The market for skilled labor is assumed to be perfectly competitive in both countries. Finally, consumer preferences are assumed to be homothetic and identical in both countries, with both goods being essential in consumption.

The basic argument can be stated by looking at the production side of an economy. Assume that at any common factor prices, good X is skill intensive relative to Y . Denote the return to unskilled labor by w , the return to skill by r , and normalize prices according to $p_X \equiv p$ and $p_Y \equiv 1$. Competitive cost conditions then ensure that for each active sector price equals unit costs:

$$p = c_X(w, r), \quad 1 = c_Y(w, r). \quad (1)$$

With fully flexible wages and a fully diversified production structure, the zero-profit conditions (??) determine factor prices (w, r) solely as a function of the terms of trade p . With wage rigidities, however, the path of determination is different. For competitive firms in both sectors to pay a minimum wage \bar{w} , this wage rate must be supported by an appropriate goods price \bar{p} . Otherwise factor payments either exceed revenues in the labor-intensive sector for any positive output $Y > 0$ (in the case of $p > \bar{p}$), or the minimum-wage rate is not a binding constraint (in the case of $p < \bar{p}$). A global equilibrium featuring (i) diversified production in both Europe and America and (ii) a binding minimum wage in

Europe then implies that the terms of trade are uniquely determined by Europe's minimum wage. With perfectly competitive US labor markets, American wages are then also determined by Europe's minimum wage rate. In other words, American wages are fully determined by European labor-market institutions.

Factor endowments only enter the above argument as far as they set the limits of a fully diversified production structure. Under diversification, however, factor prices are completely independent of factor endowments. As a result, Europe's commitment to high wages wholly insulates the American economy from exogenous shock in world factor supplies as long as (i) the minimum wage is a binding constraint in Europe both before and after the shock and (ii) Europe and the US remain fully diversified after the shock. The reason is that to support a given minimum wage \bar{w} under full diversification, the unique equilibrium price is \bar{p} . Any sectoral adjustment altering the US relative supply of goods that is caused by exogenous shocks in world factor supplies must then be exactly compensated by sectoral adjustment in Europe in order to support \bar{p} . Due to the homothetic consumer preferences, this requires that the European production structure adjust in such a way to keep the world relative supply constant. The sole degree of freedom allowing for the required sectoral adjustments is the (un)employment of unskilled labor. In particular, immigration of unskilled labor from third countries into the US economy is exactly compensated by an identical increase in unemployment in Europe.

3 The model

The present approach reconciles the common view on wage determination and the global general-equilibrium analysis favored by trade theorists. We will develop a model that allows for integration of institutionally caused wage rigidities into an otherwise standard HO-type model of international trade that does not generate implausible results about international wage determination or cross-country specialization patterns as the Davis model.² The basic difference is that the present model accounts for heterogeneous labor and the effect of this heterogeneity on

²Cf. Albert and Meckl (2001) for an efficiency-wage based approach to introduce unemployment into a general-equilibrium trade model that preserves decisive properties of the standard HO model.

individual wage incomes. We start from the observation emphasized in the empirical labor–market literature that individual wage incomes differ because (i) individuals differ in their skill levels and (ii) differ in their levels of innate abilities (cf. Taber, 2001). To capture that second effect, we distinguish between physical units of labor supply and effective units of labor supply. The difference between labor in physical end in effective units originates in differences in individual abilities. This distinction between labor supply in physical units and in effective units is the main difference between our approach and that followed by Davis. The latter implicitly assumes that individuals are homogeneous with respect to their abilities leaving any differentiation in labor supplies redundant.

It is this differentiation between labor in effective units and in physical units which allows for an integration of wage rigidities into an otherwise standard HO model that preserves most of the properties of the full–employment version of that model. This follows from the fact that minimum–wage legislation applies to wage incomes of physical labor inputs, thus ensuring that returns to effective labor units (which we term factor prices hereafter) are unaffected by wage rigidities.

In the present model, the relevant labor input in the production function is effective labor units. Consequently, the factor prices entering the unit–cost function are the returns to effective labor units (skilled and unskilled), w and r . Competitive cost conditions are again given (??). As in the standard HO model with competitive factor markets, these conditions uniquely determine the factor prices w and r as a function of goods’ price p :

$$w = w(p), \quad r = r(p); \quad w'(p) < 0, \quad r'(p) > 0. \quad (2)$$

The signs of the partial derivatives in (??) reflect our assumptions about factor intensities.

3.1 Educational decisions and aggregate factor supplies

We follow Meckl and Weigert (2003) in modeling individual and aggregate factor supplies.³ The economy is populated by a continuum of agents indexed by their innate ability a with the mass normalized to 1. Inherent abilities are distributed according to some density function $f(a)$ on the interval $[0, 1]$. The composition

³In contrast to the present paper, Meckl and Weigert (2003) emphasize the impact of educational decisions on measured wage inequality in a HO–type model of a small open economy.

of labor supply is endogenously determined by decisions of individuals with heterogeneous inherent abilities. For the moment, let us dispense with any form of institutional wage rigidities.

An individual with ability a can either enter the labor force as unskilled thereby supplying $(1 + a)$ units of unskilled labor and earn the wage rate w per unit of effective labor. Alternatively, an individual can choose to spend an exogenously given fraction λ of time in training to become a skilled worker. Education is assumed to raise individual abilities. For simplicity, we assume individual abilities of skilled workers to be ba , where $b > 1$ can be interpreted as a measure of the efficiency of the educational system. Thus, a skilled worker with ability a supplies $(1 - \lambda)(1 + ba)$ units of skilled labor and earns the wage rate r per unit of effective labor. The wage income of an individual with ability a then either is $(1 + a)w$ as an unskilled worker, or $(1 - \lambda)(1 + ba)r$ as a skilled worker.

An individual chooses to become skilled iff its ability is not smaller than some threshold value t determined by

$$t(p) = \{a : (1 + a)w(p) - (1 + ba)(1 - \lambda)r(p) = 0\}. \quad (3)$$

Provided that $2/(1 + b) \leq (1 - \lambda)\omega(p) \leq 1$ —where $\omega(p) \equiv r(p)/w(p)$ —, there exists a unique threshold value $t \in [0, 1]$. We assume this condition to be fulfilled in the following. Otherwise, either all or no individuals choose to become educated, a situation which is clearly contrary to fact. Furthermore, given our assumptions about factor intensities, t is a function of p with $t'(p) < 0$.

Individual education decisions determine the aggregate supplies of unskilled and skilled labor (L and H) as functions of p . Factor supplies are given by

$$L(p) = \int_0^{t(p)} (1 + a)f(a) da, \quad H(p) = \int_{t(p)}^1 (1 - \lambda)(1 + ba)f(a) da, \quad (4)$$

with $L'(p) < 0$, and $H'(p) > 0$. As a result, relative labor supply $h(p) := H(p)/L(p)$ is an increasing function of the goods price p . Full flexibility of factor prices then ensures that $L(p)$ and $H(p)$ are always fully employed, implying that $h(p)$ also measures relative labor employment.

Suppose now that there is an institutionally set wage floor below which wage incomes paid in an economy must not lie. For simplicity, we take this minimum wage income z as given exogenously. Furthermore, we assume that the wage floor

is sufficiently low such that minimum–wage legislation is not relevant for skilled labor. Note that minimum wages are defined as applying to physical labor units, not to effective labor units. Thus, minimum–wage legislation does not restrict the factor price of unskilled labor input that enters the firms’ unit–cost function. Hence, there is no need for the equilibrium goods price to support an exogenously given factor price in a fully diversified economy.

As a result of a binding wage floor, there are individuals with a productivity that is too low to guarantee them a wage income of z at a given return to effective unskilled labor w . Consequently, these individuals are not employed by any of the firms. The threshold ability τ to become employed is then determined by

$$\tau(p, z) = \{a : (1 + a)w(p) = z\} \quad (5)$$

Our assumptions about factor intensities imply that τ is increasing both in p and in z . Furthermore, a given minimum–wage constraint is not binding for $p \leq p_0$, where p_0 solves

$$w(p) = z$$

At price p_0 , all unskilled have sufficient productivity to earn the minimum–wage income.

With wage rigidities, the aggregate unemployment rate amounts to

$$u(p, z) = \int_0^{\tau(p, z)} f(a) da. \quad (6)$$

The unemployment rate rises with z and—due to our assumptions about factor intensities—is also increasing in p . Aggregate employment of unskilled labor is

$$\tilde{L}(p, z) = \int_{\tau(p, z)}^{t(p)} (1 + a)f(a) da, \quad (7)$$

with $\partial\tilde{L}(p, z)/\partial p < 0$, and $\partial\tilde{L}(p, z)/\partial z < 0$. Consequently, relative labor employment $\tilde{h}(p, z) := H(p)/\tilde{L}(p, z)$ is increasing in both p and z .

3.2 Equilibrium prices and unemployment

Consider a world consisting of two countries with free trade in goods and no international factor mobility. Both countries are alike in every respect except for

labor–market institutions. Labor markets in one country—Europe—are characterized by institutionally fixed wage floors. Labor markets in the other country—America—are fully competitive. From our analysis in the preceding subsection we get that, for any goods price compatible with (weak) diversification and a binding wage floor, incentives to acquire education are identical in both countries. This implies identical supplies of both types of labor in both countries. With no wage rigidities in America, the supply of unskilled labor is fully employed there. Due to the wage floor, however, Europe’s employment of unskilled is less than America’s. Consequently, Europe’s relative employment of skilled labor exceeds that of America, while aggregate income in Europe is less than in America because of unemployment.

Now we analyze the global equilibrium by applying the graphical technique shown in figure 1. The downward sloping curve CC shows the relative demand for goods as a function of p that is common to Europe and America (reflecting our assumptions about consumer preferences). The upward sloping curve AA depicts the supply of X relative to Y of the US economy. In contrast to the standard HO model, an increase in p raises relative supply by two effects. In addition to the usual sectoral restructuring in favor of X at given factor supplies, the increase in the relative factor price ω additionally lowers the threshold for acquiring education. Thus, the relative supply of skilled labor rises reinforcing sectoral adjustments by a standard Rybcynski effect. In Europe that second effect is stronger than in the US since an increase in ω additionally raises the threshold τ , thus reducing the aggregate employment of unskilled labor even by more. As a result, relative employment of skilled labor exceeds relative employment in the US *at any price* that gives rise to a binding minimum wage. For all prices $p > p_0$, Europe’s relative supply curve lies to the right of America’s, and its slope is less than the slope of the American relative supply curve.⁴

It is obvious from figure 1 that equilibrium autarky prices (determined by the intersection of national relative demand and relative supply curves as p^A and p^E , respectively) differ and hence international differences in institutionally set wage floors give rise to trade. The opening up of trade implies a striking contrast between labor markets in Europe and in America. Suppose that p^* is the price in

⁴In contrast, Davis approach implies that Europe’s relative supply becomes infinitely elastic at $p = \bar{p}$ (implying a flat segment in Europe’s import demand curve). All his relatively drastic results are caused by this infinite elasticity.

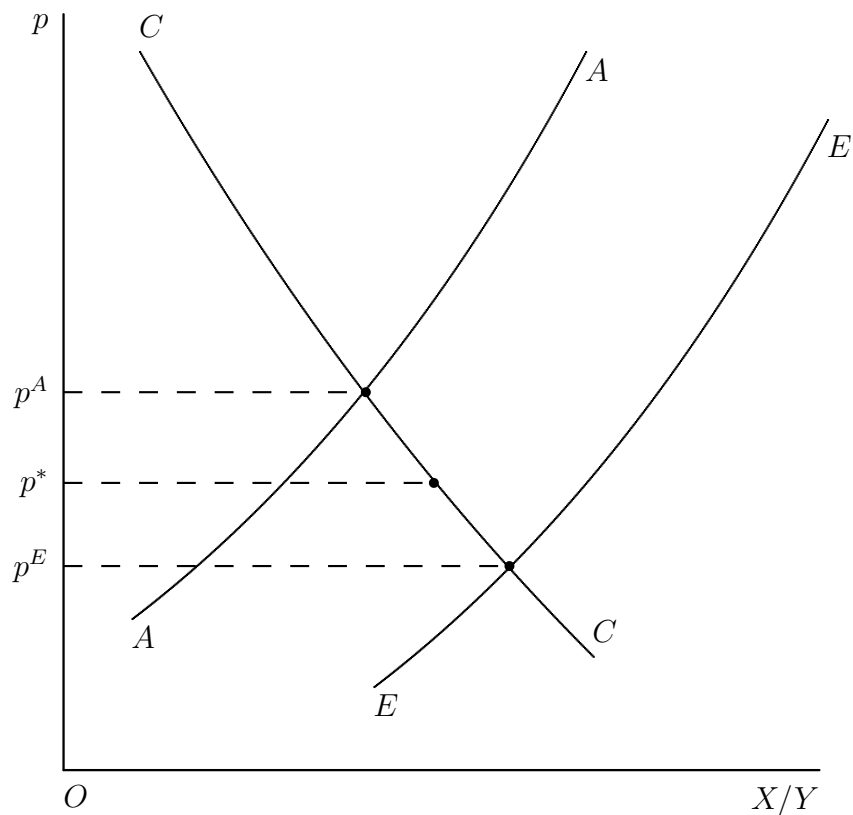


Figure 1: Determination of autarky prices

the free-trade equilibrium. In Europe, the rise in p reduces w and therefore drives up unemployment (for a given z). In America, the decline in p raises w . In principal, these results are in line with that from Davis' analysis: opening up trade between Europe and America raises both American wages and European unemployment rates. The mechanism driving these results, however, is completely different. In our model, it is the change in goods prices and the resulting changes in factor prices that alter production structures, educational decisions, and the impact of wage floors on unemployment. Basically, our mechanism is similar to the well-known adjustment mechanism from the standard full-employment HO model. The only difference is that quantitative reactions are magnified because (i) endogenous labor supply adjustments that are generated by a change in educational decisions of individuals and (ii) a given wage floor reinforces employment

adjustments. Eventually, our results provide a sound foundation for the arguments made in the comparative cross-country studies that have been criticized by Davis.

4 Shocks from the South: Implications for Europe and America

The insulation thesis stating that exogenous changes in world factor supplies do neither affect American wages nor the aggregate global production quantities is the most controversial implication of European wage institutions in Davis' analysis. The present model shows that the general-equilibrium link does not necessarily imply that the part of the world with wage rigidities has to bear the complete burden of adjustment to exogenous shocks.

Consider immigration of unskilled labor from third countries into the US. Suppose further that immigrants cannot acquire education in the US.⁵ Since the decisions about acquiring education depend on the goods price, the non-migrants' investment incentives at any given p do not change after immigration. Immigration, however, reduces the relative supply of skilled labor for each p , thus raising the difference in effective relative labor supplies between America and Europe. This change in relative employment alters the US relative supply of goods in favor of Y at any admissible price. In terms of figure 1, immigration shifts the American relative supply curve AA to the left. Consequently, the new goods price supporting global equilibrium is some $p' > p^*$. Thus, we arrive at the results prospected by empirical labor-market studies on the effect of immigration: Immigration of unskilled labor into the US reduces the wage income of the unskilled there while driving up the incentives to invest in education within the native population. In Europe, the effects are identical with respect to wage incomes of the unskilled, and about educational incentives. Additionally, unskilled unemployment rises.

⁵Alternatively, one can analyze immigration of individuals at the bottom end of the ability scale.

5 Conclusions

This paper has shown that minimum–wage–income constraints can be introduced into the classical Heckscher–Ohlin framework of international trade without altering the results derived from the standard full–employment version of that model in a fundamental way. Contrary to what is expected from Davis’ (1998) analysis of minimum wages in a HO–type model, wage rigidities in Europe do not insulate the flexible–wage economies like the US or the UK from exogenous shocks by shifting the complete burden of quantity adjustments to European labor markets. In our model, *each* exogenous shock renders price adjustments that generate adjustments in national production structures for all trading partners. Nevertheless, European unemployment does indeed prop up American wages. This is a consequence of national labor markets being linked by integrated goods markets in a global economy. However, global general equilibrium effects do not equalize wage incomes in countries with completely different labor–market institutions. Our results and the mechanisms driving them are more in line with that derived from comparative cross country studies (cf. Krugman, 1995), thus providing a consistent common framework for these results.

Our model also overcomes another problematic implication of Davis’ approach concerning specialization patterns within European economies. In European countries sharing wage rigidities, minimum wages are by no means identical. But if minimum–wage rates differ between European economies, Davis’ HO–type framework either implies that only the highest minimum wage is actually binding (with no unemployment in all other European economies) or that complete specialization of production on the skill–intensive good occurs in all economies with binding minimum–wage rates⁶ but the diversified economy with the lowest minimum wage. This implication, however, is clearly contrary to fact. Only if one allows for specific technological differences within European countries it is theoretically possible that different minimum–wage rates are supported by an identical goods price \bar{p} and diversification occurs in all countries. But this is a knife–edge case of minor practical importance. Since in our model the minimum–wage–income constraints do not completely determine factor prices, the model is compatible with diversification in all economies irrespective of the specific value

⁶This corresponds to the minimum–wage induced specialization patterns in a small–open–economy version of the HO model discussed by Neary (1985).

of the minimum wage income.

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