
ESSAYS ON THE POLITICAL ECONOMY OF PUBLIC EXPENDITURES

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Summary

The dissertation at hand contributes to the economic literature that investigates the causes and consequences of the size and composition of public expenditures. The emphasis is placed on the political economy perspective that assumes politicians and bureaucrats to be led by self-interest. The dissertation consists of an introductory chapter and a collection of three stand-alone research papers (chapters 2 to 4) that rely both on theoretical derivations as well as empirical investigations. While chapter 2 has been recently published in *Kyklos* (Hessami, 2010a), the fourth chapter has resulted from a collaboration with Dr. Thushyanthan Baskaran (University of Heidelberg).¹

Chapter 1 summarizes the motivation for this dissertation, provides an extensive literature review and gives an outline of chapters 2 to 4 while placing each chapter into the context of the literature. The main issue discussed in chapter 1 is the steady growth of public expenditures in developed countries since World War II that has recently regained prominence due to strikingly high debt levels in the Eurozone. Based on these observations, several research questions are identified, which have inspired the investigations in the following chapters.

Chapter 2 analyzes whether large governments in Europe reflect efficient responses to a changing social and economic environment ('welfare economic view') as opposed to wasteful spending ('public choice view'). To this end, the effect of government size on subjective well-being is estimated in a microeconomic model. It relies on a combined survey and country-level dataset covering 153,268 respondents from twelve EU countries over the 1990 - 2000 period. The first finding is the existence of an inversely U-shaped relationship between the size of the public sector and well-being. In addition, the investigation reveals that the impact of government size on well-being depends negatively on levels of corruption and positively on the extent of decentralization. Moreover, left-wing voters and low-income earners are the main beneficiaries of a large public sector. Finally, in all twelve EU countries included in the sample higher levels of well-being could have been achieved by allocating a higher share of public resources to education, while Finland and Germany could have given an additional boost to well-being by cutting expenditures on social protection.

Chapter 3 illustrates how the rent-seeking behavior of private firms, politicians and bureaucrats may lead to a misallocation of public expenditures. The theoretical foundation

¹An early version of chapter 4 is available as a CESifo Working Paper (Baskaran and Hessami, 2010).

for a distortion in the composition of government spending is laid in the context of a two-stage rent-seeking model with endogenous rent-setting and a divisible rent. In the first stage, firms pay bribes to a politician who then distributes the public resources available to him across the industries according to the relative sizes of the aggregate bribe payments. In the second stage, the first-stage bribe payments are sunk and the firms compete for their individual share of the rent by paying bribes to a bureaucrat.

The model illustrates that firms are more successful in obtaining a large share of the rent, when they operate in a non-competitive market and when they produce for instance high-technology goods where prices are difficult to compare. The theoretical model also suggests that the politician makes more resources available to industries, where these conditions are fulfilled as bribery is more difficult to detect and more generous bribes can be collected. The empirical analysis for 29 OECD countries over the 1996 - 2009 period tries to identify such corruption-induced distortions in the budget composition and reveals that the shares of spending on health and environmental protection increase, while the shares of expenditures on social protection and recreation, culture and religion decline with high corruption. Bearing in mind that health and environmental protection expenditures include public spending on high-tech medical appliances as well as waste (water) management, the empirical findings can be reconciled with the predictions of the theoretical model. Overall, the results for the industrialized countries in the sample are quite different from the insights gained in previous investigations that focus mainly on developing countries.

Chapter 4 analyzes whether globalization affects the educational priorities of governments. The theoretical model illustrates that by increasing the wage premium for the high-skilled as well as reducing mobility costs globalization has an indirect effect on tax rates and expenditures for different educational programs. More specifically, governments have, on the one hand, an incentive to invest more resources in tertiary education if globalization increases the wages of high-skilled workers. Readjusting education expenditures in this way leads to a larger tax base and higher tax revenues. On the other hand, globalization intensifies tax competition by decreasing mobility costs and thereby diminishes the government's ability to set high taxes. This effect induces governments to reduce funding for all educational programs as the returns to education cannot be taxed as easily as in a more closed economy. The overall effect of globalization on *absolute* expenditures for different educational programs is therefore ambiguous. However, the theoretical discussion predicts that governments spend less on primary *relative* to tertiary education with a higher level of global economic integration.

The second part of this last chapter empirically investigates the impact of globalization on the government's educational priorities with GMM-style dynamic panel estimations. The dataset covers 121 countries over the 1992 - 2006 period. The results indicate that globalization leads to a relative increase in the share of expenditures on higher education vis-à-vis the share of public education expenditures devoted to primary education in both industrialized

and developing countries. Despite the ambiguity in the theoretical analysis we even find that absolute expenditures on tertiary education have increased with globalization. Since students who originate from wealthy households benefit from an effective private support network, they require fewer public resources in order to complete primary education than students from less privileged households. This suggests that in the long run globalization increases income inequality via its effect on educational policies.

Zusammenfassung

Die vorliegende Arbeit leistet einen Beitrag zu der ökonomischen Literatur, die die Ursachen und Auswirkungen der Größe und der Zusammensetzung von Staatsausgaben analysiert. Der Fokus dieser Dissertation liegt auf der polit-ökonomischen Perspektive, welche Politikern und Bürokraten die Maximierung ihres Eigennutzes zu Lasten des Gemeinwohls unterstellt. Es handelt sich um eine kumulative Dissertation, welche aus einem einleitenden Kapitel sowie drei eigenständigen Aufsätzen besteht (Kapitel 2 bis 4). Letztere stützen sich sowohl auf theoretische Herleitungen als auch auf empirische Analysen. Das zweite Kapitel wurde in identischer Form (Hessami, 2010a) in *Kyklos* veröffentlicht. Das vierte Kapitel ist aus einer Zusammenarbeit mit Dr. Thushyanthan Baskaran (Universität Heidelberg) entstanden.²

Kapitel 1 fasst die Zielsetzung und die Motivation dieser Dissertation zusammen und stellt eine umfassende Literaturübersicht bereit. Hinzu kommt ein Überblick über die Kapitel 2 bis 4, wobei jedes Kapitel in den Kontext der Literaturübersicht eingeordnet wird. Kapitel 1 stellt vor allem das starke Wachstum des Staatssektors in entwickelten Ländern seit dem Ende des zweiten Weltkriegs in den Vordergrund. Diese sich fortsetzende Entwicklung spiegelt sich unter anderem auch in den aktuellen Schlagzeilen zur hohen Staatsverschuldungen verschiedener Länder der Euro-Zone wieder. Darauf aufbauend werden verschiedene Fragestellungen hervorgehoben, die als Grundlage für die folgenden Kapitel dienen.

Kapitel 2 analysiert, ob große Staatssektoren in Europa als effiziente Antwort auf sich verändernde soziale und ökonomische Rahmenbedingungen zu verstehen sind (‘wohlfahrtsökonomische Perspektive’) oder einen Hinweis auf eine verschwenderische Ausgabenpolitik darstellen (‘polit-ökonomische Perspektive’). Zu diesem Zwecke wird der Einfluß der Staatsgröße auf das individuelle subjektive Wohlbefinden in einem mikroökonomischen Modell geschätzt. Hierbei werden Daten aus den Eurobarometer Umfragen mit Daten auf der Länderebene kombiniert. Daraus ergibt sich ein Datensatz, der 153.268 Befragte aus zwölf EU-Ländern in der Zeitperiode von 1990 bis 2000 abdeckt. Als erstes Ergebnis lässt sich festhalten, dass es eine Beziehung zwischen der Staatsgröße und dem Wohlbefinden gibt, welche von einer inversen U-Kurve beschrieben wird. Zudem legen die Schätzungen nahe, dass der Effekt der Staatsgröße auf das Wohlbefinden negativ vom Ausmaß der Korruption und positiv vom Grad der Dezentralisierung abhängt. Darüber hinaus profitieren linke Wähler und Geringver-

²Eine ältere Version von Kapitel 4 ist als CESifo Working Paper erhältlich (Baskaran und Hessami, 2010).

diener am meisten von einem großen Staatssektor. Schließlich zeigt sich, dass in allen zwölf EU-Ländern, die in der Stichprobe enthalten sind, ein höheres Wohlbefinden hätte erreicht werden können, wenn ein größerer Anteil der Staatsausgaben auf den Bildungsbereich entfallen wäre. Zusätzlich hätten Finnland und Deutschland das Wohlbefinden der Bevölkerung durch eine Kürzung der Sozialausgaben noch weiter erhöhen können.

Kapitel 3 weist auf mögliche Ineffizienzen in der Verteilung der Staatsausgaben hin, die durch das potenziell korrupte Verhalten von privaten Firmen, Bürokraten und Politikern hervorgerufen werden. Das theoretische Fundament dieser Verzerrung wird mit Hilfe eines zweistufigen “Rent-seeking” Modells dargestellt, welches durch endogene Rentenbildung und eine teilbare Rente gekennzeichnet ist. Auf der ersten Stufe zahlen private Firmen Bestechungsgelder an einen Politiker, um die Verteilung der öffentlichen Ausgaben im Sinne ihrer Industrie zu beeinflussen. Nachdem der Politiker dann die öffentlichen Ressourcen, die ihm zur Verfügung stehen, entsprechend der relativen Höhe der Bestechungsgelder verteilt hat, beginnt die zweite Stufe des “Rent-seeking” Wettbewerbs. Da keine vorher bestimmte Verteilungsregel vorliegt, sind die Bestechungsgelder der ersten Stufe versunken und die Firmen zahlen nun Bestechungsgelder an einen Bürokraten, der den Firmen über die Erteilung von öffentlichen Aufträgen diese Renten zukommen lässt.

Die Herleitungen legen nahe, dass Firmen sich eher einen großen Anteil der Rente sichern können, wenn sie sich in einem oligopolistischen Marktumfeld befinden und wenn sie beispielsweise hoch-technologisierte Güter herstellen, bei denen es schwierig ist Preise zu vergleichen. Zudem sagt das Modell vorher, dass der Politiker gewillt ist, einer Industrie mehr Ressourcen zuzusprechen, wenn diese beiden Bedingungen erfüllt sind, da es unwahrscheinlicher ist, dass die Korruption aufgedeckt wird, und höhere Bestechungsgelder gezahlt werden. Die empirische Analyse für 29 OECD-Länder im Zeitraum zwischen 1996 und 2009 versucht solche korruptionsbedingten Verzerrungen in der Zusammensetzung der Staatsausgaben zu identifizieren. Die Ergebnisse legen nahe, dass der Anteil der Staatsausgaben für Gesundheit und Umweltschutz mit dem Ausmaß der Korruption steigt, während im Gegensatz dazu der Anteil der Ausgaben für Soziales, Freizeit, Kultur und Religion zurückgeht. Ruft man sich ins Gedächtnis, dass Ausgaben für Gesundheit und Umweltschutz öffentliche Ausgaben für hochtechnische medizinische Apparate, die Abwasserentsorgung sowie die Müllabfuhr enthalten, so ist es möglich, diese empirischen Resultate mit den Vorhersagen des theoretischen Modells in Einklang zu bringen. Generell stehen diese Ergebnisse im Kontrast zu vorherigen empirischen Analysen zu dieser Thematik, die sich vor allem auf Entwicklungsländer konzentriert haben.

Kapitel 4 beschäftigt sich mit der Frage, ob die sich fortsetzende Globalisierung die bildungspolitischen Prioritäten der Regierungen beeinflusst. Der theoretische Teil stellt dar, dass auf Grund der globalisierungsbedingten Erhöhungen der relativen Löhne für gut ausgebildete Arbeitskräfte und der Reduzierung der Mobilitätskosten indirekt Steuersätze und

Bildungsausgaben beeinträchtigt werden. Im Ergebnis bedeutet dies, dass Regierungen einerseits einen Anreiz haben, mehr Ressourcen in Hochschulbildung zu investieren. Dies ist auf die gestiegenen Löhne der hochqualifizierten Arbeitskräfte zurückzuführen, die der Regierung höhere Steuereinnahmen versprechen. Andererseits führt Globalisierung durch die Reduzierung der Mobilitätskosten zu einem stärkeren Steuerwettbewerb und nimmt den Regierungen damit die Möglichkeit hohe Steuersätze festzulegen. Schließlich bedeutet dies, dass die Regierungen durch Engpässe auf der Finanzierungsseite gezwungen sind insgesamt die Bildungsausgaben herunterzufahren. Bezogen auf die ursprüngliche Fragestellung kann keine eindeutige Aussage zu den absoluten Bildungsausgaben getroffen werden. Jedoch lässt sich aus der theoretischen Diskussion die Hypothese ableiten, dass Regierung im Zuge der Globalisierung relativ gesehen weniger für Primärbildung und relativ gesehen mehr für tertiäre Bildung ausgeben.

Der zweite Teil dieses letzten Kapitels stellt eine empirische Untersuchung für 121 Länder im Zeitraum von 1992 bis 2006 dar und erfolgt auf der Basis von dynamischen Panel-Modellen, die mit dem GMM-Verfahren geschätzt werden. Die Ergebnisse dieser Schätzungen bestätigen, dass der Anteil der Bildungsausgaben, der auf den primären Bildungssektor entfällt, sowohl in Industrie- als auch in Entwicklungsländern durch Globalisierung auf Kosten der Ausgaben im tertiären Bildungssektor zurückgegangen ist. Trotz der theoretischen Uneindeutigkeit bezüglich der absoluten Bildungsausgaben zeigt die empirische Analyse auch, dass absolute Ausgaben im tertiären Bildungsbereich angestiegen sind. Da Schüler aus wohlhabenden Verhältnissen im Gegensatz zu Schülern aus bescheidenen Verhältnissen stärker auf private Ressourcen zurückgreifen können, sind in ihrem Falle weniger öffentliche Ausgaben im primären Bildungsbereich notwendig, um die Grundschulbildung erfolgreich abschließen zu können. Dies legt nahe, dass langfristig gesehen die zunehmende ökonomische Verflechtung der Nationen durch ihren Effekt auf bildungspolitische Variablen die Einkommensungleichheit innerhalb aller Länder weltweit weiter verschärfen wird.

Erklärung

Ich versichere hiermit, dass ich die vorliegende Arbeit mit dem Titel

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ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet.

Weitere Personen, insbesondere Promotionsberater, waren an der inhaltlich materiellen Erstellung dieser Arbeit nicht beteiligt.³ Die Arbeit wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

Konstanz, den 07. September 2010

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³siehe hierzu die Abgrenzung zu Kapitel 4 auf der folgenden Seite.

Abgrenzung

Ich versichere hiermit, dass ich Kapitel 1 bis 3 der vorliegenden Dissertation ohne Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe.

Kapitel 4 ist in Zusammenarbeit mit Dr. Thushyanthan Baskaran von der Universität Heidelberg entstanden. Die individuelle Leistung der beiden Autoren lässt sich anhand folgender Gliederung zusammenfassen:

Einleitung und Literaturübersicht (4.1 und 4.2):	70% Hessami und 30% Baskaran
Theoretisches Modell (4.3):	20% Hessami und 80% Baskaran
Empirische Analyse (4.4 und 4.5):	50% Hessami und 50% Baskaran
Schlußfolgerungen (4.6):	50% Hessami und 50% Baskaran

Konstanz, den 07. September 2010

(Zohal Hessami)

Chapter 1

Introduction

1.1 Challenges to fiscal policy in the 21st century

Fiscal policy primarily denotes the use of government expenditure and revenue collection to influence the level of aggregate demand in the economy, in an effort to achieve price stability, full employment, and economic growth. In case that expenditures exceed revenues, the government runs a budget deficit and accumulates debt. Since the ability of governments to take on debt allows policy-makers to reduce fluctuations in economic activity either through automatic stabilization (Hiebert et al., 2009) or deliberately designed fiscal stimulus packages, public indebtedness in itself need not be a cause of concern. However, one should be aware that *excessive* levels of debt compromise intergenerational equity by leaving the painful burden of fiscal consolidation to future generations.

Recently, a debate on the question where to draw the line between reasonable and excessive debt levels has emerged. This question was raised in light of the strikingly high levels of public indebtedness faced by several European countries. In May 2010, the Greek government deficit was estimated to be 13.6%, while accumulated government debt in Greece is forecast to hit 120% of GDP in 2010. In the meantime, confidence in other European economies such as Ireland, Spain, and Portugal has also decreased due to comparatively high government deficits of 14.3%, 11.2% and 9.4% of GDP, respectively (Eurostat, 2010).

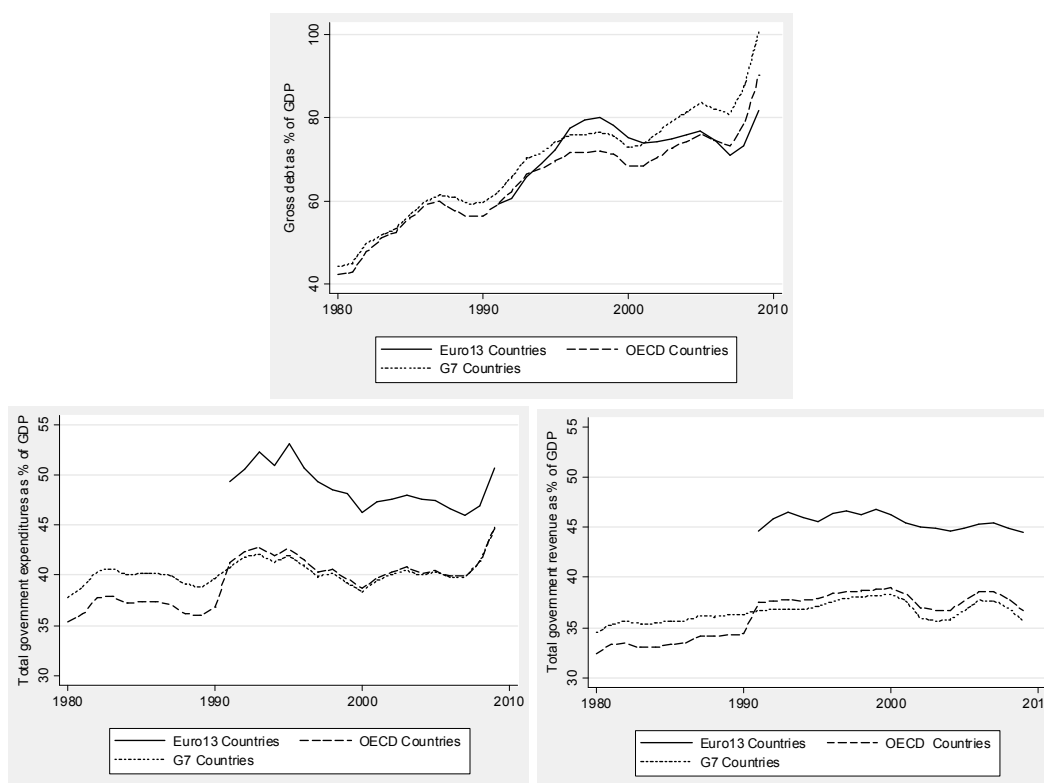
From a supranational perspective, the recent news about the tight financial situation in several European countries casts doubt on the viability of the Economic and Monetary Union (EMU). In this context, the downfall of the Euro vis-à-vis other major currencies has already been interpreted as a first sign of an impending dissolution of the EMU (The Economist, 2010c). Despite a €110 billion loan issued to Greece by the Eurozone countries and the International Monetary Fund and its explicit conditionality on the implementation of harsh austerity measures, concerns about high levels of public indebtedness remain.

The main challenge for the consolidation of public finances is the increasing cost of financing government liabilities due to the downgrading of government bond ratings and

proliferating interest payments (The Economist, 2010b). In addition, high levels of public debt weaken the capacity of the government to stimulate the economy during the recession that is continuing in some parts of Europe. Weak economic growth in turn implies fewer government revenues rendering the reduction of public debt even more difficult.

In order to understand how the current situation has come about and to what extent it can be observed in countries outside of the Eurozone, it might be worthwhile to take a closer look at the data on public finances. Figure 1.1 illustrates the evolution of public debt, public expenditures and public revenues as a share of GDP for three different groups of countries from 1980 to 2009. The objective is to compare the fiscal situation in the Eurozone (Euro13 countries) with that in the seven most powerful economies in the world (G7 countries) and in developed countries in general (OECD countries).¹

Figure 1.1: EVOLUTION OF PUBLIC FINANCES FOR GROUPS OF COUNTRIES, 1980 - 2009



Source: OECD Economic Outlook²

¹Note that the three groups overlap given that some Euro13 countries are in the G7 group (France, Germany, and Italy) and that the G7 countries are all members of the OECD. Nevertheless, the comparisons are interesting considering that the G7 and the OECD include four and 19 non-Eurozone countries, respectively.

²The data has been obtained from the OECD Economic Outlook No. 86 published in December 2009.

Figure 1.1 illustrates that the pattern in the evolution of gross debt as a percentage of GDP is very similar across the three country groups, even though data for the Euro13 countries is only available as of 1990. The fact that public debt has grown more strongly in the G7 and OECD countries than in the Eurozone is at first sight surprising given that the newspapers mostly frame the current debt crisis in the context of this particular group of countries. More specifically, average gross debt as a share of GDP has increased from slightly above 40% in 1980 to 90% (OECD countries) and 101% (G7 countries) in 2009, compared to only 82% in 2009 in the Eurozone countries. This discrepancy can partly be attributed to the fact that entry into the EMU was conditional on convergence criteria including threshold debt levels. These criteria continue to influence public finances of countries in the Eurozone even after entering the EMU due to the existence of the Stability and Growth Pact. What is also striking with regard to figure 1.1 is that about half of the 50 to 60 percentage point increase in public debt in G7 and OECD countries has occurred in the first ten years of the 21st century.

The steady growth in public debt raises the question whether it has primarily been caused by an increase in expenditures or a decline in revenues. For this reason, the plots at the bottom of figure 1.1 are added to display the evolution of two additional fiscal variables. The left-hand plot provides evidence for an increase in public spending as a percentage of GDP from 36% (OECD countries) and 38% (G7 countries) in 1980 to about 45% for both country groups in 2009, while the right-hand plot illustrates that government revenues have even slightly increased by two (G7 countries) or five (OECD countries) percentage points. This suggests that the growth in gross debt is driven by changes in public expenditures rather than revenues.³ In addition, the patterns in both plots are again very similar, even though public expenditures and public revenues divided by GDP are on average about 10 to 15 percentage points higher in the Eurozone countries than in the other two groups of countries. Finally, it should be noted that a particularly steep increase in public expenditures is observable at the end of the considered time period, while public revenues are slightly declining since 2006.

With regard to the future development of public finances, it can be stated that many of the highly indebted European governments announced to scale back expenditures rather than raise taxes (The Economist, 2010a), even though it is not clear how strongly these measures will contribute to a reduction of public debt levels. In any case, expenditure-based measures to achieve public debt reduction are justified by the economic literature providing evidence that this is the most promising approach to long-lasting fiscal consolidation (Alesina et al., 1998; Illera and Mulas-Granados, 2008).

Certainly, the current debt crisis can in part be attributed to macroeconomic shocks that can only to some extent be prevented by policy-makers. This includes the bursting of the “New Economy”-bubble at the turn of the century as well as the recent crisis in the banking sector. Moreover, the demographic shift towards an aging population necessitates

³The increase in public debt is much larger in percentage terms than the increase in public spending due to the fact that debt proliferates over time with increasing interest payments.

higher expenditures on health and social protection. However, especially with regard to the demography-induced deterioration of public finances, one can argue that appropriate reforms could have dealt with this challenge decades ago. In addition, the steady growth in public debt illustrated in figure 1.1 brings up the question why policy-makers were unable or chose not to reduce public debt in times of strong economic growth such as the 1990s.

More generally, this discussion casts doubt on the notion that representatives of the public sector exclusively seek to maximize social welfare. In this context, the political economy literature emphasizes the existence of a principal-agent conflict between representatives of the public sector and the general public, i.e. voters. One of the ideas that is very prominent in this literature and that relates to the aforementioned observations for figure 1.1 is that public expenditures are often raised shortly before elections to maximize re-election probabilities (Nordhaus, 1975). Since it is unpleasant to cut these expenditures in the post-election period, public expenditures are likely to grow over time. In addition, towards the end of a term period, a government that is likely to lose the next election has strategic incentives to increase public borrowing in order to limit the room for political maneuver for the political opponents (Pettersson-Lidblom, 2001). If this kind of behavior occurs repetitively, it is likely that public debt grows steadily as illustrated in the upper panel of figure 1.1.

Even though the literature on the political economy of fiscal policy is extensive, there are still some unanswered questions. This dissertation tries to address some of these remaining questions and fills gaps in the literature by means of three stand-alone research papers (chapters 2 to 4) that rely both on theoretical derivations as well as empirical investigations. The focus is on public expenditures given that in contrast to public debt they can be directly influenced by policy-makers and do not result from an interplay between other variables (expenditures, revenues, interest payments, etc.). In addition, figure 1.1 clearly illustrates that the current debt crisis can be explained by the evolution of expenditures rather than revenues. In particular, this dissertation investigates the following questions: has the growth in public sector size over the past few decades been in the interest of voters? Which groups in the population benefit the most from a large government? How important is the quality of institutions in this context? Are public expenditures misallocated? Which spending categories are affected by this misallocation? What are the mechanisms that induce a distortion in the allocation of public resources?

The remainder of chapter 1 is structured as follows: section 1.2 reviews the related literature. In particular, section 1.2 starts out with an overview of the literature that justifies government intervention followed by a detailed portrayal of the political economy perspective. Section 1.2 provides a description of the existing literature on the determinants of public expenditures and the literature that investigates the consequences of public expenditures. Finally, section 1.3 outlines the structure and objectives of chapters 2 to 4.

1.2 Literature review

1.2.1 Responsibilities and limitations of government

Public expenditures reflect the fact that the government intervenes in the economy. These interventions take the form of activities in the production of goods and services, the regulation and subsidization of private production, the purchase of goods and services and income redistribution (Stiglitz, 2000). Looking at this wide range of intervention mechanisms, the question arises why the government plays a role in the economy in the first place. The bulk of the literature on this question argues from an efficiency perspective and emphasizes the existence of market failures. From this viewpoint, the justification of government intervention relies on the conviction that the government is able to remedy these deficiencies.

The first economist who reflected on the question which responsibilities the government should bear was Adam Smith (1723 - 1790). Smith argued that the profit-maximizing behavior of an individual ensures the maximization of welfare for the general public.⁴ Following this argumentation, there would be only little need for government intervention. However, Smith's line of reasoning is only applicable as long as markets are competitive (including free trade). If this condition is not fulfilled, the equilibrium quantity of a good is lower and prices are higher than with perfect competition. Hence, one important responsibility of the government is to ensure competitive markets by means of an antitrust authority. Since administrative and labor expenses are necessary to entertain such a regulatory agency, this is the first purpose on which the government expends resources (Hillman, 2009).

Even in a competitive market environment, certain characteristics of goods and services may cause the amount provided to deviate from the optimum. An extreme example are public goods that are characterized by non-excludability and non-rivalry in consumption. The fact that nobody can be excluded from consuming public goods, while the consumption of a public good by one individual does not reduce the amount available to other consumers, creates the free-ridership problem. As a consequence, public goods may not be provided at all or at least insufficiently. In order to deal with this underprovision, the government steps in by collecting taxes from each individual and taking the provision public goods in its own hands.⁵

Externalities are a defining feature of public goods and yet they can also appear when public goods are absent. In the case of negative externalities, individuals do not bear the full cost of the externalities that they generate and hence the amount provided of a particular good or service is above the optimum. Conversely, if individuals do not enjoy the full benefit of activities that generate positive externalities, the amount provided of a particular good or

⁴This idea is discussed in his book *The Theory of Moral Sentiments* and also in *An Enquiry into the Causes of the Wealth of Nations* first published in 1759 and 1776, respectively.

⁵When a public good becomes congested, one speaks of impure public goods (Hillman, 2009) for which the *Tragedy of the Commons* is a famous example. The implications for public provision are similar, even though the policies chosen to deal with pure as opposed to impure public goods differ.

service is below the optimum. This under- or overprovision can be avoided by means of different forms of government intervention that may give rise to additional public expenditures. For instance, the government may entertain an agency that distributes and protects property rights or it may introduce a Pigouvian tax or subsidy.

Another failure in the marketplace that the government tries to remedy is the existence of incomplete markets. They are defined as the failure of the market “to provide a good or service even though the cost of providing it is less than what individuals are willing to pay” (Stiglitz, 2000, p.81). While the range of insurances and financial products offered nowadays is much wider than decades ago, examples for incomplete markets can still be found in insurance and capital markets. This includes government guarantees on student loans, loans to small businesses, unemployment insurance, and fire insurance in inner-city areas. The main explanation for incomplete markets according to Stiglitz (2000) is that these markets are very innovative and therefore suffer from an uncertainty with regard to the demand for these products. In addition, the considerable transaction costs related to the introduction of products may discourage the provision of a specific product. Finally, markets may fail when there is a lack of effective patent protection or when information asymmetries are relatively large making it difficult to charge a reasonable risk premium.

The most prominent cause for government intervention is related to the existence of macroeconomic disequilibria. When adverse macroeconomic shocks occur that give rise to high unemployment and a stagnation in economic activity, policy-makers respond to these shocks by increasing public expenditures for public infrastructure projects in order to give a stimulus to the economy from the demand-side. A proponent of such interventions was John Maynard Keynes (1883 - 1946) whose ideas were implemented especially during the Great Depression in the 1930s.

In addition to the aforementioned efficiency-based justifications for government intervention, political actors may also seek to achieve equity objectives.⁶ For instance, the government may be interested in closing the gap between the rich and the poor or in providing people from diverse socio-economic backgrounds with equal opportunities. Even though there are different definitions for the concept of social justice (Hillman, 2009), the pursuit of this goal usually calls for a tax system that creates redistribution through its particular design. Moreover, the government may provide private goods such as health and education that give rise to an in-kind redistribution (Blomquist and Christiansen, 1995).

Finally, the government sometimes pursues paternalistic objectives by providing so-called merit goods. These are goods that the government compels individuals to consume such as seat belts and elementary education. This paternalistic argument for government intervention stems from the concern that individuals may not act in their own best interests. However,

⁶It should be noted that the efficiency and equity objectives pursued by the government may contradict each other. For instance, it is often argued that a large public sector with generous unemployment benefits financed through high taxes causes distortions and reduces people’s motivation to work.

the elusive notion of “people’s best interests” creates the possibility of arbitrary and excessive government intervention. For this reason, the paternalistic argument is also the most controversial justification for government intervention.

While all of these justifications are reflected in the activities of current-day governments, it took several centuries to arrive at the idea that governments should pursue efficiency as well as equity objectives through direct intervention. Initially, the reasons for government were mostly efficiency-based, while later equity reasons called for an even more active role of the government. Moreover, the key ideas on the government’s role developed in the 18th and 19th century have had a strong influence on historic developments in the 20th century and still continue to be important today.

The Mercantilists in the 18th century expected the government to actively engage in the promotion of trade and industry. In opposition to this, Adam Smith argued for a limited role for government, which inspired many 19th century economists such as John Stuart Mill to promulgate the *laissez-faire* doctrine. In their opinion, the government should abstain from controlling or regulating private enterprises. However, not all 19th century minds were convinced by this doctrine. For instance, Karl Marx and his followers opposed private ownership of production means and called for a strong role of the government in controlling them. These contrary principles climaxed in the Cold War of the 20th century. While there is nowadays a broad consensus that private enterprises and markets are the core elements of a thriving economy and that the government can be an important complement to the market, the precise nature and extent of the government’s role is still a source of contention. This explains the continuing variation in government spending across countries.

The main argument put forward by the proponents of a limited role of government is that the measures taken by policy-makers to eliminate market failures are not effective. In addition, it is argued that active government intervention in the economy may give rise to new failures, i.e. so-called government failures. According to Stiglitz (2000) government failures can have different causes: limited information, limited control over private market responses, limited control over bureaucracy, and limitations imposed by the political process.

The last two sources of government failure relate to the perspective taken in this dissertation, i.e. the political economy perspective. The main idea is the existence of a principal-agent conflict between representatives of the government and voters which may lead to a suboptimal size of the government and/or a misallocation of public resources. In addition, bureaucrats responsible for the implementation of policies may also exhibit rent-seeking behavior that is at odds with the maximization of social welfare. A more detailed account of the so-called “political economy” perspective is provided in the following section.

1.2.2 The political economy perspective

Political economy originally denoted the analysis of production, buying and selling, and their relations with law, custom, and government. It emanated from the discipline of moral philosophy and was developed in the 18th century as the study of the economies of states. In the late 19th century, the term “political economy” was replaced by the term economics, used by those seeking to lift the study of economy on a mathematical foundation rather than relying on the structural relationships of production and consumption. Today, “political economy” refers to an interdisciplinary approach understood as the economic analysis of politics. This is the meaning of the term that is referred to in the remainder of this dissertation.

Within the political economy literature one distinguishes between two distinct but related fields: social choice and public choice. Social choice theory represents a theoretical framework for measuring individual interests, values, or welfares that are aggregated for the purpose of collective decision. It dates back to Condorcet’s formulation of the cyclical voting problem that later inspired Arrow’s (1951) famous “impossibility theorem”. Typically, a set of apparently reasonable axioms are used to construct a social welfare function (or constitution) and to derive the implications of those axioms.

On the other hand, public choice theory involves the use of modern economic tools to study problems that are traditionally in the province of political science.⁷ Or as Tullock (1988) put it, public choice is “the invasion of politics by economics”. From the perspective of political science, it may be classified as the subset of positive political theory dealing with individuals whose material interests predominate. In particular, public choice studies the behavior of politicians and bureaucrats as self-interested agents and their interactions in the social system. In some cases, the behavior of political actors is even investigated under alternative constitutional rules. An important assumption for the theory of public choice is that most voters are not able to fulfill their monitoring function due to the public good character of information about politics.

One may argue about the exact birth date of public choice theory and the question what contribution was the very first one in this field. A typical suggestion is Arrow’s (1951) and Black’s (1948) insight that democracy, based on the principle of majority rule, is inherently unstable since the associated aggregation of individual preferences runs into basic problems of consistency. However, long before Arrow’s and Downs’ contributions, the Swedish economist Knut Wicksell (1851 - 1926) analyzed the efficacy of majority rule and contrasted it with the unanimity rule as a benchmark.⁸ Nowadays, Wicksell is remembered as the most important

⁷Public choice theory is commonly associated with George Mason University, where Gordon Tullock and James M. Buchanan are currently faculty members. Their early work took place at the University of Virginia and Virginia Polytechnic Institute and State University. Hence, the “Virginia school of political economy” is often referred to in this context.

⁸The core of this work emphasized consensus and unanimity in place of majority rule as a standard of governance and became the guiding framework for the theory of public choice and constitutional economics. Wicksell recognized that a shift from unanimity to approximate unanimity creates a tradeoff. True unanimity

precursory figure of the public choice school and therefore his work precedes the birth date of public choice theory.

Given that the theory on the cyclical voting problem identified by Arrow and Black draws heavily on the methods of social choice, it might seem inappropriate to classify these findings as the first contribution to public choice theory. Instead, one can argue that Downs' (1957) fundamental insight that "parties formulate policies in order to win elections, rather than win elections to formulate policies" (p.28) was the first original contribution to public choice theory. In a Downsian world, voters act rationally in a sense that they vote for the party that he or she believes to offer the greatest personal benefits. Party manifestos serve as a source of information to evaluate and compare these benefits across parties. Since collecting and processing this information is costly, each voter may confine this evaluation to those areas where differences between parties are largest. Downs' main contribution can be summarized as improving the understanding of party competition and voter's rational ignorance.

In addition, Downs made a contribution to spatial voting by means of the so-called "Median Voter Theorem".⁹ In particular, the model illustrates the stylized fact that electoral competition between political parties often creates a bias towards centrist policies. Parties seek to place themselves on a political position where they maximize the number of voters located closer to them than any other party along an ideological spectrum. This theory has strong empirical support (Congleton and Shughart, 1990; Congleton and Bennett, 1995; Poole and Daniels, 1985), while it has been criticized for its lack of predictive power for multi-dimensional issues and multi-peaked preferences (Black, 1948; Plott, 1967).

Apart from casting their vote, individuals can express their preferences by joining forces with like-minded individuals to form interest groups. However, Olson (1965) pointed out that the formation of interest groups and collective action may be hindered by the free-rider problem known from the theory of public goods. Also, he argued that two conditions make the formation of interest groups more likely: a small number of persons that act collectively and the existence of "selective incentives" to penalize free-riders and/or to reward those who contribute their share of the cost of collective action.

While collective action can be beneficial to individual group members, since they are more likely to achieve their goals, there is also a reason why collective action may have negative effects based on Tullock's (1967) seminal work on rent-seeking. Broadly, one can say that when rents are available, interest groups may try to influence the government in the formulation of policies. These efforts can take the form of lobbying activities or explicit

ensures that people do not have to pay taxes for activities they are not willing to support. But it would also prove costly to work out arrangements for collective support. He concluded that a slight movement away from unanimity is a reasonable compromise. These reflections can be found in Wicksell's book *Investigations in the Theory of Public Finance* published in 1896.

⁹This theory is based on Hotelling's (1929) finding that a street with two shops will find both shops right next to each other at the halfway point. In this way, each shop will serve half the market.

monetary transfers. However, since these expenditures do not increase the resources available in a society, rent-seeking expenditures are a social waste.

One of the key propositions in public choice is that the formulation of public policy and in particular the spending behavior of the government is strongly influenced by election dates. Nordhaus (1975) contended that political parties act purely “opportunistically” by creating desirable economic conditions before elections through expansionary monetary policy and deficit spending. These manipulations create macroeconomic cycles that may aggravate business fluctuations. Hibbs (1977) argues in favor of a “partisan approach” to political business cycles. In particular, he assumes that politicians manipulate the economy to favor their clientele. Left-wing parties representing the poor prefer low unemployment and high inflation, while right-wing parties representing the rich prefer the opposite combination. Hence, this theory suggests a relationship between the ideological position of a party and macroeconomic variables, while constant changes in the government should induce a business cycle.

Other notable contributions to the theory of public choice not reviewed here for brevity are: the theory of bureaucracy by Niskanen (1971), Brennan and Buchanan’s (1980) portrayal of a Leviathan government that exploits the fiscal commons, as well as Buchanan and Tullock’s (1962) contributions to constitutional political economy. While the first articles on public choice theory were published in the 1950s, it took nearly three decades until this field became established and well-recognized. Even in recent years, different kinds of criticism have been directed at this school of thought. Political scientists such as Green and Shapiro (1994) claim that public choice only represents a restatement of existing knowledge in rational choice terms and therefore does not allow for any new insights. Moreover, representatives of the Chicago school argue that individuals reach Pareto-efficiency with regard to political decisions and that the institutions that are in place are the most efficient ones (Wittman, 1995).

Some authors have even reflected on a possible replacement of public choice theory by a new paradigm. The result of this discussion has been that “Political Economics” does provide an extension of public choice theory in some directions but does not displace the entire set of theories (Alesina et al., 2006; Blankart and Koesters, 2006; Ursprung, 2003). Despite these attacks one has to acknowledge that public choice theory has greatly contributed to our understanding of politics and that many of the hypotheses that are put forward have some empirical support. These findings will be discussed in more detail in the next section.

1.2.3 Determinants of public expenditures

The public choice literature investigates many different aspects of politics. This is especially true with regard to factors that have an impact on economic and fiscal policy. One issue that has received considerable attention are the determinants of the size and composition of government spending. The following paragraphs portray the main insights from this literature even though a fully exhaustive overview is hardly possible.

The first attempts at explaining the variation in the size of the public sector were made in the late 19th and early 20th century and rely on ‘empirical regularities’ rather than rigorous econometric investigations. Wagner (1883, 1911) argues in an early formulation in 1883 and a final statement in 1911 that the government grows with a prospering society. He bases this argument on the assumption that the income elasticity for public services and goods is larger than one. Hence, the demand for public services and goods rises disproportionately with people’s average income. This is especially attributed to an extension of the scope of government intervention in the cultural sphere. On the other hand, Brecht (1932) puts forward the hypothesis that increasing urbanization and the consequential rise in population density creates congestion costs in the consumption of publicly provided goods and services.

Three decades later, Peacock and Wiseman (1961) contended that the growth in public expenditures can be attributed to discretionary events such as the two world wars. The main argument is that increases in public expenditures under these exceptional circumstances could be more easily implemented than in times of peace. However, cutbacks did not occur at a later point in time. From an empirical perspective, Peacock and Wiseman’s “displacement effect” finds little confirmation (Henrekson, 1990). With regard to Wagner’s law, there are a number of cross-country and time-series investigations with mixed results (Akitoby et al., 2006; Chang, 2002), while the literature provides strong evidence for Brecht’s hypothesis (Hortas-Rico and Solé-Ollé, 2010).

Modern contributions extend these basic arguments in various directions and put a strong emphasis on institutional and political factors in line with the political economy perspective. One factor that has repeatedly been analyzed in this context is government ideology. However, the empirical literature provides weak evidence or no evidence that left-wing governments entertain larger public sectors (De Haan and Sturm, 1997; Katsimi, 1998) or that government ideology influences the relative importance of expenditure categories (Bräuninger, 2005; Potrafke, 2010; Van Dalen and Swank, 1996).

Another strand of the literature emphasizes the ‘common pool’ problem in relation with public spending. If the public budget is regarded as a common pool for political actors, these individuals that are driven by re-election motives have an incentive to target resources to budget items that benefit their constituencies (Buchanan and Tullock, 1962; Weingast et al., 1981). Each group benefits from specific programs of public spending, whereas the costs of these special expenditure programs are spread over the whole population. Hence, if govern-

ments are made up of multi-party coalitions and especially if the number of parties involved is high, public sector size has been shown to be larger than with single-party governments (Roubini and Sachs, 1989). However, recent contributions that replicate earlier investigations of this question cast doubt on the stability of such an effect (De Haan and Sturm, 1994; Gilligan and Matsusaka, 1995). As a way to resolve this conflictive evidence, a study from Switzerland focuses on the number of ministers and finds that cabinet size is positively related with government size (Schaltegger and Feld, 2009).

The existing literature does not focus solely on the characteristics of governments and political parties, but also analyzes how characteristics of voters affect public expenditures. In a seminal contribution, Meltzer and Richard (1981) argue that the extension of suffrage to individuals in the lower income strata has induced an extension of the welfare state and thereby a growth in government size. This is explained by the fact that low-income earners are more in need of redistributive measures. The empirical evidence for the Meltzer-Richard hypothesis that is framed in the context of a median voter model is mixed (Aidt and Jensen, 2009; Borge and Ratsø, 2004; Meltzer and Richard, 1983), while it has been suggested that the causality may run from redistribution to inequality (Sinn, 1996). Recent evidence also suggests that the introduction of women's suffrage has increased social spending and thereby total government size has grown (Aidt and Dallal, 2008; Lott and Kenny, 1999). These results are rationalized by the fact that women are more risk averse and therefore express a stronger preference for insurance against adverse events in their voting behavior.

Lobbying activities by interest groups represent an additional determinant of public expenditures. According to Olson (1982) the stable general conditions after 1945 increased the mutual trust within the different interest groups and thereby partially eliminated the free-rider problem. This would imply that during the last few decades the number and power of interest groups has increased. North and Wallis (1982) agree with the fact that the growth in interest groups has induced a growth in the size of the public sector. However, in their analysis the increasing division of labor and the growth of "white-collar and managerial" employment are the central elements that have strengthened the role of interest groups.

The last decades were characterized by a considerable acceleration in the economic integration of countries. Rodrik (1998) was one of the first researchers to analyze the influence of globalization on fiscal policy and provided evidence for a positive relation between trade openness and government size. The explanation for this observation is the so-called "compensation hypothesis" suggesting that more open economies are forced to extend redistributive measures due to a higher incidence of macroeconomic shocks. This theory stands in opposition to the "efficiency hypothesis" asserting that a higher exposure to international competition in globalized markets causes a retrenchment of the welfare state and thereby a reduction in government size.¹⁰ However, a recent study (Dreher et al., 2008) fails to provide evidence for any

¹⁰The distinction between the "compensation effects" and "efficiency effects" of globalization goes back to Garrett (1995).

of the two hypotheses. Shelton (2007) conducts a more comprehensive analysis that tests all possible determinants of public expenditures simultaneously in order to avoid omitted variable bias. Shelton's analysis suggests that globalization does have an effect on the composition of public expenditures, but not necessarily on those categories that are risk-related.

The literature on the determinants of public expenditures also points out the importance of fiscal institutions and the extent of local autonomy. In an early contribution, Marlow (1988) finds that fiscal decentralization lowers government size. Fiva (2006) makes a distinction between different forms of decentralization and finds that tax revenue decentralization is associated with a smaller public sector, while expenditure decentralization is associated with a larger public sector.¹¹ The former effect is driven by a reduction in social security transfers, while the latter effect is driven by increased government consumption. Prohl and Schneider (2009) present strong evidence that countries in which revenues and expenditure responsibilities are largely decentralized show substantially lower growth in public expenditures. They also find that direct democracy at the local level has a strong negative effect on public sector growth. Moreover, Feld and Matsusaka (2003) provide evidence that mandatory fiscal referenda lead to a containment of public sector size.

The extent of local autonomy and the design of fiscal institutions are enshrined in the constitution of a country. In recent years, characteristics of constitutions that relate to voting procedures and political regimes have brought to light additional insights. The evidence suggests that presidential regimes and majority rule-based governments are characterized by smaller public sectors (Persson, 2002; Persson and Tabellini, 2004). Moreover, Persson and Tabellini (1999) test the theoretical implications of Persson et al.'s (1998) model and find that majoritarian electoral systems are associated with less expenditure on public goods. In an attempt to refine this empirical study through various measures for the degree of proportionality of electoral systems, Milesi-Ferretti et al. (2002) find weak evidence for an effect of majoritarian systems on the provision of public goods, while they find strong support for their hypothesis that governments spend more on transfers under proportional rule.

Summarizing, the existing literature on the determinants of public expenditures suggests many different links between political/ institutional factors and the size and composition of public spending. While the very early contributions from the late 19th and early 20th century highlighted the importance of non-political factors, researchers of the political economy school emphasized the role of characteristics of the government, the socio-demographic background of voters, the changing role of the nation state in a globalized world, and constitutional elements. Even though the results of empirical investigations sometimes appear contradictory, there is reason to believe that the availability of longer time series of data and the development of more sophisticated estimation techniques will serve to resolve some of these contradictions.

¹¹See Baskaran (forthcoming) for a theoretical explanation why and under which circumstances decentralization might lead to a larger government size.

1.2.4 Consequences of public expenditures

As section 1.2.1 points out, the government seeks to achieve efficiency and equity objectives by means of direct interventions in the economy. The following paragraphs portray the actual effects of such interventions based on findings in the empirical literature. A distinction is drawn between direct and indirect effects of public spending. Whereas the former relate to effects that can be immediately attributed to total public spending or expenditures in specific categories, the latter refer to the consequences of financing public expenditures.

One of the main hypotheses investigated in the literature is that high government expenditures are associated with low economic growth rates. The idea is that government interventions are a source of distortions and that a large government creates more opportunities for rent-seeking behavior of political actors. Several studies have empirically tested this direct link between expenditures and economic growth producing mixed results (Barro, 1991; Ghosh Roy, 2009; Ram, 1986). Moreover, numerous studies dissect the effect of individual expenditure components on GDP growth such as investment spending and social expenditures. However, the empirical results do not permit a straightforward conclusion (Easterly and Rebelo, 1993; Kelly, 1997; Lindert, 1996). It has been argued that the conflictive evidence on both accounts can be attributed to a high sensitivity of the results to model specification (Levine and Renelt, 2002). In contrast, the literature concerned with the effect of public spending on unemployment rates provides more clear-cut evidence for the impairment of economic activity due to large governments (Christopoulos and Tsionas, 2002; Feldmann, 2006).

The most obvious question with regard to expenditures on social protection, health, and education is whether they support the goals that they are intended for.¹² Recent findings illustrate that public health spending promotes people's self-assessed health status (Rivera, 2001) and lowers mortality rates (Gupta et al., 2002), while an increase in education expenditures is associated with improvements in accessibility and attainment rates in schooling (Gupta et al., 2002). Moreover, the literature suggests that social security expenditures represent an effective measure to reduce poverty (Schram, 1991). Even though these results create the impression that specific types of expenditures are effective, the more interesting question is whether the benefits outweigh the costs. This is unfortunately a question that has received comparatively little attention. One reason for this neglect is the difficulty of quantifying the benefits of improved health or higher social mobility in monetary terms.

As a way to address this shortcoming, scholars have lately extended the analysis of the impact of public spending by estimating its effect on subjective well-being. This allows empirical researchers to capture an overall effect of public expenditures that includes the benefits

¹²There are two reasons why such investigations are mostly limited to these three expenditure categories. First, the objectives pursued with public spending on education, health and social protection are straightforward and data on health education, and the income distribution is widely available. Second, since there continues to be strong disagreement over the appropriate size and scope of the welfare state (Tanzi and Schuknecht, 1997), the effectiveness of the welfare state is of particular interest.

derived from the public provision of goods and services as well as the costs imposed through higher levels of taxation. While Bjørnskov et al. (2007) find in a cross-country study that life satisfaction decreases with government consumption, other studies (Di Tella and MacCulloch, 2005; Ram, 2009) suggest that there is no effect of total government spending on well-being. Moreover, researchers who study the influence of specific budgetary components on well-being present equally conflictive evidence. Veenhoven (2000) finds no significant correlation between social security expenditures and well-being in a world-wide set of countries, while Ouweneel (2002) fails to provide evidence that at least the unemployed experience higher average well-being. On the other hand, Di Tella et al. (2003) find that higher unemployment benefits have led to an increase in national well-being in European countries. Finally, Kotakorpi and Laamanen's (2010) investigation reveals that there is a positive effect of health expenditures on subjective well-being when controlling for respondents' health status.

From a political economy perspective, one specific result with regard to the consequences of public expenditures is worth mentioning. A study by Levitt and Snyder (1997) provides evidence in favor of the hypothesis that incumbents win votes and possibly even elections by means of increasing public spending. In this context, Evans (2006) finds that the significance of this effect differs between parliamentary and presidential democratic systems. This speaks in favor of the political business cycle theory as these studies confirm that politicians have an incentive to increase expenditures prior to elections.

For the sake of completeness, one should also be aware of the indirect effects of public spending that relate to the financing of expenditures by the government. Apart from one-time government revenues collected in relation with the auctioning of specific licenses or privatizations, the government has two main financing instruments at its disposal, i.e. levying taxes and taking on public debt. When public expenditures exceed public revenues, the government is forced to take on debt in order to finance the share of expenditures that is not covered by the revenues. While this can be a reasonable measure, when the economy is in recession, public debt can also have negative consequences especially for the future generations that will bear the burden of fiscal consolidation.

Even though deficits may cover some part of public expenditures, the lion's share of the government's financial means stems from taxation. However, the public finance literature emphasizes that most forms of taxation (except for a poll tax) create distortions. As an example, taxes levied on labor income affect individual's labor supply decisions and may cause them to supply a non-optimal amount of labor (Kaplow, 2007). In relation to entrepreneurial activities, it is argued that taxes have a detrimental effect on the profitability of private investment (Alesina et al., 2002). The creation of these kinds of inefficiencies is particularly notable when taking into account that government intervention is actually for the most part intended to promote efficiency (see section 1.2.1). In addition, the fact that the government

claims a certain share of people's income or wealth and spends it on behalf of these individuals implies that people's freedom in spending their resources is reduced.

Summarizing, public expenditures have various influences on the economy. While the evidence in favor of an impairment of macroeconomic efficiency is mixed, the same is true with regard to the influence on life satisfaction. However, on a lower level of aggregation, there is some evidence that the welfare state promotes subjective well-being and that specific aims such as better health, the reduction of poverty and an increase in social mobility are achieved. These results are noteworthy since the use of data on subjective well-being permits researchers to test for a net effect of public expenditures taking into account both benefits and costs. Finally, one should be aware of the indirect effects created through the financing of public expenditures with taxes and debt. This includes the deadweight loss of taxation, the reduction in individual freedom, and the impairment of intergenerational equity.

1.3 Outline of this dissertation

The objective of this dissertation is to extend the literature reviewed in the previous sections along different dimensions. More specifically, chapter 2 can be assigned to the literature on the effects of public expenditures (section 1.2.4), whereas chapters 3 and 4 relate to the literature on the determinants of public expenditures (section 1.2.3). The three chapters are not only linked with each other due to their focus on public expenditures but also the fact that the political economy perspective outlined in section 1.2.2 reappears in each chapter.

Chapter 2 empirically analyzes how the size and composition of public expenditures affects people's subjective well-being and thereby contrasts predictions derived from welfare economics and the public choice school with each other. The analysis is refined by drawing a distinction between different population groups and incorporating institutional characteristics. In addition, it is empirically tested whether public resources are misallocated across expenditure categories from the viewpoint of subjective well-being.

As an extension to chapter 2, chapter 3 investigates one particular channel that may explain how a distortion in public expenditures is created. In a rent-seeking framework, it is derived how bribes paid to bureaucrats and politicians induce a misallocation of expenditures. Thereafter, the second part of chapter 3 empirically investigates the influence of corruption on the composition of public expenditures. Chapter 4 analyzes whether policy-makers have shifted public education expenditures between the primary, secondary, and tertiary education sector for efficiency reasons. These considerations are first illustrated in a theoretical model that assumes a Leviathan government. Finally, the empirical part of chapter 4 tests whether globalization indeed has an effect on the composition of public education expenditures.

Chapter 2

The Size and Composition of Government Spending in Europe and Its Impact on Well-Being

2.1 Introduction

The fact that European governments have grown dramatically since the end of World War II cannot be questioned. In 1960, government expenditures on average amounted to 27 percent of output, while in recent years their average size has reached almost half of the GDP (Mueller, 2003; Persson, 2002). In light of the heavy tax burden that a representative European citizen is consequently facing, it needs to be established why European governments can raise and enforce a claim to such a considerable share of private income. The benefit principle of taxation provides an answer to this question by stating that tax collection by a government is justified if society at large receives an adequate reimbursement in the form of publicly provided goods and services (Lindahl, 1919). Based on these considerations the empirical analysis in this paper tests whether the benefit principle is fulfilled by studying the net effect of government size on subjective well-being.

How well-being is affected by the public sector depends on the objectives and motives of politicians and bureaucrats. The traditional welfare economic view assumes the existence of a benevolent and omniscient social planner who exclusively seeks to maximize social welfare and ensures the achievement of a first-best allocation of resources. However, this view has been challenged by the public choice school, which emphasizes agency problems as the source of inefficient outcomes. One of the main ideas of this school of thought is that politicians and bureaucrats pursue personal interests that give rise to a deviation from the optimal size of the public sector (Mueller, 2003). Thus, by exploring how government size affects life satisfaction one is indirectly testing whether this kind of self-serving behavior is observed in reality.

To date, only few researchers have investigated the relationship between public spending and well-being. Firstly, Bjørnskov et al. (2007) conduct a worldwide cross-country study and find that life satisfaction decreases with government consumption, whereas government capital formation and social spending appear to be irrelevant to subjective well-being. This would suggest that the aforementioned benefit principle of taxation is violated with respect to government consumption.¹ However, Di Tella and MacCulloch (2005)² find a positive but insignificant effect of government consumption on life satisfaction in a panel analysis for ten OECD countries. Hence, the existing literature presents ambiguous findings with regard to government consumption.

Another group of researchers studies the influence of specific types of government expenditures on well-being and presents equally conflictive evidence. Veenhoven (2000) investigates the relationship between social security expenditures and well-being for a worldwide set of countries and finds no significant correlation between the two. As an extension, Ouweneel (2002) tests the hypothesis that at least the unemployed should experience higher average well-being in nations that spend a large percentage of GDP on welfare. However, he finds that while larger welfare states generally do achieve lower levels of income inequality, this does not have a significant effect on the subjective well-being of the unemployed.

On the other hand, there are three studies suggesting that specific components of public spending do affect subjective well-being. Radcliff (2001) presents cross-country evidence for a statistically significant positive effect of generous welfare spending on average happiness. In addition, Di Tella et al. (2003) find that higher unemployment benefits have led to an increase in national well-being in European countries over the 1975 - 1992 period. Finally, Kotakorpi and Laamanen's (2010) investigation reveals that there is a positive effect of health expenditures on subjective well-being when controlling for respondents' health status. Summarizing, there is some evidence that not only government consumption but also the magnitudes of individual expenditure components influence well-being, even though these studies are ambiguous regarding the significance of the observed effects.

In line with the aforementioned studies and other investigations in the field of Happiness Research, this paper uses life satisfaction as a proxy for well-being. More specifically, it draws on a rich micro dataset based on the Eurobarometer Survey Series and covers twelve EU countries³ from 1990 to 2000. Bjørnskov et al.'s (2007) study suffers from the shortcoming that the heterogeneity in a world-wide cross-sectional study of countries such as Venezuela, Vietnam, Zimbabwe, Tanzania and Uganda cannot be captured by just a few control variables.

¹On the other hand, the benefit principle concerning social transfers and capital formation is fulfilled. A statement with regard to total spending cannot be made since the authors do not include total expenditures in the estimations.

²Di Tella and MacCulloch (2005) use government consumption as a control variable when they investigate the impact of inflation and unemployment on the well-being of left- and right-wing voters.

³The countries included in the dataset are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Sweden and the UK.

In addition, it is questionable whether the dependent variable of subjective well-being can be compared across such a heterogeneous set of countries (Diener and Oishi, 2006)⁴. Therefore, this study regards a relatively homogeneous set of EU countries and uses country fixed effects in the regression analysis. Moreover, as an extension to previous studies the analysis accounts for nonlinear effects given that the neglect of nonlinearities may be responsible for the ambiguity in the existing literature.

This paper suggests that the effect of government size on well-being follows an inverse U-shape and that the effect of public sector size on well-being depends positively on the extent of decentralization and negatively on the level of corruption. In addition, left-wing voters and low-income earners appear to be the main beneficiaries of a large public sector. Further insights are gained by considering components of public spending that characterize the welfare state in a wider sense: education, health and social protection expenditures (Blomquist and Christiansen, 1995; Boadway and Marchand, 1995⁵). These additional estimations bring to light that governments in the EU could have achieved higher levels of well-being by spending more on education and less on social protection. Summarizing, this paper makes a contribution to the literature by providing a comprehensive analysis on the impact of both the size and the composition of public expenditures on well-being while taking into account respondents' characteristics and institutional factors.

The remainder of this paper is structured as follows: Section 2.2 gives an overview of theoretical considerations and states four hypotheses. Section 2.3 describes the dataset and presents the empirical strategy, while section 2.4 reports the results for the estimations and three robustness checks. Finally, section 2.5 concludes the analysis.

2.2 Theoretical considerations

According to the traditional welfare economic view, a benevolent social planner representing the government ensures a first-best allocation of resources. For instance, Pigou (1947) argues in favor of a corrective tax in the presence of externalities, whereas Samuelson (1954) states the condition for the optimal quantity of a public good. If public decision-makers comply with these optimality conditions, marginal costs and marginal benefits of government size just outweigh each other in equilibrium. These considerations are summarized in the following *ceteris paribus* statement:

⁴This paper points out that cultural factors such as the desirability of pleasant emotions or self-criticism influence reports of subjective well-being. Thus, nations such as Japan have lower scores than one might expect based on observable factors such as income.

⁵Both groups of authors argue that governments primarily seek to achieve their redistributive goals through public expenditures on education, health care and pensions.

Hypothesis 1a: *Well-being is not affected by government size.*

The underlying assumptions of the traditional welfare economic view, i.e. perfect information and welfare-maximizing governments, are discarded by proponents of the public choice school. Instead, they highlight inefficiencies and sub-optimal outcomes caused by the propensity of politicians and bureaucrats to maximize their personal utility. As a result, the public choice school suggests that the public sector is excessively large and that resources are misallocated.

The literature describes several causes for these inefficiencies. Many of them can be attributed to specific interest groups and the ways in which they succeed in pushing through their interests. In his seminal contribution, Tullock (1959) addresses the existence of the logrolling phenomenon, which may lead to the implementation of public projects that benefit specific interest groups but not society at large. In addition, Persson and Tabellini (2000) discuss models focusing on legislative bargaining, lobbying and electoral competition that illustrate additional mechanisms for an inefficient and asymmetric allocation of publicly provided goods and services.

The behavior of bureaucrats and politicians provides another cause for excessive and inefficient public spending. Firstly, Niskanen (1971) puts forward a theoretical model illustrating bureaucrats' incentive to expand budgets beyond the social optimum since their non-pecuniary goals such as prestige and power are positively correlated with larger budgets for the provision of public goods. Hence, in the presence of an information asymmetry concerning the cost function of the public good the bureaucrat demands the largest budget, which the politician would approve of.

As an alternative to this, Brennan and Buchanan (1980) depict the government as a Leviathan that maximizes its revenue by exploiting the tax base to the full extent. Eventually, this leads to excessively large budgets. Finally, Nordhaus (1975) discusses the existence of political business cycles where politicians - portrayed as maximizers of re-election probabilities - implement expansionary fiscal policies (such as increases in government spending) before elections in order to boost their popularity. Since it is unpleasant for politicians and voters to pursue fiscal consolidation after the elections, governments remains excessively large.⁶ It follows that:

Hypothesis 1b: *Well-being is negatively affected by government size.*

As with every other policy variable, the size of the public sector is likely to affect well-defined population groups in different ways. The most important individual characteristics in this context are ideology and relative income. Firstly, a large public sector is more likely to be welcomed by individuals who express a preference for left-wing policy, i.e. large government

⁶For empirical evidence regarding political business cycles in government spending see Persson (2002) and Schuknecht (2000).

size. Secondly, people who earn a relatively low income should benefit more from a large public sector as they are more likely to receive transfers and bear a comparably lower tax burden than high-income earners. Both propositions can be traced back to Meltzer and Richard's (1981) theoretical explanation for the size of government by means of a median voter model. In sum, these considerations motivate the following hypothesis:

Hypothesis 2: Government size has a more positive impact on well-being for people who have left-wing ideological preferences or who rank low in the income distribution.

Additionally, it is worthwhile to take into account the role of institutional factors. In particular, the empirical analysis incorporates two factors, which are related to the efficient allocation of public resources. The first one is corruption, which is defined as the 'misuse of public office for private gain' (Svensson, 2005, p.20). The inclusion of corruption in the regression analysis can be justified by referring to the evidence on corruption-induced distortions in the allocation of public funds (Gupta et al., 2001; Mauro, 1998).

Secondly, expenditure decentralization is likely to play a role in the relationship between government size and well-being even though the effect may go either way. Positive effects are usually attributed to an increase in efficiency through 'yardstick competition' (Besley and Case, 1995) and a better targeted satisfaction of people's preferences (Oates, 1972), whereas opponents of decentralization emphasize a more difficult coordination of efforts (Prud'homme, 1995). In hypothesis 3, the dominance of the benefits of decentralization is presumed since there is previous evidence for a positive effect of decentralization and local autonomy on well-being (Bjørnskov et al., 2008; Frey and Stutzer, 2000a⁷). These considerations imply:

Hypothesis 3: Government size has a more positive impact on well-being in countries characterized by a high extent of expenditure decentralization or a low level of corruption.

The final hypothesis explores whether the composition of the public budget matters. Previous investigations of this question (Di Tella et al., 2003; Ouweneel, 2002; Radcliff, 2001; Veenhoven, 2000) have only considered the effect of social transfers, while we embrace a wider definition of the welfare state by also taking into account the public provision of private goods such as education and health. These can be viewed as in-kind transfers to low-income earners. Based on these considerations we formulate the following hypothesis:

Hypothesis 4: For a given size of the public sector higher well-being can be observed when a large share of the budget is spent on education, health and social protection.

⁷Frey and Stutzer (2000a) find that local autonomy of Swiss cantons leads to higher well-being through political outcomes that are closer to people's preferences and procedural utility from political participation.

To summarize, the objective for the rest of the paper is to test four hypotheses, which relate to the impact of public sector size on well-being. To allow for more depth in the analysis we make a distinction between several population groups and factor in different characteristics of the government and the shares of public spending that are allocated to redistributive purposes.

2.3 Data and model specification

2.3.1 Data description

In order to test the hypotheses stated in the previous section, the empirical analysis relies on a dataset covering 153,268 respondents from twelve EU countries over the time period between 1990 and 2000⁸. The data for the individual-level variables are derived from the Eurobarometer Survey Series. Next to the dependent variable (life satisfaction) this includes a number of control variables: gender, age, ideological preferences, relative income, marital status, education level, employment status and the number of children.

The sample of respondents for each Eurobarometer Survey is drawn based on a multi-stage, random probability procedure and is hence designed to convey a representative picture of the population aged fifteen years and over in the EU member states. The interviews were organized by research firms under the direction of the European Commission and were conducted in a face-to-face setting in people's homes and in the appropriate national language.

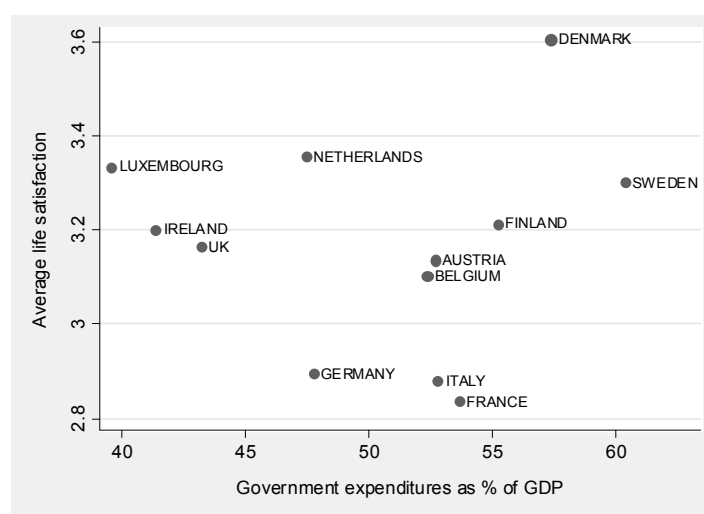
The data for the life satisfaction variable is based on the question 'On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?' (the small number of respondents answering 'Don't know' and 'No answer' is ignored) measured on a scale that runs from 1 to 4, where a higher value indicates a higher level of satisfaction.

Several findings in the economic and psychological literature justify using this data. First, there is mounting evidence that self-reported well-being is correlated with physical reactions such as the frequency of smiling (Ekman et al., 1990; Pavot et al., 1991) or heart rate and blood pressure reactions to stress (Shedler et al., 1993). Second, people's perceptions of their own well-being coincide with recall of positive events in life (Seidlitz et al., 1997) and reports of relatives and friends (Diener, 1984; Sandvik et al., 1993). Third, experimental studies reject the hypothesis that subjects bias their response upwards due to social desirability (Konow and Earley, 2008). Finally, data on subjective well-being has been shown to be negatively correlated with suicide in individual-level multivariate regressions (Daly and Wilson, 2009).

⁸The analysis is limited to this time period for several reasons. First, OECD data on government spending is not available before 1990. Second, some variables in the Eurobarometer Survey Series are not available after 2000: The number of children is not recorded from 2001 to 2003, while the same applies to relative income from 2004 to 2007.

Figure 2.1 displays values for life satisfaction and government size for twelve EU countries averaged across the time period from 1990 to 2000 (and the individuals in a particular country). Denmark is clearly identified as the country where people are on average most satisfied with their lives with an average value of 3.6 on a scale that runs from 1 to 4. At the lower end of the distribution are Germany, Italy, and France with averages of at most 2.9. The order in which the countries appear in the bar-chart is quite stable over time and across other surveys such as the World Values Survey or the European Social Survey.

Figure 2.1: AVERAGES OF LIFE SATISFACTION AND GOVERNMENT SIZE, 1990 - 2000

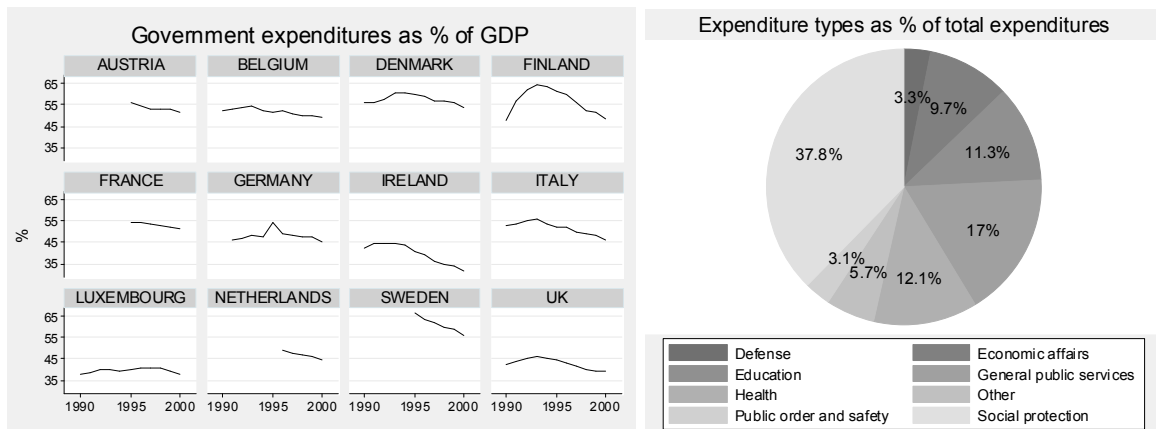


Sources: Eurobarometer, OECD National Accounts

In addition, figure 2.1 illustrates the large cross-country variation in terms of government size across the twelve EU countries in the sample. More specifically, it becomes evident that there are two extreme types of government in the EU: Scandinavian welfare states and Anglo-Saxon governments with an average of about 57 and 42 percent of GDP, respectively. Luxembourg as a particularly small country represents an exception to this classification. Figure 2.2 provides an overview with respect to the size and functional composition of public expenditures for the twelve countries. The time series plots on the left reveal that there is also some variation over time in the degree of government involvement. For Finland, Sweden and Ireland this variation amounts to up to 10 percentage points in the time period considered here.

The pie chart on the right of figure 2.2 disaggregates public expenditures according to the purposes on which they are spent and displays unweighted averages for the twelve countries across the relevant time period. Social protection expenditures represent the highest share of public spending (37.8%), followed by expenditures on general public services, health and education. Smaller categories with a share of less than 10% include economic affairs, public order and safety, and defense. The residual category sums up spending on recreation, culture

Figure 2.2: SIZE AND COMPOSITION OF GOVERNMENT EXPENDITURES, 1990 - 2000



[1] The time-series plots on the left-hand side illustrate the evolution of government size over the period from 1990 to 2000 for each of the twelve EU countries. The pie chart on the right-hand side depicts shares of the respective expenditure categories averaged over the twelve EU countries and the period from 1990 to 2000.

Source: OECD National Accounts

and religion (2.2%), environmental protection (1.3%) and housing and community amenities (2.1%). Tables 2.7 to 2.10 in the appendix provide a more detailed overview of the data and its sources as well as definitions of the expenditure categories. In the estimations in section 2.4, the focus is on education, health and social protection expenditures which on average sum up to more than 60% of the total budget.

The set of controls at the country-level includes three macroeconomic variables that are taken from the OECD databases. First, all estimations include the log of GDP per capita owing to the long tradition of investigations regarding the effect of a nation’s prosperity on well-being (Easterlin, 1974; Oswald, 1997). Second, unemployment rates are incorporated into the regression analysis given that Lucas et al. (2004) find a large and persistent effect of unemployment on life satisfaction. It appears that even people, who find a job after being unemployed for a while, do not return to their initial level of life satisfaction. In this context, one has to keep in mind that the unemployment rate also captures negative effects on well-being through social problems such as crime (Edmark, 2005)⁹ and social exclusion. The third macroeconomic variable to be found in all estimations is inflation as a result of Di Tella et al.’s (2001) evidence that high inflation depresses well-being in the United States and Europe, even if the effect is smaller than for unemployment.

The political and institutional environment related to the efficient satisfaction of voters’ preferences is also likely to affect well-being as suggested by Hudson (2006) and Wagner et al. (2009).¹⁰ The first variable of interest is corruption which is measured by means of the

⁹Using a panel of Swedish counties ranging from 1988 to 1999, she finds that unemployment has a significantly positive effect on property crimes such as burglary, car and bike theft.

¹⁰Hudson (2006) provides evidence that institutional performance and the resulting level of trust in institutions has a direct impact on subjective well-being in EU countries, while Wagner et al. (2009) find that

Corruption Perceptions Index (CPI)¹¹ and for which data is available on an annual basis. In order to facilitate the interpretation of the slope coefficients in the estimations, this measure is rescaled as Corruption = 10 - CPI score. The second institutional factor that is considered is the extent of decentralization measured as the share of sub-national expenditures in total public expenditures. Data on expenditure decentralization is provided by the World Bank as part of the Fiscal Decentralization Indicators.

2.3.2 Empirical strategy

The regression model that is best suited to this analysis is an ordered response model, where the dependent variable - people's observable satisfaction with life - is discrete and defined on a finite ordinal scale, i. e. $\text{Lifesat}_{itc} \in \{1, 2, 3, 4\}$. The first part of the ordered response model consists of a structural equation with respect to the latent, continuous dependent variable:

$$\text{Lifesat}_{itc}^* = \alpha + \beta \text{Individual}_{itc} + \gamma \text{Expenditures}_{tc} + \delta \text{Macro}_{tc} + \omega_t + \mu_c + \epsilon_{itc}, \quad (2.1)$$

where the subscripts represent individuals, time periods and countries. Expenditures_{tc} represents both total government expenditures as a share of GDP as well as expenditure subcategories as a share of total expenditures, while ϵ_{itc} represents the error term which we assume to be i.i.d. and normally distributed. Therefore, we are estimating an ordered probit model. Individual_{itc} includes a number of characteristics of the respondents such as gender, age, relative income, ideological preferences, marital status, education level, employment status and the number of children.

On a country level, Macro_{tc} includes the log of GDP per capita, unemployment rates and inflation rates.¹² In addition, all regressions include time fixed effects ω_t in order to control for common exogenous shocks, an intercept α , and country fixed effects μ_c . Country fixed effects are included due to the available evidence that measures of subjective well-being are not internationally comparable (Diener and Oishi, 2006). In some of the regressions nonlinear relationships between government expenditures and life satisfaction are tested by means of interactions with institutional factors and a quadratic government expenditures term. These are not explicitly specified in equation 2.1 to save space.

The second part of the ordered response model (equation 2.2) is an observation rule for the ordinal dependent variable, which relates the observable dependent variable to the latent

institutional quality measured by the rule of law, well-functioning regulation and low corruption has a positive effect on people's satisfaction with democracy. This may lead to higher subjective well-being in general.

¹¹The CPI is a 'poll of polls' using information from up to 12 individual surveys. Country scores correlate strongly with other available indexes. For further details on its construction see Treisman (2007). Data reaching back to 1995 for a large number of countries are available at http://www.transparency.org/policy_research/surveys_indices/cpi.

¹²Note that even though the dataset does not include respondents' absolute income, the simultaneous inclusion of individual income quartiles and GDP per capita allows us to approximate individual income levels.

variable. It simply spells out how Lifesat_{itc} changes its value if Lifesat_{itc}^* crosses a fixed given threshold τ_j :

$$\text{Lifesat}_{itc} = \begin{cases} 1, & \text{if } \text{Lifesat}_{itc}^* \leq \tau_1 \\ 2, & \text{if } \tau_1 < \text{Lifesat}_{itc}^* \leq \tau_2 \\ 3, & \text{if } \tau_2 < \text{Lifesat}_{itc}^* \leq \tau_3 \\ 4, & \text{if } \tau_3 < \text{Lifesat}_{itc}^* \end{cases}. \quad (2.2)$$

The estimation of these models in section 2.4.1 is followed by three robustness checks that involve the exclusion of outliers, the inclusion of economic openness¹³ and OLS estimations (section 2.4.2). The least-squares estimations have the advantage that the interpretation of the coefficients is more straightforward than for ordered probit estimations.

2.4 Estimation results

2.4.1 Baseline regressions

The empirical analysis is subdivided into three main parts: estimations for total public spending including nonlinear effects, regressions with regard to expenditure subcategories and finally three robustness checks. The results for the first set of estimations are summarized in table 2.1, where the estimations differ in the sense that the nonlinear terms are added consecutively. To begin with, model 1a represents a baseline estimation without any nonlinear terms, while models 2a to 7a each take into account different combinations of interaction and quadratic terms.¹⁴ Since there are some missing observations for the expenditure decentralization variable and since corruption data is only available as of 1995, models 3a to 7a rely on a lower number of observations than models 1a and 2a.

We start the interpretation of table 2.1 by pointing out that the coefficients of the control variables are in most cases significant, while their signs are largely in line with our expectations. On an individual level, people's gender, age, relative income, ideological preferences, marital status, education level, employment status and their number of children have a significant impact on subjective well-being as pointed out in previous studies. In this respect models 1a to 7a provide a very coherent and robust picture. With regard to the variables at the country level, the log of GDP per capita and government expenditures have a positive linear impact on well-being. In addition, a higher unemployment or inflation rate has a significantly negative impact on well-being, while the former even goes beyond the effect of one's

¹³Economic openness is not included in the baseline estimations due to potential multicollinearity.

¹⁴Expenditure decentralization and corruption do not enter any of the models simultaneously, since there is a strong negative correlation between the two with $\rho = -0.6$.

own employment status. Thus, unemployment reduces well-being even for employed people as they may perceive their own job to be at stake.

Now let us turn to the interaction terms at the top of table 2.1. First of all, relative income does not have a significant effect on the relationship between public sector size and well-being since the coefficients for the relevant interaction term are insignificant in models 2a, 5a, 6a and 7a. On the other hand, the coefficients for the interaction with ideological preferences are highly significant and have the correct signs with respect to hypothesis 2. This suggests that government size has a more positive impact on subjective well-being for people with left-wing political preferences.

Secondly, the coefficient for the interaction between government expenditures and expenditure decentralization is significant at the 1% level. Hence, government size has a more positive effect on well-being in countries that allow for a higher degree of local autonomy. Finally, the interaction term with regard to corruption has the expected negative sign and is significant at the 10% or 1% level, respectively. Model 7a additionally reveals a highly significant negative quadratic term for government expenditures. This suggests an inversely U-shaped relationship and diminishing returns to government size in terms of well-being.

The above statements only refer to statistical significance, while we have not been able to say anything about the coefficients' economic significance. Given that the magnitudes of the coefficients have no meaningful interpretation in microeconomic estimations the usual procedure is to calculate marginal effects. These would for instance summarize how an increase in government size affects a person's probability to be 'very satisfied' with his or her life. However, for several reasons we abstain from making these calculations and resort to the coefficients of the OLS estimations in section 2.4.2. Firstly, Ferrer-i-Carbonell and Frijters (2004) provide overwhelming evidence that results barely differ between OLS and ordered probit estimations in the context of happiness research. After all, the main difference between these two estimators is that the former assumes a cardinal interpretation of life satisfaction data, while the latter is more conservative and only presumes an ordinal ranking.

Secondly, the marginal effects that we are interested in refer to the interaction terms at the top of table 2.1. However, the calculation of marginal effects in the context of nonlinear estimations with interaction terms is much more difficult than assumed by many researchers. In this context, Ai and Norton (2003) have identified 72 articles published between 1980 and 1999 in the economics journals listed on JSTOR that use interaction terms in nonlinear models. However, none of them provides a correct interpretation of the interaction term's marginal effect. In fact, the reported results often diverge strongly from the true results. As Ai and Norton (2003) point out, these marginal effects are not calculated by standard statistical software packages such as Stata.¹⁵

¹⁵Ai and Norton have in the meantime made available the *inteff* module which does calculate these marginal effects for the binary case. For the ordered response case, no such module has become available yet (Norton et al., 2004).

Table 2.1: ORDERED PROBIT ESTIMATION RESULTS (TOTAL GOVERNMENT EXPENDITURES)

	Model 1a	Model 2a	Model 3a	Model 4a	Model 5a	Model 6a	Model 7a
Government expenditures	0.020*** (7.710)	0.021*** (7.415)	-0.044*** (-3.866)	0.055*** (8.745)	-0.045*** (-3.890)	0.056*** (8.686)	0.230*** (8.850)
Relative income		-0.001 (-1.128)			-0.000 (-0.716)	-0.000 (-0.863)	-0.001 (-1.029)
* Government expenditures		-0.003*** (-3.992)			-0.004*** (-5.254)	-0.002*** (-2.991)	-0.002*** (-2.579)
Expenditure decentralization			0.003*** (7.189)		0.003*** (7.263)		
* Government expenditures				-0.002* (-1.823)		-0.002* (-1.733)	-0.006*** (-4.581)
Corruption							-0.001*** (-6.870)
* Government expenditures ²							
Relative income	0.131*** (42.877)	0.156*** (6.956)	0.128*** (36.800)	0.147*** (35.195)	0.147*** (5.674)	0.172*** (6.017)	0.177*** (6.222)
Ideological preferences	0.073*** (18.259)	0.206*** (6.158)	0.088*** (19.336)	0.038*** (7.248)	0.290*** (7.491)	0.163*** (3.873)	0.146*** (3.463)
Expenditure decentralization			-0.113*** (-6.035)		-0.114*** (-6.099)		
Corruption				0.041 (0.776)		0.037 (0.690)	0.230*** (3.790)
Log of GDP per capita	0.281* (1.810)	0.298* (1.915)	0.803*** (2.781)	0.074 (0.231)	0.754*** (2.607)	0.140 (0.435)	1.767*** (4.404)
Unemployment rate	-0.018*** (-4.313)	-0.018*** (-4.264)	-0.025*** (-4.372)	-0.044*** (-4.101)	-0.025*** (-4.494)	-0.043*** (-4.001)	-0.028** (-2.571)
Inflation rate	-0.013*** (-3.314)	-0.014*** (-3.499)	-0.017*** (-2.937)	-0.028*** (-2.796)	-0.017*** (-3.048)	-0.030*** (-2.982)	-0.036*** (-3.477)
Male	-0.075*** (-11.672)	-0.074*** (-11.609)	-0.089*** (-12.152)	-0.084*** (-10.061)	-0.088*** (-12.050)	-0.084*** (-10.011)	-0.084*** (-10.001)
Age	-0.028*** (-23.022)	-0.028*** (-23.112)	-0.026*** (-19.141)	-0.029*** (-18.338)	-0.026*** (-19.278)	-0.029*** (-18.388)	-0.029*** (-18.415)
Age ²	0.000*** (24.491)	0.000*** (24.560)	0.000*** (21.148)	0.000*** (19.056)	0.000*** (21.260)	0.000*** (19.088)	0.000*** (19.070)

<i>Marital status</i>							
Married	0.148*** (15.657)	0.148*** (15.685)	0.131*** (12.204)	0.176*** (14.336)	0.132*** (12.240)	0.177*** (14.365)	0.176*** (14.324)
Divorced	-0.202*** (-13.155)	-0.202*** (-13.154)	-0.226*** (-12.916)	-0.158*** (-8.257)	-0.226*** (-12.924)	-0.158*** (-8.235)	-0.159*** (-8.276)
Separated	-0.305*** (-11.678)	-0.305*** (-11.655)	-0.333*** (-11.215)	-0.225*** (-6.581)	-0.332*** (-11.181)	-0.224*** (-6.554)	-0.222*** (-6.510)
Widowed	-0.100*** (-6.430)	-0.099*** (-6.400)	-0.131*** (-7.371)	-0.054*** (-2.637)	-0.131*** (-7.360)	-0.053*** (-2.594)	-0.052** (-2.550)
<i>Education till age</i>							
16 to 19 yrs	0.084*** (10.992)	0.084*** (11.027)	0.086*** (9.948)	0.077*** (7.776)	0.086*** (10.015)	0.078*** (7.820)	0.078*** (7.817)
> 19 yrs	0.137*** (13.910)	0.138*** (13.961)	0.144*** (12.242)	0.143*** (10.128)	0.145*** (12.363)	0.144*** (10.168)	0.136*** (9.572)
<i>Employment status</i>							
Unemployed	-0.609*** (-50.993)	-0.609*** (-50.972)	-0.637*** (-48.574)	-0.590*** (-37.899)	-0.637*** (-48.561)	-0.590*** (-37.871)	-0.591*** (-37.918)
School	0.108*** (8.012)	0.107*** (7.937)	0.114*** (7.391)	0.143*** (7.846)	0.112*** (7.291)	0.142*** (7.794)	0.139*** (7.664)
Retired	-0.028** (-2.313)	-0.028** (-2.299)	-0.050*** (-3.604)	0.009 (0.551)	-0.050*** (-3.590)	0.009 (0.584)	0.011 (0.693)
Home	-0.017 (-1.447)	-0.016 (-1.389)	-0.006 (-0.467)	-0.029* (-1.843)	-0.006 (-0.419)	-0.028* (-1.788)	-0.023 (-1.497)
Self-employed	-0.015 (-1.287)	-0.015 (-1.227)	-0.021 (-1.549)	-0.007 (-0.451)	-0.020 (-1.462)	-0.006 (-0.400)	-0.006 (-0.386)
<i>Number of children \leq 15 yrs</i>							
1	-0.047*** (-5.309)	-0.047*** (-5.314)	-0.041*** (-4.048)	-0.042*** (-3.575)	-0.041*** (-4.065)	-0.042*** (-3.570)	-0.043*** (-3.621)
2	-0.026*** (-2.691)	-0.026*** (-2.694)	-0.022** (-2.013)	-0.024* (-1.846)	-0.022** (-2.023)	-0.024* (-1.853)	-0.026** (-1.973)
\geq 3	-0.068*** (-4.849)	-0.068*** (-4.836)	-0.070*** (-4.419)	-0.029 (-1.512)	-0.069*** (-4.397)	-0.030 (-1.520)	-0.031 (-1.575)
Pseudo R ²	0.100	0.100	0.108	0.105	0.108	0.105	0.105
Observations	153,268	153,268	118,763	89,017	118,763	89,017	89,017

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity ² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***) ⁴ Regressions include time and country fixed-effects

To conclude, hypothesis 3 stating that government size has a more positive impact on well-being with high expenditure decentralization and low corruption cannot be rejected. Moreover, the hypothesis that government size has a more positive effect on well-being for left-wing voters cannot be rejected (first part of hypothesis 2). Hypotheses 1a and 1b are both rejected in terms of statistical significance given that we neither find that well-being is unaffected by government size nor that government size has a negative effect on well-being. Statements on economic significance follow in section 2.4.2 in the context of OLS estimations.

Table 2.2 provides an extension of the estimations in table 2.1 through the inclusion of three types of expenditures as a share of total public expenditures. This allows us to investigate the validity of hypothesis 4, which did not play a role in the previous estimations. The general structure of this new set of estimations is as follows: Models 8a to 11a analyze the linear effect of expenditure categories on well-being, while model 12a adds squared terms. In the linear specifications, education and social protection expenditures have a significantly positive impact, while health expenditures have a significantly negative effect.

The positive influence of social protection expenditures contradicts previous findings by Veenhoven (2000) and Ouweneel (2002) and confirms those by Di Tella and MacCulloch (2004) and Radcliff (2001), while the negative impact of health expenditures stands in opposition to evidence by Kotakorpi and Laamanen (2010). Most likely, this surprising result can be attributed to the fact that the dataset does not include information on individual health status and therefore, there might be a spurious correlation at work: Societies with a low average health status require high levels of health expenditures. At the same time, a low average health status implies low levels of subjective well-being.

Table 2.2: ORDERED PROBIT ESTIMATION RESULTS (EXPENDITURE SUBCATEGORIES)

	Model 8a	Model 9a	Model 10a	Model 11a	Model 12a
Government expenditures	0.019*** (7.658)	0.020*** (7.752)	0.018*** (7.109)	0.018*** (6.935)	0.024*** (7.396)
Education expenditures	0.033*** (3.296)			0.051*** (4.759)	0.253*** (2.681)
Social protection expenditures		0.008** (2.085)		0.009** (2.509)	0.080*** (3.671)
Health expenditures			-0.026*** (-3.288)	-0.032*** (-3.918)	-0.158*** (-4.051)
Education expenditures ²					-0.008** (-2.165)
Social protection expenditures ²					-0.001*** (-3.502)
Health expenditures ²					0.005*** (3.235)
Log of GDP per capita	0.300* (1.929)	0.335** (2.115)	0.413** (2.566)	0.540*** (3.306)	0.319 (1.486)
Unemployment rate	-0.016*** (-3.673)	-0.020*** (-4.667)	-0.018*** (-4.369)	-0.017*** (-3.954)	-0.021*** (-4.551)

Inflation rate	-0.016*** (-3.980)	-0.009** (-2.070)	-0.015*** (-3.748)	-0.015*** (-3.312)	-0.012*** (-2.652)
Male	-0.075*** (-11.681)	-0.075*** (-11.680)	-0.075*** (-11.656)	-0.075*** (-11.676)	-0.075*** (-11.658)
Age	-0.028*** (-23.015)	-0.028*** (-23.041)	-0.028*** (-23.028)	-0.028*** (-23.043)	-0.028*** (-23.062)
Age ²	0.000*** (24.476)	0.000*** (24.510)	0.000*** (24.496)	0.000*** (24.498)	0.000*** (24.511)
Relative income	0.131*** (42.882)	0.131*** (42.897)	0.131*** (42.916)	0.131*** (42.960)	0.131*** (42.993)
Ideological preferences	0.074*** (18.291)	0.073*** (18.226)	0.073*** (18.203)	0.073*** (18.200)	0.073*** (18.198)
<i>Marital status</i>					
Married	0.148*** (15.685)	0.148*** (15.632)	0.148*** (15.617)	0.148*** (15.622)	0.147*** (15.595)
Divorced	-0.202*** (-13.143)	-0.202*** (-13.163)	-0.202*** (-13.165)	-0.202*** (-13.158)	-0.202*** (-13.150)
Separated	-0.305*** (-11.670)	-0.305*** (-11.685)	-0.305*** (-11.680)	-0.305*** (-11.678)	-0.305*** (-11.665)
Widowed	-0.099*** (-6.399)	-0.100*** (-6.442)	-0.100*** (-6.442)	-0.099*** (-6.413)	-0.099*** (-6.398)
<i>Education till age</i>					
16 to 19	0.085*** (11.105)	0.084*** (10.956)	0.083*** (10.883)	0.084*** (10.995)	0.082*** (10.767)
> 19	0.137*** (13.880)	0.137*** (13.900)	0.136*** (13.802)	0.135*** (13.718)	0.137*** (13.868)
<i>Employment status</i>					
Unemployed	-0.609*** (-50.991)	-0.609*** (-51.014)	-0.609*** (-51.010)	-0.610*** (-51.037)	-0.610*** (-51.049)
School	0.108*** (8.003)	0.107*** (7.969)	0.108*** (8.009)	0.107*** (7.942)	0.107*** (7.947)
Retired	-0.028** (-2.296)	-0.028** (-2.325)	-0.028** (-2.319)	-0.028** (-2.311)	-0.028** (-2.300)
Home	-0.016 (-1.427)	-0.017 (-1.447)	-0.016 (-1.395)	-0.016 (-1.352)	-0.015 (-1.276)
Self-employed	-0.015 (-1.273)	-0.015 (-1.300)	-0.015 (-1.281)	-0.015 (-1.275)	-0.015 (-1.293)
<i>Number of children ≤ 15 yrs</i>					
1	-0.047*** (-5.335)	-0.047*** (-5.293)	-0.047*** (-5.303)	-0.047*** (-5.323)	-0.047*** (-5.314)
2	-0.027*** (-2.737)	-0.026*** (-2.685)	-0.026*** (-2.685)	-0.027*** (-2.747)	-0.027*** (-2.807)
≥ 3	-0.069*** (-4.901)	-0.068*** (-4.827)	-0.068*** (-4.823)	-0.068*** (-4.869)	-0.069*** (-4.933)
Pseudo R ²	0.100	0.100	0.100	0.100	0.100
Observations	153,268	153,268	153,268	153,268	153,268

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity ² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**), and 1% (***) ⁴ Regressions include time and country fixed-effects

⁵ Government expenditures are measured as % of GDP, while expenditure types are divided by total expenditures

The estimation results for model 12a reveal that the effects of education and social protection expenditures on well-being exhibit an inverted U-shape. This expresses the diminishing benefit of higher expenditures on these two purposes. Based on the estimation results for models 8a, 9a, and 11a, the hypothesis stating that respondents on average report higher well-being when a larger share of the budget is spent on education and health expenditures (hypothesis 4) cannot be rejected. In section 2.4.2, we will additionally calculate the peaks for these curvilinear relationships in the context of OLS estimations and compare them to actual spending patterns in the twelve countries included in the sample. Finally, we cannot make a meaningful statement regarding the validity of hypothesis 4 for health expenditures given that the dataset does not include information on respondents' health status.

2.4.2 Sensitivity analysis

This section presents three robustness checks that are intended to address potential shortcomings of the baseline estimations. First, we eliminate the influence of outlying observations. Denmark stands out from the rest of the sample given that its average value for government size and especially for average life satisfaction lead to an isolation in the top right corner in figure 2.1 (see section 2.3.1). Therefore, the first robustness check excludes observations for this particular country. The underlying question is whether previous estimation results are driven by the peculiarity of Denmark's public sector and its society. Table 2.3 reports estimation results for six models that already appeared in tables 2.1 and 2.2. To be more exact, models 2a to 4a and 7a from the table relating to total government expenditures and models 11a and 12a from the table on expenditure subcategories are re-estimated. Since Denmark is excluded from the sample, the number of observations drops from 153,268 to 132,945.

Compared to the results in tables 2.1 and 2.2, the signs and levels of significance for the individual characteristics and the macroeconomic variables are in principle unaffected. There are, however, some small differences with regard to the interaction terms and expenditure subcategories. First, the interaction term between relative income and government expenditures is significant at the 5 or 10% level. This implies in line with hypothesis 2 that for individuals with a higher position in the income distribution the effect of government size on well-being is lower. Second, the coefficient for the interaction term between corruption and government expenditures is insignificant in model 4b, while it continues to be significant in model 7b. Since the latter is the more complete model, it can still be argued that the results are in support of hypothesis 3 with regard to corruption.

Table 2.3: ROBUSTNESS CHECK I: EXCLUSION OF DENMARK

	Model 2b	Model 3b	Model 4b	Model 7b	Model 11b	Model 12b
Government expenditures	0.013*** (3.753)	-0.085*** (-5.595)	0.053*** (7.999)	0.241*** (9.077)	0.013*** (3.802)	0.022*** (4.766)
Relative income	-0.001** (-2.019)			-0.001* (-1.772)		
* Government expenditures						
Ideological preferences	-0.004*** (-4.791)			-0.002** (-2.260)		
* Government expenditures						
Expenditure decentralization		0.005*** (8.495)				
* Government expenditures						
Corruption			-0.001 (-1.291)	-0.005*** (-4.247)		
* Government expenditures						
Government expenditures ²				-0.002*** (-7.190)		
Education expenditures					0.057*** (4.106)	-0.055 (-0.285)
Health expenditures					-0.033*** (-3.655)	-0.133*** (-3.246)
Social protection expenditures					0.006 (1.538)	0.088*** (3.390)
Education expenditures ²						0.005 (0.591)
Health expenditures ²						0.005*** (2.805)
Social protection expenditures ²						-0.001*** (-3.323)
Log of GDP per capita	0.780*** (3.954)	0.950*** (3.008)	0.112 (0.331)	1.790*** (4.356)	0.729*** (3.648)	0.422* (1.799)
Unemployment rate	0.001 (0.145)	-0.038*** (-3.595)	-0.043*** (-3.851)	-0.028** (-2.454)	-0.007 (-0.957)	-0.016** (-2.127)
Inflation rate	-0.030*** (-5.594)	-0.010 (-1.409)	-0.033*** (-2.924)	-0.036*** (-3.193)	-0.024*** (-3.768)	-0.014* (-1.945)
Expenditure decentralization		-0.209*** (-7.630)				
Corruption			0.018 (0.325)	0.215*** (3.504)		
Male	-0.068*** (-9.919)	-0.082*** (-10.350)	-0.077*** (-8.761)	-0.076*** (-8.694)	-0.068*** (-9.955)	-0.068*** (-9.942)
Age	-0.028*** (-21.648)	-0.026*** (-17.318)	-0.030*** (-18.063)	-0.030*** (-18.141)	-0.027*** (-21.569)	-0.028*** (-21.588)
Age ²	0.000*** (23.013)	0.000*** (19.308)	0.000*** (18.772)	0.000*** (18.785)	0.000*** (22.946)	0.000*** (22.961)
Relative income	0.182*** (7.347)	0.129*** (34.274)	0.146*** (33.724)	0.200*** (6.661)	0.132*** (40.925)	0.132*** (40.930)
Ideological preferences	0.247*** (6.715)	0.091*** (18.202)	0.042*** (7.524)	0.141*** (3.176)	0.073*** (16.853)	0.073*** (16.840)
<i>Marital status</i>						
Married	0.139*** (13.657)	0.114*** (9.687)	0.170*** (13.195)	0.170*** (13.166)	0.138*** (13.583)	0.138*** (13.579)
Divorced	-0.208*** (-12.784)	-0.242*** (-12.743)	-0.161*** (-8.037)	-0.162*** (-8.068)	-0.209*** (-12.833)	-0.209*** (-12.824)
Separated	-0.312*** (-11.414)	-0.350*** (-11.086)	-0.225*** (-6.386)	-0.222*** (-6.310)	-0.314*** (-11.444)	-0.313*** (-11.429)
Widowed	-0.107*** (-6.480)	-0.148*** (-7.721)	-0.061*** (-2.878)	-0.059*** (-2.787)	-0.107*** (-6.515)	-0.107*** (-6.503)

<i>Education till age</i>						
16 to 19 yrs	0.088*** (11.071)	0.095*** (10.411)	0.083*** (7.958)	0.082*** (7.891)	0.088*** (10.992)	0.087*** (10.850)
> 19 yrs	0.138*** (13.008)	0.143*** (10.881)	0.143*** (9.621)	0.135*** (9.036)	0.136*** (12.797)	0.137*** (12.875)
<hr/>						
<i>Employment status</i>						
Unemployed	-0.629*** (-49.414)	-0.666*** (-46.988)	-0.607*** (-37.214)	-0.607*** (-37.229)	-0.630*** (-49.514)	-0.630*** (-49.525)
School	0.121*** (8.161)	0.133*** (7.583)	0.152*** (7.858)	0.149*** (7.685)	0.120*** (8.104)	0.120*** (8.113)
Retired	-0.010 (-0.763)	-0.030** (-1.976)	0.016 (0.968)	0.019 (1.129)	-0.010 (-0.815)	-0.010 (-0.805)
Home	-0.007 (-0.602)	0.003 (0.199)	-0.022 (-1.356)	-0.016 (-0.976)	-0.007 (-0.614)	-0.007 (-0.555)
Self-employed	-0.007 (-0.573)	-0.012 (-0.875)	-0.001 (-0.090)	-0.000 (-0.024)	-0.008 (-0.658)	-0.008 (-0.666)
<hr/>						
<i>Number of children ≤ 15 yrs</i>						
1	-0.053*** (-5.594)	-0.048*** (-4.413)	-0.040*** (-3.244)	-0.041*** (-3.277)	-0.053*** (-5.622)	-0.053*** (-5.624)
2	-0.035*** (-3.392)	-0.034*** (-2.853)	-0.026* (-1.891)	-0.028** (-2.015)	-0.036*** (-3.463)	-0.037*** (-3.541)
≥ 3	-0.075*** (-5.100)	-0.079*** (-4.668)	-0.025 (-1.213)	-0.026 (-1.263)	-0.076*** (-5.165)	-0.077*** (-5.232)
<hr/>						
Pseudo R ²	0.069	0.072	0.079	0.080	0.069	0.069
Observations	132,945	98,440	80,179	80,179	132,945	132,945

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity ² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***) ⁴ Regressions include time and country fixed-effects

⁵ Government expenditures are measured as a % of GDP, while expenditure types are divided by total expenditures

Third, the squared term for education expenditures is not significant in model 12b suggesting a positive linear impact of education expenditures on well-being. As an alternative robustness check, we have excluded all observations where the absolute value of the studentized residual is larger than 1.5. These additional estimation results – to be found in Hessami (2010b) – corroborate the finding that the results in tables 2.1 and 2.2 are not driven by outlying observations.

The reader may suspect that the effect of government size on well-being identified in tables 2.1 and 2.3 is due to a spurious correlation with economic openness given that people's subjective well-being is higher in more economically integrated countries owing to a specialization in the production process (Krugman and Obstfeld, 2006) or the possibility to consume more diverse goods (Broda and Weinstein, 2006). This might especially be relevant in the context of the European integration process, which accelerated at the end of the 1990s with the introduction of the Euro. In addition, several authors (Kimakova, 2009; Ram, 2009; Rodrik, 1998) have argued that more open countries may host larger governments.¹⁶ In order to eliminate the potential spurious correlation, robustness check II includes the sum of imports and exports as a share of GDP as a control variable.

¹⁶Note that another group of authors finds no correlation between public expenditures and openness (Shelton, 2007) or suspects that the observed positive correlations are driven by a third variable (Alesina and Wacziarg, 1998).

Table 2.4: ROBUSTNESS CHECK II: INCLUSION OF ECONOMIC OPENNESS

	Model 2c	Model 3c	Model 4c	Model 7c	Model 11c	Model 12c
Government expenditures	0.021*** (7.284)	-0.044*** (-3.870)	0.047*** (7.246)	0.207*** (7.577)	0.018*** (6.822)	0.024*** (7.119)
Relative income	-0.001 (-1.124)			-0.001 (-1.094)		
* Government expenditures						
Ideological preferences	-0.003*** (-3.992)			-0.002*** (-2.617)		
* Government expenditures						
Expenditure decentralization		0.003*** (7.187)				
* Government expenditures						
Corruption			-0.002* (-1.716)	-0.005*** (-4.161)		
* Government expenditures						
Government expenditures ²				-0.001*** (-5.947)		
Education expenditures					0.051*** (4.651)	0.252*** (2.668)
Health expenditures					-0.032*** (-3.812)	-0.157*** (-3.993)
Social protection expenditures					0.009** (2.454)	0.081*** (3.642)
Education expenditures ²						-0.008** (-2.157)
Health expenditures ²						0.005*** (3.144)
Social protection expenditures ²						-0.001*** (-3.466)
Log of GDP per capita	0.315 (1.348)	0.763** (2.007)	-1.051** (-2.541)	0.912* (1.749)	0.564** (2.235)	0.372 (1.159)
Unemployment rate	-0.018*** (-3.523)	-0.025*** (-4.085)	-0.071*** (-5.713)	-0.046*** (-3.523)	-0.017*** (-3.217)	-0.020*** (-3.557)
Inflation rate	-0.014*** (-3.481)	-0.016*** (-2.881)	-0.049*** (-4.346)	-0.047*** (-4.210)	-0.015*** (-3.314)	-0.012*** (-2.654)
Economic openness	-0.000 (-0.095)	0.000 (0.158)	0.005*** (4.245)	0.003** (2.496)	-0.000 (-0.124)	-0.000 (-0.222)
Expenditure decentralization		-0.113*** (-6.036)				
Corruption			0.043 (0.804)	0.210*** (3.445)		
Male	-0.074*** (-11.610)	-0.089*** (-12.152)	-0.084*** (-10.069)	-0.084*** (-10.005)	-0.075*** (-11.677)	-0.075*** (-11.659)
Age	-0.028*** (-23.113)	-0.026*** (-19.140)	-0.029*** (-18.356)	-0.029*** (-18.423)	-0.028*** (-23.043)	-0.028*** (-23.063)
Age ²	0.000*** (24.561)	0.000*** (21.148)	0.000*** (19.060)	0.000*** (19.074)	0.000*** (24.498)	0.000*** (24.513)
Relative income	0.156*** (6.949)	0.128*** (36.801)	0.148*** (35.324)	0.180*** (6.294)	0.131*** (42.946)	0.131*** (42.981)
Ideological preferences	0.206*** (6.158)	0.088*** (19.335)	0.038*** (7.232)	0.147*** (3.500)	0.073*** (18.200)	0.073*** (18.198)
<i>Marital status</i>						
Married	0.148*** (15.686)	0.131*** (12.203)	0.176*** (14.310)	0.176*** (14.316)	0.148*** (15.624)	0.147*** (15.598)
Divorced	-0.202*** (-13.154)	-0.226*** (-12.915)	-0.158*** (-8.235)	-0.158*** (-8.258)	-0.202*** (-13.158)	-0.202*** (-13.149)
Separated	-0.305*** (-11.655)	-0.333*** (-11.215)	-0.225*** (-6.583)	-0.223*** (-6.515)	-0.305*** (-11.677)	-0.305*** (-11.664)

Widowed	-0.099*** (-6.399)	-0.131*** (-7.371)	-0.054*** (-2.634)	-0.052** (-2.550)	-0.099*** (-6.412)	-0.099*** (-6.398)
<i>Education till age</i>						
16 to 19 yrs	0.084*** (11.025)	0.086*** (9.948)	0.078*** (7.806)	0.078*** (7.835)	0.084*** (10.988)	0.082*** (10.760)
> 19 yrs	0.138*** (13.962)	0.144*** (12.241)	0.142*** (9.993)	0.136*** (9.548)	0.135*** (13.720)	0.137*** (13.870)
<i>Employment status</i>						
Unemployed	-0.609*** (-50.971)	-0.637*** (-48.574)	-0.590*** (-37.914)	-0.591*** (-37.921)	-0.610*** (-51.037)	-0.610*** (-51.049)
School	0.107*** (7.937)	0.114*** (7.391)	0.142*** (7.812)	0.139*** (7.655)	0.107*** (7.942)	0.107*** (7.947)
Retired	-0.028** (-2.299)	-0.050*** (-3.603)	0.009 (0.589)	0.011 (0.702)	-0.028** (-2.312)	-0.028** (-2.301)
Home	-0.016 (-1.390)	-0.006 (-0.465)	-0.028* (-1.771)	-0.023 (-1.482)	-0.016 (-1.354)	-0.015 (-1.280)
Self-employed	-0.015 (-1.227)	-0.021 (-1.549)	-0.007 (-0.462)	-0.006 (-0.397)	-0.015 (-1.275)	-0.015 (-1.293)
<i>Number of children ≤ 15 yrs</i>						
1	-0.047*** (-5.314)	-0.041*** (-4.048)	-0.042*** (-3.580)	-0.043*** (-3.617)	-0.047*** (-5.323)	-0.047*** (-5.314)
2	-0.026*** (-2.693)	-0.022** (-2.013)	-0.025* (-1.877)	-0.026** (-1.979)	-0.027*** (-2.745)	-0.027*** (-2.806)
≥ 3	-0.068*** (-4.835)	-0.070*** (-4.420)	-0.029 (-1.505)	-0.031 (-1.565)	-0.068*** (-4.868)	-0.069*** (-4.930)
Pseudo R ²	0.100	0.108	0.105	0.105	0.100	0.100
Observations	153,268	118,763	89,017	89,017	153,268	153,268

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity ² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***) ⁴ Regressions include time and country fixed-effects

⁵ Government expenditures are measured as a % of GDP, while expenditure types are divided by total expenditures

While in models 4c and 7c in table 2.4 the coefficient for economic openness is significantly positive in line with our expectations, only few changes emerge with regard to the coefficients of the other explanatory variables. First, in model 3c the coefficient for the log of GDP per capita is negative and significant at the 5% level. However, this is most likely due to multicollinearity given that the relatively high correlation between economic openness and the log of GDP per capita ($\rho = 0.46$) is significant at the 1% level. What is most important is that the coefficients for the variables of interest at the top of table 2.4 are unaffected and therefore, we can conclude that the estimation results in section 2.4.1 are not driven by a spurious correlation with economic openness.

The final robustness check involves a re-estimation of the baseline models in tables 2.1 and 2.2 with the OLS estimator.¹⁷ The rationale behind this robustness check has been discussed in section 2.4.1: the interpretation of the coefficients is more straightforward and the results between linear and nonlinear estimations in most cases barely differ in the context of

¹⁷Another possible robustness check would involve the inclusion of tax revenues. However, if government expenditures and tax revenues are included simultaneously in the estimations, the coefficient for government expenditures is not meaningful anymore. It would simply measure whether government expenditures that are financed with debt, privatization income or other non-tax revenues contribute to people's well-being.

subjective well-being. The main results from the baseline estimations are again confirmed and only few differences emerge: social protection expenditures do not have a significant linear effect on well-being, while the inverted U-shape in model 7d for this expenditure category continues to be significant. Moreover, as in robustness check I the coefficient for the interaction term between government expenditures and corruption is only significant in model 7d, while the coefficient for the interaction term between relative income and government expenditures is significant at the 1% level in models 2d and 7d.

Table 2.5: ROBUSTNESS CHECK III: OLS ESTIMATION RESULTS

	Model 2d	Model 3d	Model 4d	Model 7d	Model 11d	Model 12d
Government expenditures	0.012*** (7.680)	-0.026*** (-4.289)	0.031*** (9.014)	0.127*** (8.933)	0.009*** (6.152)	0.012*** (6.858)
Relative income * Government expenditures	-0.001*** (-3.471)			-0.001** (-2.487)		
Ideological preferences * Government expenditures	-0.002*** (-5.088)			-0.001*** (-2.660)		
Expenditure decentralization * Government expenditures		0.001*** (7.636)				
Corruption * Government expenditures			-0.001 (-1.326)	-0.003*** (-4.032)		
Government expenditures ²				-0.001*** (-6.877)		
Education expenditures					0.024*** (4.244)	0.142*** (2.986)
Health expenditures					-0.019*** (-4.258)	-0.090*** (-4.225)
Social protection expenditures					0.003 (1.516)	0.040*** (3.208)
Education expenditures ²						-0.005** (-2.557)
Health expenditures ²						0.003*** (3.294)
Social protection expenditures ²						-0.000*** (-3.196)
Log of GDP per capita	0.195** (2.326)	0.463*** (2.847)	-0.018 (-0.106)	0.909*** (4.195)	0.328*** (3.703)	0.197* (1.680)
Unemployment rate	-0.009*** (-4.144)	-0.013*** (-4.149)	-0.027*** (-4.676)	-0.019*** (-3.118)	-0.009*** (-3.746)	-0.010*** (-4.365)
Inflation rate	-0.009*** (-4.294)	-0.011*** (-3.499)	-0.017*** (-3.208)	-0.021*** (-3.933)	-0.011*** (-4.393)	-0.009*** (-3.755)
Expenditure decentralization		-0.060*** (-6.371)				
Corruption			0.009 (0.290)	0.110*** (3.271)		
Male	-0.042*** (-11.822)	-0.051*** (-12.576)	-0.046*** (-10.106)	-0.046*** (-10.012)	-0.043*** (-11.933)	-0.043*** (-11.915)
Age	-0.016*** (-23.367)	-0.015*** (-19.349)	-0.016*** (-18.537)	-0.016*** (-18.609)	-0.016*** (-23.253)	-0.016*** (-23.271)
Age ²	0.000*** (24.859)	0.000*** (21.413)	0.000*** (19.343)	0.000*** (19.357)	0.000*** (24.750)	0.000*** (24.762)

Relative income	0.115*** (9.585)	0.072*** (37.240)	0.082*** (35.600)	0.119*** (7.885)	0.074*** (43.540)	0.074*** (43.569)
Ideological preferences	0.129*** (7.221)	0.047*** (18.670)	0.020*** (6.800)	0.078*** (3.506)	0.039*** (17.506)	0.039*** (17.503)
<i>Marital status</i>						
Married	0.079*** (14.913)	0.069*** (11.439)	0.092*** (13.523)	0.093*** (13.560)	0.079*** (14.778)	0.078*** (14.747)
Divorced	-0.126*** (-13.617)	-0.141*** (-13.297)	-0.100*** (-8.777)	-0.100*** (-8.796)	-0.126*** (-13.614)	-0.126*** (-13.610)
Separated	-0.195*** (-11.734)	-0.212*** (-11.192)	-0.148*** (-6.942)	-0.146*** (-6.863)	-0.196*** (-11.777)	-0.196*** (-11.766)
Widowed	-0.060*** (-6.711)	-0.078*** (-7.669)	-0.034*** (-2.951)	-0.032*** (-2.818)	-0.061*** (-6.788)	-0.060*** (-6.775)
<i>Education till age</i>						
16 to 19 yrs	0.050*** (11.480)	0.051*** (10.352)	0.045*** (8.115)	0.045*** (8.152)	0.050*** (11.454)	0.049*** (11.211)
> 19 yrs	0.078*** (14.121)	0.080*** (12.355)	0.078*** (10.212)	0.074*** (9.611)	0.076*** (13.894)	0.077*** (14.044)
<i>Employment status</i>						
Unemployed	-0.385*** (-50.496)	-0.404*** (-48.139)	-0.367*** (-37.800)	-0.367*** (-37.799)	-0.386*** (-50.551)	-0.386*** (-50.565)
School	0.057*** (7.866)	0.060*** (7.427)	0.078*** (8.103)	0.076*** (7.895)	0.057*** (7.988)	0.057*** (7.989)
Retired	-0.017** (-2.525)	-0.029*** (-3.691)	0.004 (0.411)	0.004 (0.499)	-0.017** (-2.460)	-0.017** (-2.451)
Home	-0.011* (-1.678)	-0.005 (-0.705)	-0.017** (-1.995)	-0.014 (-1.628)	-0.011* (-1.658)	-0.010 (-1.583)
Self-employed	-0.009 (-1.351)	-0.012 (-1.562)	-0.004 (-0.427)	-0.003 (-0.409)	-0.009 (-1.367)	-0.009 (-1.384)
<i>Number of children ≤ 15 yrs</i>						
1	-0.025*** (-5.050)	-0.022*** (-3.874)	-0.022*** (-3.315)	-0.022*** (-3.338)	-0.025*** (-5.095)	-0.025*** (-5.081)
2	-0.014*** (-2.617)	-0.012** (-2.020)	-0.013* (-1.800)	-0.014* (-1.924)	-0.014*** (-2.685)	-0.015*** (-2.737)
≥ 3	-0.038*** (-4.779)	-0.039*** (-4.347)	-0.016 (-1.479)	-0.016 (-1.537)	-0.038*** (-4.811)	-0.039*** (-4.873)
Adjusted R ²	0.182	0.196	0.190	0.190	0.182	0.182
Observations	153,268	118,763	89,017	89,017	153,268	153,268

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity ² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***) ⁴ Regressions include time and country fixed-effects

⁵ Government expenditures are measured as a % of GDP, while expenditure types are divided by total expenditures

Since so far we have not been able to make any statements with regard to economic significance, this is done in the following. As an example, the coefficients for the unemployed dummy are at around -0.4 in all six models of table 2.5. This means that all else equal, an unemployed person experiences a life satisfaction that is on average 0.4 units lower than for someone who is employed. This makes up 10% of the overall scale from 1 to 4 and can be regarded as a quite sizable effect in line with previous findings (Lucas et al., 2004).

Given that all models in table 2.5 except for model 11d include either interaction terms or squared terms, the marginal effects at mean values are reported in table 2.6.¹⁸ These calculations demonstrate that the influence of government size on well-being fluctuates between 0.009 (model 2d) and 0.041 (model 7d). Hence, all else equal a government that is 10 percentage points larger leads to an increase in well-being by 0.09 to 0.41 units (For example, the UK and Italy have average government sizes of around 43% and 53% over the considered period, respectively). Moreover, an increase in corruption by one unit and an extension of expenditure decentralization by 10 percentage points leads to changes in well-being by -0.03 and 0.1 units, respectively.

Table 2.6: MARGINAL EFFECTS AT MEAN VALUES FOR ROBUSTNESS CHECK III

	Model 2d	Model 3d	Model 4d	Model 7d		Model 12d
$\frac{\partial \text{Life satisfaction}}{\partial \text{Govt. expend.}}$	0.010*** (7.089)	0.016*** (6.348)	0.029*** (9.154)	0.041*** (11.339)	$\frac{\partial \text{Life satisfaction}}{\partial \text{Educ. expend.}}$	0.035*** (4.453)
$\frac{\partial \text{Life satisfaction}}{\partial \text{Relative income}}$	0.074*** (43.508)			0.082*** (35.837)	$\frac{\partial \text{Life satisfaction}}{\partial \text{Social expend.}}$	0.003 (1.109)
$\frac{\partial \text{Life satisfaction}}{\partial \text{Ideol. preferences}}$	0.040*** (17.801)			0.020*** (6.955)	$\frac{\partial \text{Life satisfaction}}{\partial \text{Health expend.}}$	-0.022*** (-4.166)
$\frac{\partial \text{Life satisfaction}}{\partial \text{Decentralization}}$		0.009*** (3.386)				
$\frac{\partial \text{Life satisfaction}}{\partial \text{Corruption}}$			-0.032*** (-4.351)	-0.027*** (-3.649)		

With regard to types of government expenditures in model 12d, it can be concluded that in a country that spends 5 percentage points more of its total budget on education people's well-being is on average 0.18 units higher (To give an example, in 1999 Germany and Denmark have spent 9% and 14% of the public budget on education, respectively). In addition, the optimum of the inversely U-shaped relationship between education expenditures and well-being occurs at 14.5%. Consequently, all countries included in the dataset spend too little on education compared to this benchmark. On the other hand, we find an insignificant marginal effect of social expenditures in model 12d, while the optimum for social protection expenditures occurs at 41.1%. The only countries that spend on average a higher share of the public budget on social protection in the considered time period are Finland (42.5%) and Germany (42.9%).

Additional calculations of breakeven points imply that government size has a positive marginal effect on life satisfaction if the share of sub-national expenditures in total expenditures amounts to at least 18.7% (fulfilled for all countries except for Belgium, France and Luxembourg) and regardless of the extent of corruption. Decentralization has a positive in-

¹⁸If the original model is $y = \alpha + \beta_1 x + \beta_2 z + \beta_{12} xz + \epsilon$, the marginal effect of x on y is given by $\frac{\partial y}{\partial x} = \beta_1 + \beta_{12} z$. As a next step, we have evaluated this effect at the sample average \bar{z} . Finally, the variance of the estimated marginal effect is given by $Var(\frac{\partial y}{\partial x}) = Var(\beta_1) + \bar{z}^2 Var(\beta_{12}) + 2\bar{z} Cov(\beta_1, \beta_{12})$. The formula for the calculation of marginal effects in the presence of squared terms can be derived in a similar fashion.

fluence on well-being if government expenditures amount to at least 43.6% of GDP, i.e. for all countries except Ireland, Luxembourg and the UK, while the marginal effect of corruption on well-being requires a government size of 40.4% to turn negative. This is fulfilled for all of the twelve countries except for Luxembourg. Finally, government size only has a negative impact on well-being for out-of-sample values for ideological preferences and relative income suggesting that the effect of government expenditures on well-being is always positive regardless of these individual characteristics.¹⁹

A breakeven analysis for government expenditures in model 7d reveals that the peak of the inversely U-shaped relationship with well-being occurs at a government size of 76.5%. This means that given average values for relative income, ideological preferences and corruption, the marginal benefit and the marginal cost of a larger government just outweigh each other at this level as summarized in hypothesis 1a. There are, however, several reasons why the numerical value for the optimal government size should be interpreted with caution. First, the largest government size in our sample is recorded for Sweden in 1995 with 66.3%, while none of the countries in our sample has any experience with a government of more than 70% in the time period considered here. Therefore, it is difficult to predict whether such a large government would indeed contribute to people's well-being. Second, the value for the peak is quite sensitive to the exclusion of observations. If Finland or Ireland are dropped from the sample, the peak shifts down to 69.2% and 70.0%, respectively.

Third, by including the log of GDP per capita as an explanatory variable and thereby holding income constant, the estimations do not capture to what extent high tax rates lead to economic distortions and lower income levels. Hence, there is an indirect channel for a negative effect of government size on life satisfaction which the single-equation estimations do not take into account. Dropping the log of GDP per capita from the regression equation, however, is also unreasonable as this would cause an omitted variable bias with regard to the coefficient of government expenditures. Summarizing, it is likely that the estimation of a system of equations would suggest a lower value for the optimal government size.

Fourth, one should generally be aware of the dynamic effects created by a larger government or more specifically a more generous welfare state. In this context, Heinemann (2008) provides evidence for deteriorating welfare state ethics in the presence of generous benefits which may lead to a self-destruction of the welfare state in the long run. Fifth, even though the estimation results suggest a further extension of government size, the magnitude of the effect on subjective well-being may be as low as 0.09 given an increase of government size by 10 percentage points (see model 11d). The main message to remember from the empirical analysis is that there is robust evidence for a curvilinear relationship indicating diminishing returns to government size in terms of well-being.

¹⁹Another noteworthy insight from the calculations in table 2.6 is that at mean values of government size right-wing voters are more satisfied with their lives than left-wing voters by 0.04 to 0.08 units. Furthermore, if an individual advances to the next income quartile, his or her life satisfaction increases by 0.07 to 0.08 units.

When taking the results from tables 2.1 to 2.6 together, the following conclusions can be drawn: Hypotheses 1a and 1b are rejected, which is not surprising, as they represent very extreme views on the government. In reality, there are neither omniscient social planners who can determine the optimal government size nor do politicians exclusively follow selfish interests given their desire to be re-elected. What we can conclude is that enlargements of government size in the past have been in the best interest of citizens in the EU as one would expect in democratic societies. In addition, neither hypothesis 2 nor hypothesis 3 can be rejected. Hence, the effect of public sector size on people's well-being is strongly affected by institutional quality (degrees of decentralization and corruption) and respondents' characteristics (position in the income distribution and ideological preferences). Finally, hypothesis 4 cannot be rejected with respect to education expenditures, but with respect to social protection expenditures. This implies that the positive effect of government size on well-being is larger in countries where a large share of the budget is spent on education.

2.5 Conclusion

The preceding sections have analyzed the impact of the size and composition of government expenditures on life satisfaction. The first finding is an inversely U-shaped relationship between government size and well-being. More detailed calculations reveal that enlargements of government size in the past have not occurred against the interests of citizens in the EU. Secondly, the quality of institutions (levels of corruption and expenditure decentralization) has on average a significantly positive impact on well-being given current sizes of governments in the EU. Thirdly, low-income earners and left-wing voters benefit the most from a larger government in terms of well-being. Finally, the governments of all twelve EU countries in the sample could have increased well-being in the period from 1990 to 2000 by spending more on education. Finland and Germany could have further boosted subjective well-being by allocating a smaller share of the public funds to social protection.

The analysis in this paper can be augmented in the future with a more detailed disaggregation of the public budget and the inclusion of data on respondents' health status. In addition, an extension of the empirical model towards a system of equations would capture additional channels for the effect of government size on well-being and thereby yield more accurate estimates. Finally, some restrictions regarding the policy implications of the above findings are in order. As pointed out by Frey and Stutzer (2000b), entrusting government officials with the task of maximizing people's well-being may give rise to manipulations and some degree of arbitrariness in the public decision-making process. Therefore, the results in this paper should be supplemented by investigations that rely on alternative well-being indicators. The combination of results thus obtained can inform and guide policy-makers.

2.6 Appendix

Table 2.7: DEFINITIONS AND SOURCES OF VARIABLES

VARIABLE	DESCRIPTION	SOURCE
Dependent variable		
Life satisfaction	Measured on a reversed scale from 1 (not satisfied at all) to 4 (very satisfied)	Eurobarometer
Individual control variables		
Male	Gender dummy (1: Male, 0: Female)	Eurobarometer
Age	Age in years	
Relative income	Income quartile that applies to the respondent on a scale from 1 (lowest quartile) to 4 (highest quartile)	
Ideological preferences	Measured from -1 (left) to +1 (right)	
Marital status	Dummies for married, divorced, separated and widowed (single is the base category)	
Education till age	Dummies for 16-19 years and >19 years indicating the respondent's age when he finished his education (≤ 15 years is the base category)	
Employment status	Dummies for unemployed, school, retired, home and self-employed (employed is the base category)	
Number of children ≤ 15 years	Dummies for 1, 2 or more than 3 children (no children is the base category)	
Macroeconomic control variables		
Government expenditures	Total public expenditures as a share of GDP	Own calculations based on OECD National Accounts - Volume IV
Education expenditures	Public expenditures on education as a share of total public expenditures	
Health expenditures	Public expenditures on health as a share of total public expenditures	
Social protection expenditures	Public expenditures on social protection as a share of total public expenditures	
Log of GDP per capita	Logarithmic transformation of real GDP in PPP-adjusted US dollars (in thousands) divided by population size	OECD Economic Outlook No. 86
Unemployment rate	Standardized unemployment rates	OECD Key Economic Indicators OECD Macro Trade Indicators
Inflation rate	Growth rate of the Consumer Price Index	
Economic openness	Exports plus imports divided by GDP	
Institutional control variables		
Expenditure decentralization	Sub-national public expenditures as a share of total public expenditures	World Bank - Fiscal Decentralization Indicators
Corruption	Corruption Perceptions Index (CPI) on a transformed scale from 10 (very corrupt) to 0 (not corrupt at all)	Transparency International

Table 2.8: OECD GOVERNMENT SPENDING CATEGORIES

Category	Included items
Education	Pre-primary, primary, secondary, post-secondary but non-tertiary, tertiary education, and subsidiary services to education
Health	Medical products, appliances and equipment, outpatient, hospital and public health services
Social protection	Sickness, disability, old age, survivors, family, children, unemployment and housing
Defense	Military defense, civil defense and foreign military aid
Public order and safety	Police services, fire-protection services, law courts and prisons
Economic affairs	Economic, commercial and labor affairs, agriculture, forestry, fishing and hunting, fuel and energy, mining, manufacturing and construction, transport and communication
General public services	Executive and legislative organs, financial, fiscal and external affairs, basic research, transfers between different levels of government, foreign economic aid, general services and public debt transactions
Environmental protection	Waste and waste water management, pollution abatement, protection of biodiversity and landscape
Recreation, culture and religion	Recreational and sporting services, cultural services, broadcasting and publishing services, religious and other community services
Housing and community amenities	Housing development, community development, water supply and street lighting

Source: European Commission (2007)

Table 2.9: SUMMARY STATISTICS FOR VARIABLES AT THE INDIVIDUAL LEVEL

Variable	Mean	Minimum	Maximum	Std. dev.	Observations
Life satisfaction	3.143	1	4	0.712	153,268
Male	0.508	0	1	0.500	153,268
Age	44.068	15	99	17.310	153,268
Relative income	2.509	1	4	1.119	153,268
Ideological preferences	-0.115	-1	1	0.767	153,268
Married	0.625	0	1	0.484	153,268
Divorced	0.054	0	1	0.226	153,268
Separated	0.015	0	1	0.120	153,268
Widowed	0.078	0	1	0.269	153,268
Education till age 16 - 19	0.409	0	1	0.492	153,268
Education till > 19 years	0.234	0	1	0.424	153,268
Unemployed	0.079	0	1	0.270	153,268
School	0.081	0	1	0.273	153,268
Retired	0.204	0	1	0.403	153,268
Home	0.106	0	1	0.308	153,268
Self-employed	0.074	0	1	0.262	153,268
1 child \leq 15 years	0.158	0	1	0.365	153,268
2 children \leq 15 years	0.131	0	1	0.338	153,268
At least 3 children \leq 15 years	0.057	0	1	0.232	153,268

Table 2.10: SUMMARY STATISTICS FOR VARIABLES AT THE COUNTRY LEVEL

Variable		Mean	Minimum	Maximum	Std. dev.	Observations
Government expenditures /GDP	Overall	48.768	31.563	64.031	7.115	86
	Between		39.132	60.066	6.683	12
	Within		1.199	55.075	2.612	7.167
Education expenditures /Government expenditures	Overall	11.286	8.879	14.715	1.215	86
	Between		9.074	13.186	1.110	12
	Within		10.283	12.815	0.444	7.167
Health expenditures /Government expenditures	Overall	12.178	6.808	17.895	1.850	86
	Between		7.876	15.288	1.917	12
	Within		10.060	14.785	0.728	7.167
Social protection exp. /Government expenditures	Overall	37.762	24.828	47.661	4.791	86
	Between		27.855	43.561	4.405	12
	Within		32.849	41.936	1.598	7.167
GDP per capita (in thousands)	Overall	29.294	17.659	60.694	7.971	86
	Between		23.441	50.093	6.974	12
	Within		21.856	39.895	2.914	7.167
Unemployment rate	Overall	7.664	1.633	15.633	3.333	86
	Between		2.326	11.762	2.972	12
	Within		1.003	12.387	1.834	7.167
Inflation rate	Overall	2.328	-0.267	7.533	1.539	86
	Between		0.457	3.868	0.928	12
	Within		-0.135	6.612	1.280	7.167
Economic openness	Overall	97.020	35.710	278.990	55.412	86
	Between		43.237	215.726	51.275	12
	Within		64.625	160.285	14.553	7.167
Expenditure decentralization	Overall	27.538	10.709	46.388	11.286	59
	Between		10.959	44.798	10.256	12
	Within		25.060	29.755	1.027	4.917
Corruption	Overall	2.073	0	6.580	1.600	59
	Between		0.186	5.530	1.595	12
	Within		1.011	3.543	0.388	4.917

Chapter 3

Corruption and the Composition of Public Expenditures: Evidence from OECD Countries

3.1 Introduction

The literature provides robust evidence that corruption is detrimental to the economic development of a country. More specifically, empirical investigations suggest that an increase in corruption by one standard deviation is associated with an 0.8 to 1.0 percentage point decline in the GDP growth rate (Mauro, 1995; Pellegrini and Gerlagh, 2004). A recent study that benefits from the availability of longer time series of corruption data even suggests a causal link that runs from corruption to economic growth (Swaleheen, 2011).¹ This causal effect apparently relies on the following transmission channels: investments, trade openness, and political stability (Méon and Sekkat, 2005; Pellegrini and Gerlagh, 2004).

Firstly, corruption reduces expected returns on investments through an increase in uncertainty and the creation of additional costs. Higher levels of risk associated with returns on investments are due to the difficulty of enforcing bribes (Boycko et al., 1996) and the fact that bribery introduces the risk of being detected. On the other hand, corruption diminishes returns on investments (even when ignoring the risk involved) because it acts as a tax. For instance, when an entrepreneur intends to start a business in a developing country, he may have to bribe a bureaucrat in order to obtain a mandatory business license.

Secondly, policy-makers are likely to create more barriers to trade than is socially optimal since trade restrictions can be a substantial source of rents (Krueger, 1974). For instance, a domestic monopolist has an incentive to pay bribes in order to be protected against for-

¹In contrast, Huntington (1968) and Leff (1964) assert that corruption has a positive impact on economic development. However, these contributions ignore that bureaucratic inefficiency can be endogenous.

eign competition. Since free trade and international competition increase economic efficiency (Krugman and Obstfeld, 2006), such restrictions cause an impairment of economic growth (Pellegrini and Gerlagh, 2004). Thirdly, the perception that corrupted practices are pervasive in the public sector fuels political discontent and causes instability and violence. Empirical studies (Bardhan, 1997; Jong-A-Pin, 2009; Mo, 2001) point out that such a climate of political instability can be a serious obstacle to economic activity.

A fourth channel, which is relatively neglected in the existing literature, is corruption's distortionary effect on the allocation of public spending². Given the growth in public expenditures during the past few decades, this transmission channel has most likely gained importance and therefore deserves more attention. The rationale behind a corruption-induced distortion of the public budget is that bribe-maximizing politicians and/or bureaucrats prefer to shift resources to areas with the best opportunities to be bribed. More specifically, they have an incentive to increase the share of public expenditures that is spent on high-technology goods produced in oligopolistic markets (Mauro, 1998). This ensures that bribery is difficult to detect as prices are hardly comparable for innovative products and allows politicians and/or bureaucrats to collect more generous bribes since large profits are at stake.

In line with the fourth transmission channel, Gupta et al. (2001) provide evidence that corruption stimulates military spending, while Mauro (1998) presents cross-sectional evidence that corruption has a negative impact on education expenditures. The neglect of unobserved heterogeneity in Mauro's cross-country analysis may explain why he does not find a positive association of corruption with defense expenditures in contrast to Gupta et al. (2001). Another shortcoming is that both studies mostly rely on data from developing countries, which makes it difficult to draw conclusions with regard to the developed world.

This paper first derives how a distortion in public spending arises in a two-stage rent-seeking model with endogenous rent-setting that captures both "political corruption" and "bureaucratic corruption". The model illustrates how the number of firms in an industry (representing the degree of competition) and transaction costs (representing the difficulty of concealing bribery) affect the allocation of public expenditures and the amount of resources a politician makes available as the contest prize. To our knowledge, the distortion of public spending due to corruption has so far not been addressed in the existing rent-seeking literature.

The second part of this paper addresses the shortcomings of the aforementioned empirical literature and analyzes corruption's effect on the composition of public expenditures with panel data for 29 OECD countries that reaches from 1996 to 2009.³ Even though the focus on a specific group of countries reduces the heterogeneity in the dataset, the cross-country variation in Transparency International's Corruption Perceptions Index (CPI) is quite large.

²For a short summary of the evidence for a link between corruption and public finances see Hillman (2004).

³Another reason why the focus is on developed countries is that the GFS data by the IMF on worldwide public expenditures is criticized for its lack of cross-country comparability (Mauro, 1998). Australia, Chile, Estonia, Mexico, and Turkey are not included in our sample due to missing data on the budget composition or important control variables.

To be exact, in the data used in this paper the CPI ranges from 0.42 (average for Denmark) to 6.05 (average for Poland)⁴. As a third extension to existing studies, the regression analysis includes all ten expenditure categories that are commonly provided in fiscal databases instead of a priori assuming that only one or two specific expenditure categories are affected.⁵

The empirical analysis suggests that an increase in the perceived level of corruption induces a growth in the shares of spending on health and environmental protection, while the shares of expenditures on social protection and recreation, culture and religion decline with increasing corruption. The significance of these distortions is robust to specifications with fixed effects, random effects, and seemingly unrelated regressions. When taking into account endogeneity concerns, the statistical significance of the results is lower, while the magnitude of the effects that remain significant is larger.

The analysis is structured as follows: Section 3.2 discusses on an intuitive level the role that non-competitive market structures and high-technology play for the existence of corruption in the public sector. Section 3.3 formalizes this intuition by means of a two-stage rent-seeking model with endogenous rent-setting. Afterwards, section 3.4 describes the dataset and the empirical strategy, while section 3.5 reports the results for the baseline estimations and four robustness checks. Finally, section 3.6 concludes the analysis.

3.2 Market structure, technology, and corruption

Governments spend the resources that are available to them in various ways. In some cases, governments directly provide services such as education and fire protection. In other cases, governments redistribute income across members of society. The following discussion focuses on expenditures that arise when politicians or bureaucrats commission private sector firms to provide the government (and ultimately citizens) with specific goods or services. Examples for public procurement can be found in the health and military sector as well as with regard to waste management. The objective is to gain an intuitive understanding as to what factors foster corruption when the government and the private sector interact in such a setting.

In her seminal contribution, Krueger (1974) points out the simple fact that the existence of rents induces rent-seeking behavior.⁶ Hence, one way to assess where public sector corruption most likely occurs is to analyze which types of public expenditures promise rents to politicians and/or bureaucrats. Going one step further, it makes sense to analyze which types of public expenditures promise the *highest* rents to politicians and/or bureaucrats.

⁴The CPI scale from 0 to 10 has been inverted so that a higher value indicates a higher level of corruption.

⁵Dellavalade (2006) also includes several expenditure categories in her analysis, but focuses on a set of developing countries over the 1996 - 2001 period.

⁶Note that rent-seeking and corruption are related but not entirely congruent concepts. Lambsdorff (2002) provides an overview of the literature that uses rent-seeking models to describe corruption.

One factor that is strongly related to the size of the rent, which the public official can expect, is the market structure that potential bribers are facing (Rose-Ackerman, 1975). Since the stakes for being awarded a public contract are much higher in a non-competitive than in a competitive setting, a bribe-maximizing politician has an incentive to shift as much of the public resources available to him to types of expenditures which are spent in non-competitive markets (Mauro, 1998). Of course, there is a limit as to how large this distortion will get since the politician wants to keep the probability of detection reasonably low. The impact of the market structure on rent-seeking activities can also be extended to the international sphere given the evidence that corruption prevails in countries where firms have low exposure to foreign competition (Ades and Di Tella, 1999).

Due to high entry barriers one can well imagine that the above argument related to non-competitive market structures applies especially to high-technology markets. Yet, there is also another reason why public officials prefer to shift resources to types of expenditure that are technology-intensive. The necessity of secrecy for an illegal act such as bribery implies that corrupt politicians prefer to collect bribes on goods whose exact value cannot be ascertained such as high-technology goods that are not too widely distributed (Mauro, 1998; Shleifer and Vishny, 1993). The fact that this is especially true for defense expenditures due to national security reasons is pointed out by Hines (1995) who provides evidence that international trade in military aircraft is particularly prone to corruption.

The bribe that an agent from the private sector is willing to pay in order to succeed in a public invitation to tender is likely to increase proportionally with the profits that the briber earns with the involved public project. This line of reasoning implies that corruption induces a shift of public resources to expenditure types that are allocated to large projects (Bardhan, 1997). Since the size of a project increases with the prices of the products bought, this argument is again related to oligopolistic market structures and the fact that high-technology products require large R&D investments. Tanzi and Davoodi's (1997) finding that public resources are shifted to investments in the building and creation of projects and away from operation and maintenance lends some support to this hypothesis.

To conclude, the above considerations suggest that two main factors affect the likelihood that corruption occurs. First, the number of bribers in an industry that try to induce a shift of public expenditures in their favor is negatively correlated with the likelihood that this shift will occur. Second, it is more likely that corruption occurs in fields where it is easy to keep bribery secret, i.e. where products involve high-technology and prices are hardly comparable. The following section will integrate these considerations in a two-stage rent-seeking model to illustrate how these two factors affect the composition of public spending. To do so, we divide the private sector into different industries that may be commissioned by the government to provide a good or a service, which in turn translates into expenditures in distinct categories.

3.3 A two-stage bribing contest with endogenous rent-setting

3.3.1 General framework

This section applies the two-stage rent-seeking framework by Katz and Tokatlidu (1996) in the context of public sector corruption. The model is augmented by allowing for an endogenous determination of rent size in line with Appelbaum and Katz (1987). The considerations from section 3.2 are integrated into this model by means of an asymmetry in the number of firms $n_j \geq 2$ (representing the degree of competition)⁷ and an asymmetry in the effectiveness of rent-seeking efforts β_j ⁸ (inversely related to the transaction costs involved in keeping bribery secret) across two industries $j = A, B$. The objective is to illustrate how these factors affect the share of the rent that the two industry groups are expected to gain. This in turn sheds light on the question how the allocation of public expenditures is distorted.

The model rests on the assumption that a politician has discretion over the allocation of a budget $G > 0$. Even though G itself is fixed, the politician can determine what share $(1 - \gamma)$ of the public budget G he wants to make available to the rent-seeking contest and therefore, he is a rent-setter. There are two industries denoted as $j = A, B$ that consist of n_j symmetric firms and that pay bribes x_{ij} to the politician in order to win the rent $S = (1 - \gamma)G$.

Given that the rent is divisible, each industry wins an expected share of the rent S which represents a *public good* at this point. If the politician announces that he will allocate a large share of the public budget G to the rent-seeking contest, he is likely to lose the election and to receive neither any of the bribe income R_1 (will be defined at the end of section 3.3) nor his salary in office y . Instead, he earns an alternative compensation $V < y$.⁹

On the other hand, if the politician announces that a small share of G will be allocated to the contest, he is more likely to win the election. However, as we will learn at the end of section 3.3.3, the size of the politician's bribe income, that he only receives if he takes office, depends positively on the share of the public budget that is allocated to the contest. Therefore, the politician is in summary weighing up the benefit of a higher probability of winning the election against the benefit of receiving more bribe income when in office.¹⁰

⁷Note that the term competition in this model is limited to competition in the rent-seeking contest measured by the number of firms present in an industry.

⁸This relates for instance to the analysis by Stein (2002) on the implications of asymmetry in the ability to convert expenditures into meaningful efforts.

⁹At first sight, one is tempted to believe that the politician earns a lower wage when in office than when he works in the private sector. However, for several reasons we make the opposite assumption. First, one could interpret y and V as utility levels and argue that politicians gain an "ego-rent" from holding office. Second, one has to take into account that successful election candidates are offered more lucrative employment opportunities after their political career than candidates that never hold an office. Hence, y and V can be interpreted as the present value of the candidate's lifetime utility in the two scenarios. Moreover, while in comparison Appelbaum and Katz (1987) require $y + R_1 > V$ to hold, this is automatically fulfilled with $y > V$.

¹⁰Ursprung (1990) relies on a similar theoretical framework to analyze how underdissipation arises with contested rents that have a public good character. The main difference to the model at hand is that he uses explicit electoral competition in a two-candidate setting in order to endogenize the prize of the contest.

The second stage constitutes a separate contest since the recipient of the bribe is now a different person (a bureaucrat) assumed to be independent from the politician, which implies that the first-stage bribes are sunk.¹¹ In this intra-industry bribing contest, the expected share of the rent S represents a *private good*. Expenditures by each firm in the second round are denoted by y_{ij} . The idea that corruption occurs at multiple levels has previously been put forward especially by Shleifer and Vishny (1998), who have in this context coined the term ‘the grabbing hand’. A detailed classification of the theoretical literature on corruption can be found in Aidt (2003), where it is argued that “Only by taking seriously the possibility of self-interest at all levels of government as advocated by *The Grabbing Hand* can real progress be made in developing a satisfactory positive theory of corruption” (p. F649), which clearly supports our modeling approach.

In sections 3.3.2 to 3.3.4, this model is solved recursively, i.e. the analysis starts out with the second stage. The reason is that the individual firms anticipate in the first stage that they will have to engage in a second-round contest where they have to incur additional expenses in order to win their individual share of the rent.

3.3.2 Bureaucratic corruption: Bribing contest between firms

In the second stage, the firms in industries A and B compete for their individual share of the rent S by paying bribes y_{ij} to a bureaucrat who has complete discretion over the allocation of his fixed budget. His decision is based entirely on the relative amount of bribes that he receives. More specifically, following Tullock (1980) the share of the rent S that firm i wins is represented by:

$$p_{ij} = \begin{cases} \frac{y_{ij}}{y_j} & \text{if } \max \{y_{1j}, \dots, y_{n_j j}\} > 0 \\ \frac{1}{n_j} & \text{else.} \end{cases} \quad (3.1)$$

Since it has not been derived yet what share of S is allocated to the two industries, we solve the optimization problem for the case where one of the groups wins the whole rent S in the first stage. Consequently, firm $i = 1, \dots, n_j$ in industry $j = A, B$ solves:

$$\text{Max } \pi_{ij} = p_{ij}S - y_{ij}. \quad (3.2)$$

¹¹An alternative approach is to use an exogenous sharing rule as in Nitzan (1991). However, our objective is to explicitly allow for a second stage in line with the notion of Shleifer and Vishny’s (1998) ‘grabbing hand’.

Assuming a Cournot-Nash equilibrium, an interior solution and symmetric firms within each industry, the size of the bribe that an individual firm pays to the bureaucrat and the sum of bribes paid by an entire industry can be expressed as follows:

$$y_{ij}^* = \frac{n_j - 1}{n_j^2} S, \quad y_j^* = \frac{n_j - 1}{n_j} S. \quad (3.3)$$

We can infer from these equations that the optimal bribe paid by an individual firm decreases with the number of firms since each firm expects to win a smaller share of the rent. Yet, the sum of bribes paid by an industry increases with the number of firms. If we plug the expression for the optimal bribe paid to the bureaucrat into equation 3.2, the expected profit of an individual firm is derived as:¹²

$$\pi_{ij}^* = \frac{1}{n_j^2} S. \quad (3.4)$$

Note that the existence of a second-stage contest gives rise to a waste of resources. If the individual firms abstain from bribing the bureaucrat, each firm would receive an expected profit of $\pi_{ij}^* = \frac{1}{n_j} S$. However, the firms are likely to mistrust each other and have no reason to believe that the other firms will abstain from bribing the bureaucrat.

In the case where $n_A < n_B$ holds, equation 3.4 predicts that the expected profit for firms in industry A is higher than for firms in industry B , i.e. $\pi_{iA}^* > \pi_{iB}^*$.¹³ If the valuation of firms in industry B for entering the second-round contest is comparatively lower, this is likely to have an influence on the first-stage bidding behavior of this industry. This will be analyzed in the next section.

3.3.3 Political corruption: Bribing contest between industries

In the first stage of the contest, the politician decides what share of the rent S to allocate to each of the two industries. His decision depends on the relative size of the bribes that he receives from the two industries. When industry j collectively expends x_j , the politician receives $\beta_j x_j$ with $0 < \beta_j \leq 1$.¹⁴

The parameter β_j is introduced in order to reflect the fact that the transaction costs involved in keeping the bribe payment secret may differ between the two industries. The

¹²Obviously, the share of the rent that an individual firm obtains (i.e. the value of the project(s) that the firm has been assigned to) does not represent pure profits. However, in order to keep the model tractable we have abstained from introducing an additional parameter that captures the profit margin.

¹³Note that the difference in expected profits between the two industries grows disproportionately with the difference in group sizes n_A and n_B due to the squared term in the denominator.

¹⁴We have abstained from introducing a parameter to capture transaction costs in section 3.3.2 since there is no inter-industry heterogeneity in this respect. Therefore, any such parameter would drop out of the contest success function presented in equation 3.1.

larger β_j is, the lower are the transaction costs. In conclusion, the share of the rent S that the firms in industry $j = A, B$ obtain is represented by:

$$P_j = \begin{cases} \frac{\beta_j x_j}{\beta_j x_j + \beta_{-j} x_{-j}} & \text{if } \max \{x_j, x_{-j}\} > 0 \\ \frac{1}{2} & \text{else .} \end{cases} \quad (3.5)$$

Even though the politician allocates S according to the relative size of the aggregate bribes in each industry, each firm decides individually on the size of the bribe x_{ij} that is paid to the politician. The profit that an individual firm can expect when entering the second round of the contest is represented by π_{ij}^* (see section 3.3.2). Based on these considerations, each of the n_j symmetric firms in industry $j = A, B$ solves the following maximization problem:

$$\text{Max } \Pi_{ij} = P_j \pi_{ij}^* - x_{ij}. \quad (3.6)$$

The first-order condition for this optimization problem can be written as follows:

$$\beta_j \beta_{-j} \sum_{i=1}^{n_{-j}} x_{i,-j} S - \left(\beta_j \sum_{i=1}^{n_j} x_{ij} + \beta_{-j} \sum_{i=1}^{n_{-j}} x_{i,-j} \right)^2 n_j^2 = 0. \quad (3.7)$$

Taking into account the symmetry of firms within the two industries, we obtain:

$$n_{-j} \beta_j \beta_{-j} x_{i,-j} S - (n_j \beta_j x_{ij} + n_{-j} \beta_{-j} x_{i,-j})^2 n_j^2 = 0. \quad (3.8)$$

As a next step, we combine equation (3.8) with the equivalent first-order condition for the optimization problem of industry $-j$. This allows us to determine the following expression for the relationship between the total expenditures of the two industries in equilibrium:

$$x_j^* = x_{-j}^* \frac{n_{-j}^2}{n_j^2}. \quad (3.9)$$

Finally, we combine equations 3.8 and 3.9 to obtain the equilibrium expenditures by industry j . As the following expression shows, this amount depends on the number of firms in each industry, the transaction costs in making a bribe payment, and the size of the total rent:

$$x_j^* = \frac{\beta_j \beta_{-j}}{n_{-j}^2 (\beta_{-j} \frac{n_j^2}{n_{-j}^2} + \beta_j)^2} S. \quad (3.10)$$

On the basis of equation 3.10, it is straightforward to derive the politician's total bribe income $(\beta_j x_j^* + \beta_{-j} x_{-j}^*)$, which we denote as R_1 :

$$R_1 = \left(\frac{\beta_j}{n_{-j}^2(\beta_{-j} \frac{n_j^2}{n_{-j}^2} + \beta_j)^2} + \frac{\beta_{-j}}{n_j^2(\beta_j \frac{n_{-j}^2}{n_j^2} + \beta_{-j})^2} \right) \beta_j \beta_{-j} S. \quad (3.11)$$

Equation 3.11 suggests that the larger the rent S is, the more bribe income is collected by the politician. However, the influence of the number of firms and the size of transaction costs is less obvious at this point (see section 3.3.4 for such comparative statics analyses).

3.3.4 Endogenous rent-setting

Following Appelbaum and Katz (1987), the politician is at the same time a rent-seeker and a rent-setter. Therefore, the size of the rent is determined endogenously. More specifically, the politician is torn between two objectives. He seeks to be elected and earn a high salary y , but on the other hand he also wants to collect a high bribe income R_1 .

Both of these objectives depend on what share $(1 - \gamma)$ (with $0 \leq \gamma \leq 1$) of the total budget G he makes available to the rent-seeking contest ($S = (1 - \gamma)G$). When γ is large, the rent S is small and following equation 3.11 the politician's bribe income will be low. On the other hand, a large γ increases the probability g that the politician wins the election and receives a high salary. In summary, the politician, who we assume to be risk-neutral for simplicity, faces the following objective function:

$$\text{Max } E[U] = g(\gamma)(y + R_1) + (1 - g(\gamma))V. \quad (3.12)$$

In order to allow for an explicit solution for equation 3.12, we assume $g(\gamma) = \gamma$. The maximization of equation 3.12 yields the following expression for the equilibrium share of the budget G that is not allocated to the rent-seeking contest:

$$\gamma^* = \frac{1}{2} + \frac{y - V}{2\kappa G} \quad \text{with } \kappa = \left(\frac{\beta_j}{n_{-j}^2(\beta_{-j} \frac{n_j^2}{n_{-j}^2} + \beta_j)^2} + \frac{\beta_{-j}}{n_j^2(\beta_j \frac{n_{-j}^2}{n_j^2} + \beta_{-j})^2} \right) \beta_j \beta_{-j}. \quad (3.13)$$

Equation 3.13 shows that the politician makes less than half of the total budget G available as a rent for the bribing contest under the assumption that $y > V$ holds. In addition, since $\gamma^* \leq 1$ has to be fulfilled, we know that $G \geq \frac{y - V}{\kappa}$. Hence, the total budget has to be large enough or conversely the salary gain from being elected into office should be moderate.

Based on equation 3.13, one can easily derive the following relationships:

$$\frac{\partial \gamma^*}{\partial y} > 0, \quad \frac{\partial \gamma^*}{\partial V} < 0, \quad \text{and} \quad \frac{\partial \gamma^*}{\partial G} < 0. \quad (3.14)$$

Equation 3.14 suggests that the politician's motivation to abstain from making public resources available for the rent-seeking contest depends positively on the size of his salary when in office y and negatively on his alternative wage V . This corresponds with the existing evidence in the empirical (Van Rijckeghem and Weder, 2001) and experimental literature (Schulze and Frank, 2003) for a negative relationship between the wage level in the public sector (compared to the wage level in the private sector) and corruptibility.

Finally, the larger the overall budget G is, the higher is the potential bribe income of the politician and the more public resources will he make available as a contest prize. This aspect is noteworthy when considering the growth in public sector size over the past few decades suggesting an increase in corruption-induced distortions of the budget composition over time.

In addition to the relationships summarized in equation 3.14, one can derive how γ^* is influenced by the number of firms and the size of the transaction costs in each industry (complete derivations are provided in appendix A):

$$\frac{\partial \gamma^*}{\partial \beta_j} < 0, \quad \frac{\partial \gamma^*}{\partial \beta_{-j}} < 0, \quad \frac{\partial \gamma^*}{\partial n_j} > 0 \quad \text{and} \quad \frac{\partial \gamma^*}{\partial n_{-j}} > 0. \quad (3.15)$$

It follows from equation 3.15 that higher transaction costs ($1 - \beta_j$ or $1 - \beta_{-j}$) associated with concealing corruption induce the politician to allocate a smaller share ($1 - \gamma^*$) of public resources to the rent-seeking contest. Moreover, the politician reduces the amount of resources available as a rent if the degree of competitiveness increases in the two industries, i.e. if the number of firms increases. Both conclusions confirm the intuitive argumentation in section 3.2.

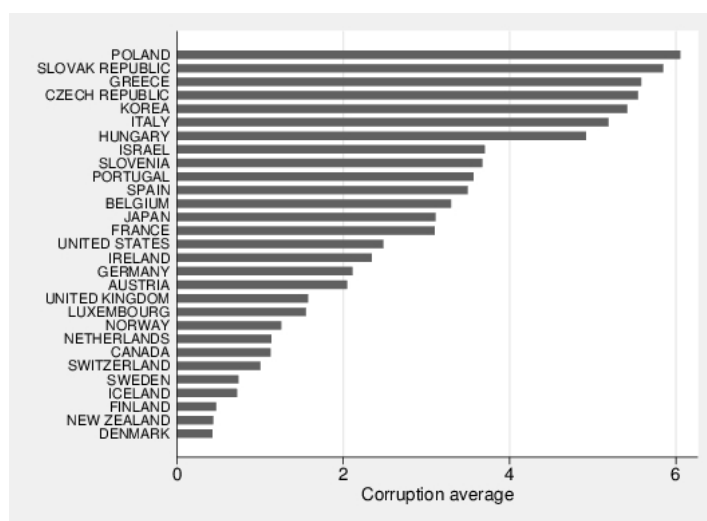
3.4 Data and model specification

3.4.1 Data description

The dependent variable in the estimations is one of ten expenditure types as a share of total public expenditures from the OECD National Accounts database (see table 2.8 in chapter 2 for a list of items included in the expenditure categories). Even though the *absolute* amount of public resources spent on purposes such as social protection is unlikely to be affected by corruption in the way described in sections 3.2 and 3.3, we include these expenditure types in the regression analysis since it is still possible that the *relative* shares are affected.

Corruption is the main explanatory variable measured by the Corruption Perceptions Index (CPI) from Transparency International. This data is of a subjective nature since the CPI relies on surveys among international business people, risk analysts, local residents and expatriates. Figure 1 illustrates country averages from 1996 to 2009 suggesting that corruption is lowest in Scandinavian countries, whereas the most corrupt countries are mainly located in Eastern Europe and the Mediterranean region. The CPI averages exhibit a high cross-country variation with values ranging from less than 1 until up to 6 on a scale from 0 to 10.

Figure 3.1: CORRUPTION AVERAGES PER COUNTRY, 1996 - 2009



Source: Transparency International

While we are aware of the shortcomings of subjective indicators, using the CPI is justified. First, objective data such as the number of corruption-related prosecutions may be rather noisy with regard to an illegal act such as corruption and this data may mostly capture the extent and effectiveness of anti-corruption law enforcement. Second, even though the different surveys that are used in order to construct the CPI rely on different methodologies and interview different people, they correlate strongly with each other (Lambsdorff, 2004a). This is not a trivial finding given that one might expect foreign experts to have different perceptions of the incidence of corruption in a country than residents and local businessmen.

Third, Kaufmann et al. (2004) investigate the potential for biases in perceptions more specifically and report that they do not find any significant ideological biases in corruption ratings. Finally, it has been argued that the CPI allows for year-to-year comparisons even if the sources used are not the same in each year. This is due to the fact that the effect of changes in the sources on the CPI estimate is rather small (Lambsdorff, 2004b).

In order to accommodate the fact that demographic factors affect the composition of the public budget, we include the age-dependency ratio in the estimations. In addition,

the regressions control for population density since the provision of public goods should be cheaper in more densely populated areas due to economies of scale. The data for both population-related variables is taken from the World Bank's World Development Indicators. The estimations also take into account the interest rate on government bonds (OECD National Accounts database) as a catch-all measure for the fiscal situation in a certain country as well as government stability and political risks.

In addition, we include the log of real GDP per capita as one of two economic variables from the OECD databases in the regressions due to Wagner's Law. According to this rule, the public sector grows as a society becomes wealthier based on two arguments. Firstly, as states grow wealthier they also grow more complex, increasing the need for public regulatory action. Secondly and more importantly, certain publicly provided goods such as education are luxury goods only provided when society reaches a certain level of wealth. In addition, we include the unemployment rate given that the relative importance of social protection expenditures in the public budget is likely to increase with high levels of unemployment.

Two of the robustness checks include additional control variables, i.e. inflation rates as well as the debt-GDP ratio. The former variable is included given that inflation is an additional indicator for the business cycle, which is likely to affect public expenditures. Government debt is included in the robustness checks given that a government that faces high levels of debt is likely to temporarily cut expenditures in certain areas.

Moreover, these two robustness checks take into account three political/institutional factors from the Database of Political Institutions (DPI) by Beck et al. (2001). First of all, we expect that left-wing governments allocate public resources in a different way than right-wing governments, which has been illustrated in numerous empirical studies (see for instance Bräuningner 2005; Van Dalen and Swank 1996). The second political variable is the number of years left in the current term given the evidence for political cycles in public expenditures in line with the theoretical prediction by Nordhaus (1975). Finally, we include a measure of government fragmentation as the number of parties in a government coalition and their relative sizes are likely to affect how the budget is allocated (for a more detailed definition of the political variables see table 3.6).¹⁵

Finally, we use two alternative measures for corruption as a robustness check. The first measure belongs to the World Bank Governance Indicators (Kaufmann et al., 2004), which is an aggregate index like the CPI. Its main advantage is that it uses more sources than the CPI and therefore captures corruption in the public as well as the private sector (some sources provide data on corruption at the household level) as perceived by experts and opinion polls, while the CPI measures public sector corruption as perceived by experts only. We do not use the World Bank's corruption measure in the baseline estimations because it has only been published bi-annually prior to 2002. The second corruption measure is provided by the private

¹⁵For evidence on the relationship between fragmentation and fiscal policy see Ricciuti (2004) and Volkerink and de Haan (2001).

risk-rating agency Political Risk Services, Inc. that publishes the International Country Risk Guide (ICRG). The advantage of the ICRG corruption measure is that it is not a composite indicator, which makes year-to-year comparisons more reliable.¹⁶

3.4.2 Empirical strategy

In addition to being affected by the extent of corruption and the control variables outlined in the previous section, the budget composition in a country may also be directly influenced by the budget composition in other countries. In line with Devereux et al. (2008), the policy reaction function in this particular case can be expressed as follows:

$$\text{Expshare}_{it} = R_i(\text{Expshare}_{-i,t-1}, Z_{it}). \quad (3.16)$$

In equation 4.1 the term Expshare_{it} represents the respective expenditure share, while $\text{Expshare}_{-i,t-1}$ captures the vector of expenditure shares in all other countries in the previous period since fiscal policy responses are likely to take time. Finally, Z_{it} stands for all remaining factors that influence the budget composition including the extent of corruption.

Since equation 4.1 cannot be estimated given the available degrees of freedom, Devereux et al. (2008) recommend to replace the vector $\text{Expshare}_{-i,t-1}$ by weighted averages. As weights ω_{ij} , we choose the inverse of the spatial distance between the countries' capitals, since governments are more likely to respond to fiscal policy changes in countries that are close by rather than geographically distant (see Baicker, 2005; Devereux et al., 2008; Kammass, forthcoming). Summarizing, we estimate the following equation for each of the ten expenditure categories:

$$\text{Expshare}_{it} = \alpha_i + \beta \text{Corruption}_{it-1} + \gamma \sum_{j \neq i} \omega_{ij} \text{Expshare}_{jt-1} + \delta X_{it} + \nu_t + \epsilon_{it}, \quad (3.17)$$

where the subscripts refer to a country $i = 1, 2, \dots, 29$ and the respective time period $t = 1996, 1997, \dots, 2009$. ϵ_{it} represents the normally distributed error term.¹⁷

The vector X_{it} includes the interest rate on government bonds, the population density, the age-dependency ratio, the log of real GDP per capita, and the unemployment rate. All regressions include time dummies in order to control for common exogenous shocks ν_t and an intercept α_i in order to deal with unobserved heterogeneity. Hypothesis tests are based on standard errors that are robust to heteroscedasticity.

There is reason to believe that endogeneity plays a role in the empirical investigation at hand. First and foremost, there is the possibility of reverse causality. There are a number

¹⁶Summary statistics for all variables used in the estimations are provided in table 3.7 in the appendix.

¹⁷The empirical approach taken in this paper corresponds to a large extent with Dreher et al. (2008).

of studies that analyze the effect of government size on corruption (Arvate et al., 2010; Goel and Nelson, 1998) or of the degree of local autonomy on corruption (Arikan, 2004; Fan et al., 2009; Fisman and Gatti, 2002a,b; Treisman, 2000). However, it should be noted that previous studies that focus on the composition of public expenditures provide evidence for the opposing direction of causality (Delavallade, 2006; Gupta et al., 2001; Mauro, 1998), i.e. corruption is the cause of a distortion in the budget composition. Therefore, while we choose to be in line with the latter investigations, it is likely that a two-way relationship represents the most accurate description of reality.

A second reason for endogeneity is the potential measurement error with regard to subjective corruption indices. Third, as in every other empirical study it is impossible to control for all factors that may influence public spending patterns. Therefore, even though we include five additional control variables in two of the robustness checks, the problem may persist. In order to address these three sources of endogeneity, we use instruments for corruption in two of the four robustness checks, while the baseline estimations and the first two robustness checks rely on the lag of Transparency International’s CPI $Corruption_{it-1}$ (section 3.5.1) in order to deal with reverse causality.

As a final remark on the empirical strategy pursued, it should be emphasized that using expenditure shares as the dependent variable in the empirical analysis only allows us to *indirectly* test the considerations in sections 3.2 and 3.3. While we have information on the components of these expenditure categories (see table 2.8), we do not have data on the degrees of competitiveness and transaction costs in concealing bribery (or technology intensity) across various sectors, countries, and time periods. Therefore, we proceed by estimating our empirical model as described above and afterwards looking more closely at the items included in the expenditure categories affected by corruption. This will allow us assess whether the degree of competition and costs of concealing bribery are likely to play a role for the observed corruption-induced distortion of public expenditures.

The estimation results for the two-way fixed effects models are presented in section 3.5.1. The baseline estimations are followed by four robustness checks (section 3.5.2) that involve random effects, seemingly unrelated regressions, the inclusion of additional controls, the use of instrumental variables as well as alternative corruption measures.

3.5 Estimation results

3.5.1 Baseline regressions

The results for the baseline estimations are summarized in table 3.1, where models 1a to 10a differ with regard to the dependent variable and the respective spatially weighted expenditure shares. To begin with, a higher level of corruption is associated with an increase in the share of expenditures on health and environmental protection. On the other hand, the relative importance of expenditures on social protection and recreation, culture and religion decreases.

When taking a closer look at the definitions of the expenditure categories (see table 2.8), it becomes clear why these effects correspond with the theoretical considerations in sections 3.2 and 3.3. First of all, health products often involve high-technology and are produced in oligopolistic markets (Robone and Zanardi, 2006).

Second, there is anecdotal evidence on corruption related to the multi-million dollar construction of waste incineration plants falling into the category of environmental protection expenditures. One example is the Cologne incinerator project in Germany, where allegedly US \$13 million were paid in bribes during the construction of a US \$500 million waste incineration plant (Transparency International, 2005). A second example is the Naples waste management crisis that peaked in the summer of 2008 (Smolczyk, 2008). In the latter case, municipalities awarded expensive waste disposal contracts to shady consortiums controlled by the local Mafia. After fourteen years and a total cost of US \$2 billion none of the three waste incinerators were operational and the garbage piled up on the streets of Naples.

An alternative explanation for the observed positive correlation with expenditures on environmental protection is that corruption represents a major obstacle to environmental protection as bribe payments may allow companies to circumvent laws and regulations (Fredriksson and Svensson, 2003; Woods, 2008). In the long run, this should lead to a deterioration in environmental quality that creates a need for higher expenditures on pollution abatement or landscape and biodiversity protection.

Finally, Anbarci et al. (2009) provide evidence for public sector corruption in the water and sanitation sector, which includes waste water management as one of the components of environmental protection expenditures. Two particular anecdotes in this context relate to the largest private multinationals in this sector operating in France: Vivendi Water and Suez-Lyonnaise. In both instances, these oligopolistic market players bribed government officials in order to secure contracts for sizable public projects and were eventually convicted of bribery and sentenced to substantial fines and prison.

Since public spending on social protection merely represents redistributive transfers between different population groups that are unlikely to be influenced by bribe-paying firms, the relative importance of this expenditure category decreases with corruption. This does not necessarily imply that expenditures in this area are cut, but only that the relative share

significantly shrinks. In addition, public spending on recreation, culture and religion decreases as well relative to other expenditure categories, which is in line with the theoretical considerations in sections 3.2 and 3.3 as they also provide very few opportunities for bribery.

The magnitudes of the coefficients for corruption in table 3.1 can be interpreted as follows: A one-unit increase in perceived corruption (on an overall scale from 0 to 10) leads *ceteris paribus* to an increase in expenditures on health and environmental protection by 0.26 and 0.07 percentage points as well as a decrease in expenditures on social protection and recreation, culture and religion by 0.4 and 0.07 percentage points, respectively.¹⁸ With regard to the control variables, it can be stated that the ten expenditure categories are in most cases significantly affected by demographic factors, national income, unemployment rates and the government's lending rate, while fiscal policy shocks in neighboring countries are only significant in three cases.

To conclude, even though we discover corruption-induced changes in the relative importance of expenditure categories that are quite different from those observed by Mauro (1998) and Gupta et al. (2001), the results that are presented in table 3.1 are still in line with the theoretical predictions laid out in sections 3.2 and 3.3. By realizing that we limited the empirical analysis to developed countries and used panel-specific estimation techniques as well as a longer time series than previous investigations the novelty regarding the specific nature of the distortions in the budget composition is not surprising.

There are in particular two aspects that deserve special attention when speaking of industrialized as opposed to developing countries. First, democracy ensures that politicians in industrialized countries pay attention to voter's sensitivity towards military expenditures (Hartley and Russett, 1992) as well as expenditures on education (Tepe and Vanhuyse, 2009) in order to maximize the likelihood of being elected.¹⁹ Second, the existence of a free press leads to better informed voters, which in turn strengthens the functioning of democracy and further impedes the distortion of expenditure types to which voters pay increased attention.

Moreover, it should be noted that on a global scale corruption in the military sector appears to rely mostly on a link between arms firms in developed countries and government officials in developing countries. If governments from Western countries are at all involved in these instances of corruption, then in a sense that public officials promote arms sales in developing countries (Willett, 2009). Finally, given that many developing countries are currently involved in armed conflicts it is much easier for government officials in these countries to conceal corruption-induced increases of defense expenditures.

¹⁸Note that the effect on health and social protection expenditures is larger in terms of percentage point changes since these categories are two of the largest shares of the total budget.

¹⁹Hartley and Russett (1992) provide evidence that US military expenditures between 1965 and 1990 were influenced strongly by public opinion, which implies that policymakers' decisions regarding military expenditures are closely followed by the public. Tepe and Vanhuyse (2009) find that teacher hiring across German states is accelerated by incumbents during election periods and partly reversed thereafter in order to maximize re-election probabilities.

Table 3.1: ESTIMATION RESULTS WITH FIXED EFFECTS, 1996 - 2009

	Model 1a	Model 2a	Model 3a	Model 4a	Model 5a	Model 6a	Model 7a	Model 8a	Model 9a	Model 10a
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environmental protection	Recreation, culture and religion
Corruption ($t - 1$)	-0.398** (-2.350)	0.261** (2.099)	0.113 (1.369)	-0.050 (-0.876)	0.258 (1.396)	0.030 (0.807)	-0.271 (-1.259)	0.083 (1.611)	0.071** (2.279)	-0.072** (-2.016)
Spatially weighted exp. shares ($t - 1$)	-0.000 (-0.485)	-0.000* (-1.931)	0.000 (1.157)	-0.539** (-2.500)	-0.020 (-0.116)	0.198** (2.011)	0.000 (0.417)	-0.203 (-1.019)	-0.000 (-0.358)	-0.000 (-0.964)
Interest rate on government bonds	-0.191** (-2.185)	-0.268*** (-4.180)	-0.171*** (-4.018)	0.011 (0.371)	-0.108 (-1.145)	0.036* (1.943)	0.655*** (5.901)	0.046* (1.735)	0.004 (0.267)	-0.030 (-1.641)
Log of real GDP per capita	1.262 (0.562)	5.212*** (3.159)	1.959* (1.788)	-4.598*** (-6.098)	5.202** (2.116)	0.008 (0.017)	-8.123*** (-2.846)	-0.202 (-0.297)	-0.893** (-2.145)	0.198 (0.415)
Unemployment rate	0.396*** (7.460)	-0.212*** (-5.440)	-0.089*** (-3.447)	-0.061*** (-3.428)	0.296*** (5.130)	-0.045*** (-3.952)	-0.220*** (-3.246)	0.006 (0.385)	-0.046*** (-4.672)	-0.029*** (-2.610)
Age-dependency ratio	0.234*** (3.446)	0.185*** (3.729)	0.031 (0.929)	-0.049** (-2.173)	0.097 (1.254)	0.028* (1.916)	-0.392*** (-4.556)	-0.049** (-2.414)	-0.075*** (-5.944)	-0.009 (-0.648)
Population density	-0.077*** (-3.693)	0.007 (0.467)	-0.003 (-0.301)	-0.046*** (-6.450)	-0.016 (-0.708)	-0.001 (-0.144)	0.099*** (3.727)	0.001 (0.115)	0.010** (2.534)	0.021*** (4.834)
R ²	0.347	0.629	0.271	0.418	0.506	0.165	0.223	0.100	0.233	0.229
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

¹ Hypothesis tests are based on panel-corrected standard errors that are robust to heteroscedasticity

² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***)

⁴ R-squared values are adjusted for country fixed effects

⁵ Country and time fixed effects are jointly significant at the 1% level

3.5.2 Sensitivity analysis

General robustness checks

Two-way fixed effects estimations only take into account the within-variation of the data. Since existing investigations mostly rely on cross-sectional estimations and since the Hausman test does not clearly indicate whether we should use random or fixed effects, we are now investigating to what extent the results change with random effects.²⁰ The key difference is that in fixed effects estimations one assumes that the time-invariant characteristics of a country are correlated with the explanatory variables, while in random effects estimations they are not correlated. In table 3.2, we collect these additional estimation results.

The most important insight gained from table 3.2 is that with random effects the relationship between corruption and the composition of public expenditures is almost the same as with country fixed effects. In congruence with the estimation results in table 3.1, expenditures on health and environmental protection increase significantly, while expenditures on social protection, recreation, culture and religion decline significantly. The magnitudes of the coefficients hardly change, while the coefficients for lagged corruption are now even significant at the 1% level for the latter two expenditure shares.

The second robustness check estimates the ten models in table 3.1 as a system rather than estimating each equation separately. Since the ten expenditure categories sum up to a total of 100%, the regressions for each of the categories are by definition not independent from each other. In fact, when one of the shares decreases, we have the additional information that at least one of the other shares must have increased. Zellner's (1962) Seemingly Unrelated Regressions (SUR) model makes use of this information. This particular estimation procedure allows for an improvement in efficiency compared to estimating the ten models separately with OLS. The results for this robustness check are summarized in table 3.3.

While the coefficients for corruption in the previous period are significant and have the same sign with regard to the models for social protection, recreation, culture and religion, and environmental protection, for health expenditures the significance level declines from 5% to 10%. Moreover, in model 8c (housing and community amenities) the corruption coefficient is positive and significant at the 10%, while in model 8a it was almost significant with a t-statistic of 1.61. To conclude, in congruence with the first robustness check we find strong confirmation of the results in table 3.1.

²⁰We have chosen to conduct the baseline estimations and robustness checks II to IV with two-way fixed effects since they are jointly significant at the 1% level. In addition, this allows us to deal with unobserved heterogeneity and the existence of common exogenous shocks.

Table 3.2: ROBUSTNESS CHECK I: ESTIMATION RESULTS WITH RANDOM EFFECTS, 1996 - 2009

	Model 1b	Model 2b	Model 3b	Model 4b	Model 5b	Model 6b	Model 7b	Model 8b	Model 9b	Model 10b
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environmental protection	Recreation, culture and religion
Corruption ($t - 1$)	-0.423*** (-2.613)	0.288** (2.454)	0.077 (1.023)	-0.043 (-0.607)	0.265 (1.307)	0.025 (0.607)	-0.008 (-0.054)	0.080 (1.588)	0.070** (2.003)	-0.076*** (-2.606)
Spatially weighted exp. shares ($t - 1$)	-0.000 (-0.235)	-0.000*** (-4.215)	0.000*** (2.837)	-0.625* (-1.954)	-0.051 (-0.421)	0.097 (1.128)	0.000 (0.446)	-0.228* (-1.661)	-0.000 (-1.412)	-0.000** (-2.017)
Interest rate on government bonds	-0.194** (-1.976)	-0.298*** (-3.065)	-0.156* (-1.930)	0.036 (0.572)	-0.127 (-0.989)	0.033 (1.355)	0.758*** (2.899)	0.047* (1.790)	0.007 (0.294)	-0.032 (-1.247)
Log of real GDP per capita	0.505 (0.323)	1.404 (1.497)	0.994 (1.406)	-3.227*** (-4.015)	0.773 (0.689)	-0.528 (-1.422)	-0.337 (-0.316)	-0.016 (-0.048)	0.039 (0.176)	0.111 (0.329)
Unemployment rate	0.381*** (8.383)	-0.244*** (-5.472)	-0.105*** (-3.706)	-0.060** (-2.240)	0.245*** (3.488)	-0.051*** (-3.985)	-0.174*** (-2.586)	0.009 (0.554)	-0.036*** (-3.701)	-0.026** (-2.548)
Age-dependency ratio	0.208*** (2.835)	0.110** (2.014)	0.010 (0.307)	-0.024 (-1.005)	0.017 (0.228)	0.015 (0.955)	-0.354*** (-4.452)	-0.048*** (-2.789)	-0.055*** (-4.007)	-0.007 (-0.538)
Population density	-0.017* (-1.913)	-0.009** (-1.994)	-0.004 (-1.067)	-0.006 (-1.294)	0.001 (0.208)	0.001 (0.579)	0.007** (2.544)	0.001 (0.948)	0.002*** (2.748)	0.001 (0.870)
R ²	0.328	0.618	0.267	0.332	0.500	0.158	0.171	0.100	0.214	0.171
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity

² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***)

⁴ All regressions include time fixed effects

Table 3.3: ROBUSTNESS CHECK II: ESTIMATION RESULTS WITH FIXED EFFECTS (SEEMINGLY UNRELATED REGRESSIONS), 1996 - 2009

	Model 1c	Model 2c	Model 3c	Model 4c	Model 5c	Model 6c	Model 7c	Model 8c	Model 9c	Model 10c
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environmental protection	Recreation, culture and religion
Corruption ($t - 1$)	-0.393** (-2.323)	0.243* (1.959)	0.121 (1.463)	-0.054 (-0.957)	0.257 (1.398)	0.021 (0.572)	-0.275 (-1.275)	0.088* (1.730)	0.071** (2.269)	-0.073** (-2.026)
Spatially weighted exp. shares ($t - 1$)	-0.000 (-0.004)	-0.000 (-0.762)	0.000 (0.635)	-0.109 (-1.390)	-0.012 (-0.608)	0.046 (1.002)	-0.000 (-0.021)	-0.003 (-0.040)	-0.000 (-0.165)	-0.000 (-0.366)
Interest rate on government bonds	-0.192** (-2.194)	-0.263*** (-4.093)	-0.174*** (-4.082)	0.023 (0.786)	-0.109 (-1.146)	0.036* (1.937)	0.656*** (5.897)	0.045* (1.692)	0.005 (0.279)	-0.030 (-1.637)
Log of real GDP per capita	1.276 (0.568)	5.417*** (3.285)	1.862* (1.703)	-4.696*** (-6.228)	5.185** (2.128)	-0.024 (-0.050)	-8.105*** (-2.835)	-0.150 (-0.222)	-0.902** (-2.169)	0.200 (0.419)
Unemployment rate	0.396*** (7.438)	-0.209*** (-5.368)	-0.089*** (-3.447)	-0.059*** (-3.333)	0.296*** (5.132)	-0.047*** (-4.115)	-0.218*** (-3.221)	0.007 (0.420)	-0.046*** (-4.671)	-0.030*** (-2.619)
Age-dependency ratio	0.236*** (3.474)	0.187*** (3.753)	0.028 (0.851)	-0.047** (-2.077)	0.095 (1.299)	0.026* (1.817)	-0.392*** (-4.544)	-0.048** (-2.341)	-0.075*** (-5.965)	-0.009 (-0.606)
Population density	-0.076*** (-3.660)	0.007 (0.441)	-0.002 (-0.232)	-0.043*** (-6.190)	-0.016 (-0.707)	0.000 (0.050)	0.099*** (3.717)	0.000 (0.019)	0.010** (2.516)	0.022*** (4.868)
R ²	0.346	0.625	0.268	0.410	0.506	0.158	0.223	0.097	0.233	0.228
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity

² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***)

⁴ R-squared values are adjusted for country fixed effects

Reverse causality, omitted variable bias, and measurement error

The third robustness check re-estimates the models in table 3.1 while adding two economic and three political control variables in order to address the problem of omitted variable bias. Moreover, we use two instrumental variables (press freedom and import penetration rate) in order to deal more generally with endogeneity issues arising from reverse causality, omitted variables, and measurement error. The estimations are conducted with the GMM estimator given that the assignment of weights to the moment conditions according to their variance has an efficiency advantage over the simple TSLS estimator. Moreover, given that for nine out of ten estimations the Arellano-Bond AR(1) test causes us to reject the null hypothesis of no autocorrelation at the 5% level, standard errors are clustered at the country-level.

It should be noted that for the time period considered, there is no data available for government ideology in the DPI with regard to Switzerland. Therefore, the number of countries included in the regressions drops to 28, while the total number of observations drops from 341 to 320. The results for this robustness check are summarized in table 3.4.

In line with the existing literature (Ades and Di Tella, 1999; Brunetti and Weder, 2003), the Press Freedom Index provided by the Freedom House and the import penetration rate (OECD Macro Trade Indicators) have a significantly negative correlation with Transparency International's CPI. On an intuitive level, a free press helps to expose instances of bribery, while competition by foreign firms reduces the gains from corruption in line with our previous theoretical considerations and Ades and Di Tella (1999). The p-values for the over- and underidentification tests at the bottom of table 3.4 underline the validity of the two instruments as the null hypothesis for the overidentification test is never rejected, while being rejected in all ten models for the underidentification test.

The coefficients for corruption are significantly positive in table 3.4 in the estimations for health and environmental protection expenditures (models 2d and 9d) as in table 3.1. Moreover, while the significance levels have dropped from 5% to 10%, the magnitude of those two coefficients has increased about tenfold. This implies that an increase in the CPI by one unit would lead to an increase in health and environmental protection expenditures by 2.87 and 0.64 percentage points, respectively. The baseline results for social protection and recreation, culture and religion expenditures from table 3.1 cannot be confirmed.

The inclusion of five additional control variables has reduced the significance of the other controls' coefficients, even though the overall picture is similar to table 3.1. Furthermore, the coefficients for government debt, government ideology and the number of years left in the current term are always insignificant, while a more fragmented government appears to be positively correlated with education expenditures. Finally, a higher inflation rate, which usually occurs in a booming period of the business cycle, appears to be negatively correlated with social protection expenditures and positively correlated with expenditures on economic affairs and housing and community amenities.

Table 3.4: ROBUSTNESS CHECK III: GMM ESTIMATIONS WITH INSTRUMENTAL VARIABLES AND ADDITIONAL CONTROLS, 1996 - 2009

	Model 1d	Model 2d	Model 3d	Model 4d	Model 5d	Model 6d	Model 7d	Model 8d	Model 9d	Model 10d
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environmental protection	Recreation, culture and religion
Corruption	-0.147 (-0.079)	2.871* (1.741)	0.995 (1.457)	-1.259 (-1.544)	-1.899 (-1.116)	0.199 (0.438)	-1.319 (-1.133)	0.361 (0.901)	0.643* (1.710)	0.086 (0.278)
Spatially weighted exp. shares ($t - 1$)	0.000** (2.202)	-0.000 (-1.152)	0.000* (2.014)	0.057 (1.669)	-0.000 (-0.020)	-0.012 (-0.720)	-0.000 (-0.634)	0.009 (0.286)	-0.033 (-1.350)	0.018 (1.126)
Interest rate on govt bonds	0.126 (0.721)	-0.472*** (-3.919)	-0.157** (-2.316)	0.147* (1.980)	0.114 (0.648)	0.032 (0.932)	0.231* (1.875)	-0.031 (-0.760)	-0.045 (-1.124)	0.017 (0.523)
Log of real GDP per capita	-0.085 (-0.019)	6.238 (1.037)	5.135* (1.818)	-6.353** (-2.060)	4.862 (0.767)	1.384 (0.734)	-9.983** (-2.292)	0.007 (0.005)	-0.017 (-0.015)	0.850 (0.776)
Unemployment rate	0.274* (2.018)	-0.251** (-2.094)	-0.040 (-0.796)	0.003 (0.043)	0.283* (1.934)	-0.044 (-1.305)	-0.106 (-1.151)	0.013 (0.381)	-0.073** (-2.338)	-0.026 (-0.832)
Age-dependency ratio	0.240 (1.377)	0.362 (1.668)	0.148 (1.656)	-0.115 (-1.148)	-0.140 (-0.530)	0.059 (1.120)	-0.483*** (-2.931)	0.005 (0.152)	-0.024 (-0.567)	0.012 (0.364)
Population density	-0.047 (-0.883)	0.010 (0.202)	-0.001 (-0.075)	-0.040* (-1.706)	0.004 (0.101)	0.004 (0.387)	0.068*** (3.329)	-0.006 (-0.582)	0.001 (0.136)	0.014* (1.792)
Inflation rate	-0.285* (-1.868)	-0.043 (-0.311)	-0.045 (-0.809)	-0.050 (-1.050)	-0.094 (-0.697)	-0.003 (-0.109)	0.539* (1.793)	0.048* (1.808)	0.001 (0.035)	-0.023 (-0.917)
Government debt	0.019 (1.130)	0.006 (0.240)	-0.016 (-1.581)	-0.005 (-0.590)	0.019 (0.670)	-0.003 (-1.310)	-0.006 (-0.216)	-0.002 (-0.541)	-0.006 (-1.594)	-0.005 (-1.406)
Government ideology	0.174 (1.072)	-0.069 (-0.434)	0.019 (0.245)	-0.007 (-0.068)	-0.102 (-0.600)	-0.048 (-1.597)	-0.078 (-0.623)	0.074 (1.638)	0.000 (0.011)	0.009 (0.308)
Years left in current term	0.022 (0.494)	0.036 (0.734)	0.019 (0.895)	-0.041 (-1.616)	-0.012 (-0.348)	0.004 (0.387)	-0.018 (-0.421)	-0.005 (-0.315)	0.012 (1.160)	0.012 (1.171)
Government fragmentation	0.001 (0.047)	0.010 (0.755)	0.009** (2.063)	0.005 (0.621)	-0.005 (-0.320)	0.003 (1.508)	-0.012 (-1.076)	-0.008 (-1.262)	-0.004 (-1.103)	-0.004 (-1.093)
RMSE	1.160	1.295	0.627	0.624	1.493	0.263	1.502	0.387	0.323	0.262
Overid. test	0.163	0.725	0.281	0.502	0.982	0.438	0.673	0.168	0.333	0.559
Underid. test	0.018	0.022	0.007	0.012	0.014	0.010	0.014	0.012	0.011	0.012
Observations	320	320	320	320	320	320	320	320	320	320
Countries	28	28	28	28	28	28	28	28	28	28

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity and autocorrelation

² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***)

⁴ The values referring to under- and overidentification tests represent p-values

Table 3.5: ROBUSTNESS CHECK IV: GMM ESTIMATIONS WITH INSTRUMENTAL VARIABLES, ADDITIONAL CONTROLS, AND ALTERNATIVE CORRUPTION MEASURES, 1996 - 2009

	World Bank Corruption Indicator					ICRG Corruption Index				
	Model 1e	Model 2e	Model 8e	Model 9e	Model 10e	Model 1f	Model 2f	Model 8f	Model 9f	Model 10f
	Social protection	Health	Housing & community amenities	Environmental protection	Recreation, culture and religion	Social protection	Health	Housing & community amenities	Environmental protection	Recreation, culture and religion
Corruption	1.975 (0.865)	-1.977 (-1.267)	0.067 (0.184)	0.258 (1.500)	-0.803* (-1.748)	-0.064 (-0.085)	-0.382 (-0.575)	-0.130 (-0.700)	0.225* (1.921)	0.089 (0.665)
Spatially weighted exp. shares ($t - 1$)	0.000** (2.273)	0.000*** (3.923)	0.019 (0.540)	-0.018 (-0.982)	0.034* (1.761)	0.000** (2.032)	0.000*** (3.586)	0.015 (0.670)	-0.014 (-0.728)	0.017 (1.261)
Interest rate on govt bonds	0.096 (0.879)	-0.066 (-0.994)	-0.027 (-0.978)	-0.013 (-1.101)	0.031 (1.585)	0.126 (1.601)	-0.215*** (-4.112)	-0.026 (-0.986)	-0.001 (-0.045)	0.017 (0.870)
Log of real GDP per capita	6.243 (1.485)	5.557 (1.602)	-0.754 (-0.549)	-0.728 (-0.996)	-0.168 (-0.155)	1.271 (0.266)	3.836 (0.961)	-0.427 (-0.322)	-1.686* (-1.873)	0.118 (0.116)
Unemployment rate	0.279*** (3.506)	-0.098* (-1.648)	0.036* (1.701)	-0.031** (-2.411)	-0.027 (-1.513)	0.267*** (3.826)	-0.074 (-1.260)	0.035 (1.546)	-0.047*** (-3.112)	-0.029 (-1.257)
Age-dependency ratio	0.357** (2.085)	0.099 (0.834)	-0.008 (-0.283)	-0.049* (-1.866)	-0.003 (-0.122)	0.282* (1.663)	0.143 (1.023)	-0.013 (-0.420)	-0.072** (-2.553)	0.001 (0.061)
Population density	-0.065 (-1.396)	0.028 (0.914)	-0.005 (-0.725)	0.005 (0.758)	0.018*** (2.757)	-0.050 (-1.385)	0.038 (1.344)	-0.009 (-1.040)	0.004 (0.840)	0.017** (2.526)
Inflation rate	-0.258* (-1.779)	-0.303** (-2.501)	0.063*** (2.649)	-0.016 (-1.214)	-0.024 (-0.968)	-0.283** (-2.444)	-0.228** (-2.077)	0.043* (1.952)	-0.007 (-0.508)	-0.016 (-0.814)
Government debt	0.020 (1.172)	-0.002 (-0.144)	-0.004 (-1.114)	-0.009*** (-4.050)	-0.005* (-1.752)	0.020 (1.450)	-0.014 (-1.085)	-0.004 (-1.171)	-0.008*** (-3.653)	-0.004 (-1.292)
Government ideology	0.220 (1.451)	-0.046 (-0.493)	0.068* (1.947)	-0.001 (-0.043)	0.028 (0.949)	0.164 (1.063)	-0.117 (-1.132)	0.080** (2.278)	-0.002 (-0.063)	0.000 (0.007)
Years left in current term	0.008 (0.199)	0.038 (1.090)	-0.008 (-0.420)	0.005 (0.660)	0.006 (0.505)	0.014 (0.328)	0.018 (0.547)	-0.001 (-0.049)	0.011 (1.387)	0.010 (1.076)
Government fragmentation	-0.000 (-0.026)	0.021*** (2.765)	-0.005 (-0.931)	-0.002 (-1.260)	-0.002 (-0.650)	0.001 (0.112)	0.008 (1.080)	-0.005 (-1.021)	-0.002 (-1.005)	-0.004 (-1.256)
RMSE	1.167	0.876	0.349	0.193	0.244	1.112	0.884	0.346	0.220	0.251
Overid. test	0.571	0.146	0.867	0.405	0.315	0.578	0.017	0.339	0.829	0.622
Underid. test	0.000	0.000	0.000	0.000	0.000	0.023	0.041	0.024	0.025	0.025
Observations	259	259	259	259	259	322	322	322	322	322
Countries	28	28	28	28	28	28	28	28	28	28

¹ Hypothesis tests are based on standard errors that are robust to heteroscedasticity and autocorrelation

² t-statistics in parentheses

³ Stars indicate significance at 10% (*), 5% (**) and 1% (***)

⁴ The values referring to under- and overidentification tests represent p-values

As a final robustness check, we have re-estimated the models for expenditures on social protection, health, housing and community amenities, environmental protection and recreation, culture and religion from table 3.4 with two alternative corruption indicators. The analysis is limited to these five models since the lagged corruption coefficient has not been significant in any of the other five models in tables 3.1 to 3.4. Columns 2 to 6 in table 3.5 report the results for the estimations that use the World Bank Corruption Indicator, while columns 7 to 11 refer to the estimations that rely on the ICRG Corruption Index.

At first, we estimated these ten models with the same instruments as in table 3.4. However, this combination of instruments was unsatisfying both in terms of the significance of the coefficients in the first-stage estimations as well as the p-values for the under- and overidentification tests. The instrument combinations that performs best regarding these criteria were the Press Freedom Index and the Rule of Law Index (World Bank Governance Indicators) for the World Bank Corruption Indicator and measures for press freedom, economic freedom, and the import penetration rate for the ICRG measure. The intuitive reasoning for the two new instruments is that the effectiveness and predictability of the judiciary measured by the Rule of Law index acts as a deterrent to corruption and that a higher degree of economic freedom is associated with less government intervention creating fewer opportunities for corruption in the public sector. While the underidentification test performs well in all ten estimations in table 3.5, the overidentification test suggests for model 2f (health expenditures using ICRG index) that the instruments are not valid.

In the estimations that use the World Bank measure for corruption, only the share of recreation, culture and religion expenditures is negatively affected by corruption at the 10% significance level. Moreover, the coefficient is again ten times larger than in table 3.1. The coefficient for environmental protection has a t-statistic of 1.5 and is therefore close to the 10% threshold. On the other hand, in the estimations that rely on the ICRG corruption measure, there is evidence that the share of environmental protection expenditures is positively affected by corruption at the 10% level. To conclude, the four robustness checks confirm the results obtained for the baseline estimations, even though the statistical significance of the effects is lower in the estimations that address endogeneity issues.

3.6 Conclusion

This paper analyzes the effect of corruption on the composition of public expenditures. The theoretical part first derives how a distortion in public spending arises in the context of a two-stage rent-seeking model with endogenous rent-setting that captures both “political corruption” and “bureaucratic corruption”. The model illustrates how the degree of competition within an industry and the difficulty of concealing bribery affect the share of the rent that is obtained by an industry and the willingness of a politician to make resources available to the rent-seeking contest.

The empirical analysis is based on a panel dataset for 29 OECD countries over the time period from 1996 to 2009. The results suggest that with an increase in corruption the shares of spending on health and environmental protection increase, while the shares of expenditures on social protection and recreation, culture and religion decline. The significance of these distortions is robust to specifications with fixed effects, random effects, and seemingly unrelated regressions. When taking into account endogeneity concerns, the statistical significance of the results is lower, while the magnitude of the effects that remain significant is larger.

The findings in this paper raise concerns about the wider implications of a distortion in public expenditures. First of all, not only the distortion in the allocation of public resources itself may cause inefficiency. In addition, bribe payments represent social waste as they are spent to influence the allocation of an income that has already been earned (Hillman, 2009). If one additionally assumes that bribe payments between politicians and bureaucrats occur as in a multi-stage hierarchical contest framework, the extent of this social waste is even more considerable (Hillman and Katz, 1987).

Second, a distortion in the allocation of public expenditures leads to a failure of the government in fulfilling its objectives. For instance, due to an allocation of resources to private sector firms other than the most efficient suppliers, both the quantity and quality of public provision will be less satisfactory. As a consequence, voters’ disenchantment with politics may increase which means that more and more voters will be less interested in following the news. More importantly, politicians will have even more freedom in distorting the allocation of public resources. Hence, the problem feeds itself and public sector corruption is likely to have more serious consequences in the future. To conclude, the results in this paper suggest that the fight against corruption should rank high on the agenda of international institutions and decision-makers and should not be limited to developing countries.

3.7 Appendix

Equations 3.18 to 3.21 summarize how the relationships in equation 3.15 have been derived.

$$\begin{aligned} \frac{\partial \gamma^*}{\partial \beta_j} = & - \frac{y-V}{2\beta_j^2 \beta_{-j} \left(\frac{\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} \right) G} \\ & - \frac{\left(-\frac{2\beta_{-j} n_{-j}^2}{n_j^4 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^3} + \frac{1}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} - \frac{2\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^3 n_{-j}^2} \right) (y-V)}{2\beta_j \beta_{-j} \left(\frac{\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} \right) G} = -\frac{n_j^2 (y-V)}{2\beta_j^2 G} < 0 \end{aligned} \quad (3.18)$$

$$\begin{aligned} \frac{\partial \gamma^*}{\partial \beta_{-j}} = & - \frac{y-V}{2\beta_j \beta_{-j}^2 \left(\frac{\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} \right) G} \\ & - \frac{\left(\frac{1}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} - \frac{2\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^3} - \frac{2\beta_j n_j^2}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^3 n_{-j}^4} \right) (y-V)}{2\beta_j \beta_{-j} \left(\frac{\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} \right) G} = -\frac{n_{-j}^2 (y-V)}{2\beta_{-j}^2 G} < 0 \end{aligned} \quad (3.19)$$

$$\begin{aligned} \frac{\partial \gamma^*}{\partial n_j} = & - \frac{\left(-\frac{2\beta_{-j}}{n_j^3 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{4\beta_j \beta_{-j} n_{-j}^2}{n_j^5 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^3} - \frac{4\beta_j \beta_{-j} n_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^3 n_{-j}^4} \right) (y-V)}{2\beta_j \beta_{-j} \left(\frac{\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} \right) G} = \frac{n_j (y-V)}{\beta_j G} > 0 \end{aligned} \quad (3.20)$$

$$\begin{aligned} \frac{\partial \gamma^*}{\partial n_{-j}} = & - \frac{\left(-\frac{4\beta_j \beta_{-j} n_{-j}}{n_j^4 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^3} - \frac{2\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^3} + \frac{4\beta_j \beta_{-j} n_j^2}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^3 n_{-j}^5} \right) (y-V)}{2\beta_j \beta_{-j} \left(\frac{\beta_{-j}}{n_j^2 \left(\frac{\beta_j n_{-j}^2}{n_j^2} + \beta_{-j} \right)^2} + \frac{\beta_j}{\left(\frac{\beta_{-j} n_j^2}{n_{-j}^2} + \beta_j \right)^2 n_{-j}^2} \right) G} = \frac{n_{-j} (y-V)}{\beta_{-j} G} > 0 \end{aligned} \quad (3.21)$$

Table 3.6: DEFINITIONS AND SOURCES OF VARIABLES

VARIABLE	DESCRIPTION	SOURCE
Dependent variables		
Expenditure shares	Public expenditures divided into different categories (see table 2.8) as a share of total public expenditures	Own calculations based on OECD National Accounts
Explanatory variables		
Corruption (CPI)	Corruption Perceptions Index (CPI) on a reversed scale from 0 (not corrupt at all) to 10 (very corrupt)	Transparency International
Spatial lag of expenditure shares	Weighted average of respective shares in $t - 1$, inverse of distance between country capitals as weights	Own calculations
Interest rate on government bonds	Interest rate on 10-year government bonds	OECD Economic Outlook No. 86
Unemployment rate	Harmonized unemployment rates	OECD Annual Labour Force Statistics (ALFS)
Real GDP per capita	Real GDP per capita (PPP-adjusted and in US\$)	OECD National Accounts
Age-dependency ratio	Sum of the population older than 65 yrs and younger than 15 yrs divided by working-age population	World Bank - World Development Indicators
Population density	Total population divided by surface area in square km	World Bank - World Development Indicators
Additional control variables (see tables 3.4 and 3.5)		
Government debt	Gross financial liabilities of the general government as a share of GDP	OECD Economic Outlook No. 86
Inflation rate	Growth rate of the Consumer Price Index	OECD Main Economic Indicators
Government ideology	Categorical dummy (1 = right-wing, 2 = center, and 3 = left-wing)	Database of Political Institutions (DPI)
Years left in current term	Number of years left in the current term for the ruling government (0 indicates election year)	Database of Political Institutions (DPI)
Government fragmentation	Probability that two deputies picked at random from among the govt parties will be of different parties	Database of Political Institutions (DPI)
Alternative corruption indicators (see table 3.5)		
Corruption (ICRG)	Corruption as perceived by foreign investors on a reversed scale from 0 (least corrupt) to 6 (most corrupt)	International Country Risk Guide
Corruption (WB)	Control of corruption measure on a reversed scale from about -2.5 (least corrupt) to +2.5 (most corrupt)	World Bank Governance Indicators
Instrumental variables (see tables 3.4 and 3.5)		
Press freedom	Index based on an annual survey of media independence scaled from 0 (most free) to 100 (least free)	Freedom House
Import penetration rate	Imports divided by domestic demand measuring to what degree domestic demand is satisfied by imports	OECD Macro Trade Indicators
Economic freedom	Weighted average of 10 submeasures graded using a scale from 0 (least free) to 100 (most free)	Heritage Foundation
Rule of law	Index measuring perceptions of the incidence of crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts (-2.5 to +2.5)	World Bank Governance Indicators

Table 3.7: SUMMARY STATISTICS

Variable		Mean	Std. dev.	Minimum	Maximum	Observations
Corruption (CPI _{t-1})	Overall	2.776	1.796	0.000	6.600	341
	Between		1.853	0.424	6.050	29
	Within		0.411	1.726	4.973	11.759
Interest rate on government bonds	Overall	5.104	1.783	1.003	16.243	341
	Between		1.364	1.678	8.930	29
	Within		1.251	1.988	14.709	11.759
Real GDP per capita	Overall	23,236.98	10,929.57	3,730.28	56,412.28	341
	Between		11,170.22	4,728.18	47,998.82	29
	Within		2,238.26	12,159.94	31,650.44	11.759
Unemployment rate	Overall	7.019	3.496	1.900	20.000	341
	Between		3.207	3.127	15.573	29
	Within		1.715	-0.293	12.755	11.759
Age-dependency ratio	Overall	48.652	4.409	37.886	61.486	341
	Between		4.610	39.401	61.168	29
	Within		1.350	44.354	54.444	11.759
Population density	Overall	154.926	135.560	2.768	492.323	341
	Between		133.678	2.957	479.759	29
	Within		4.541	133.119	173.400	11.759
Inflation rate	Overall	2.432	1.648	-0.895	12.655	322
	Between		1.226	0.078	6.130	28
	Within		1.158	-0.930	10.066	11.500
Government debt	Overall	65.674	31.869	6.928	175.272	322
	Between		30.566	10.655	144.439	28
	Within		9.921	15.032	97.852	11.500
Government ideology	Overall	2.040	0.911	1.000	3.000	322
	Between		0.609	1.000	3.000	28
	Within		0.727	0.326	3.887	11.500
Years left in current term	Overall	1.742	1.232	0.000	4.000	322
	Between		0.374	1.000	3.000	28
	Within		1.191	-0.472	3.885	11.500
Government fragmentation	Overall	30.649	25.883	0.000	82.780	322
	Between		23.650	0.000	79.116	28
	Within		11.108	-13.255	60.944	11.500
Corruption (WB)	Overall	-1.481	0.698	-2.625	0.022	259
	Between		0.724	-2.383	-0.285	28
	Within		0.128	-1.938	-1.065	9.250
Corruption (ICRG)	Overall	1.768	1.180	0.000	4.000	322
	Between		1.115	0.000	3.734	28
	Within		0.528	-0.254	3.012	11.500
Press freedom	Overall	17.475	7.150	5.000	49.000	322
	Between		6.980	7.923	32.333	28
	Within		2.615	7.142	34.142	11.500
Import penetration rate	Overall	49.839	35.006	8.752	213.126	322
	Between		32.896	10.133	174.494	28
	Within		8.356	5.317	88.471	11.500
Economic freedom	Overall	68.950	6.220	55.500	82.600	322
	Between		6.090	60.145	81.633	28
	Within		2.752	59.785	76.393	11.500
Rule of law	Overall	1.392	0.444	0.304	1.964	259
	Between		0.460	0.475	1.889	28
	Within		0.085	1.073	1.809	9.250

Chapter 4

Globalization and the Composition of Public Education Expenditures: A Dynamic Panel Analysis

4.1 Introduction

Globalization has received considerable attention in the political economy literature. One reason is that deliberate political actions such as trade liberalization and the abandonment of international capital controls have promoted the emergence of globalization. However, the true driving force behind globalization are technological advances in transportation, communication, and the processing of information that are only weakly influenced by policy-makers (James, 2002).¹ An alternative explanation for the concentration of globalization research in the political economy literature is the content of this research focusing on the vices and virtues of globalization's influence on public policy. More specifically, many contributions investigate whether a higher degree of global economic integration has changed the scope and limits of policy-making (Schulze and Ursprung, 1999).

From the public finance perspective, the literature highlights the implications of globalization for governments' ability to collect tax revenue. The main hypothesis investigated is whether the loss of governments' monopoly of coercion and strategic interactions with other governments competing for fiscal revenues has affected the design of tax systems (Aizenman and Jinjarak, 2009; Dreher, 2006b; Hines and Summers, 2009). This includes the question whether taxes have shifted from mobile production factors such as capital to less mobile factors such as labor (Rodrik, 1997; Schwarz, 2007; Zodrow and Mieszkowski, 1986). Even though such investigations are enlightening, it should not be overlooked that labor nowadays also

¹Cohen (1996) refers to political-driven versus technology-driven globalization as the "liberal" and "realist" models. In addition, he mentions two other perspectives emphasizing the role of the domestic political process and the importance of political culture and belief systems.

more easily transcends national borders, albeit not as much as capital. In this context, one may wonder whether governments have adjusted the composition of education expenditures given that especially high-skilled labor is considered to be mobile (Docquier and Marfouk, 2006; Egger and Radulescu, 2009; Grogger and Hanson, 2011).

Following such considerations, this paper investigates the effect of globalization on the composition of public education expenditures. Assuming a Leviathan government, we first derive theoretically that the readjustments of educational policies due to globalization are determined by the extent to which global economic integration affects (i) wages for different types of labor and (ii) mobility costs. By affecting wages and mobility costs, i. e. the “economic variables” in our model, globalization has an indirect effect on the fiscal policy of governments. This indirect effect will impact tax rates and expenditures for different educational programs.

The model shows that governments have, on the one hand, an incentive to invest more resources in tertiary education if globalization increases the wages of high-skilled workers. Readjusting education expenditures in this way would lead to a larger tax base and as a result would increase tax receipts. On the other hand, globalization, by decreasing mobility costs, intensifies tax competition and thereby diminishes the government’s ability to choose high taxes. This effect incentivizes governments to reduce funding for all educational programs as the returns to education cannot be taxed as easily as in a more integrated world. The overall effect of globalization on expenditures for different educational programs is therefore ambiguous. However, the theoretical discussion suggests that governments spend less on primary *relative* to tertiary education with a higher level of global economic integration.

Despite this theoretical result, the net effect of globalization on the government’s educational priorities is essentially an empirical matter, which is addressed in the second part of the paper. The dynamic panel analysis is based on System GMM estimations and uses data for 121 countries over the 1992 - 2006 period. The estimation results reveal that globalization has induced governments in developed as well as developing countries to increase spending for tertiary relative to primary education. Most likely, students from socio-economically disadvantaged backgrounds benefit predominantly from primary education expenditures, while students with a wealthy background benefit from tertiary education expenditures (Blanden and Machin, 2004; Hansen and Weisbrod, 1969). We therefore conclude that the effect of globalization on the composition of public education expenditures may widen the gap between rich and poor in the long-run.²

²Wälde (2000) explains the negative relationship between the share of primary education expenditures and income inequality by deriving that a higher share of secondary and tertiary expenditures provides incentives for the development of technologies. These technologies in turn lead to a replacement of unskilled by skilled labor that gives rise to a higher extent of income inequality.

While the shift in educational priorities towards higher education reduces equity, the effect from an efficiency point of view is ambiguous.³ On the one hand, there is evidence for developing countries that the ‘social rate of return’ to public resources invested at the primary level is higher than for public expenditures on higher education levels (Carnoy, 1992; Lockheed and Verspoor, 1991; Psacharopoulos, 1985).⁴ This would suggest that the observed shift in educational priorities is inefficient. On the other hand, a higher share of tertiary education expenditures can be justified from an efficiency perspective by pointing out that an increasingly technology-driven world characterized by fierce international competition requires more high-skilled labor.

The remainder of chapter 4 is structured as follows. Section 4.2 briefly reviews the existing literature on the linkages between globalization and education expenditures. Section 4.3 discusses the relationship between globalization and public expenditures for primary, secondary, and tertiary education in the context of a theoretical model. Section 4.4 presents the data and the empirical strategy, while we explore the effect of globalization on the composition of public education expenditures empirically in section 4.5. Section 4.6 concludes the analysis.

4.2 Globalization and public education: a literature review

The implications of globalization for public education are studied in several social sciences, each of which emphasize different aspects of educational policies.⁵ The sociological and pedagogical literature primarily analyze how globalization affects structural aspects of public education systems. More specifically, the main questions that are investigated are whether globalization leads to a convergence of nationally diverse educational systems (Green, 1999), whether it causes a “commodification”⁶ of education (Naidoo and Jamieson, 2005), and whether it increases the influence of international organizations on educational systems, especially in developing countries (McNeely, 1995).

While the analysis of globalization’s influence on different aspects of educational policies brings to light interesting insights, one has to acknowledge that educational policy has many dimensions. Hence, an analysis that is intended to analyze the overall effect of globalization on

³For a distinction between competitiveness-, finance- and equity-driven educational reforms due to globalization see Carnoy (1999).

⁴Note that Birdsall (1996) challenges the prevalent view that public resources for education in developing countries should be reallocated from higher to lower levels of education. Her main argument is that the available measures for social rates of returns to education do not capture all relevant dimensions.

⁵For an overview of recent research on the relationship between globalization on education across several academic disciplines see Spring (2008).

⁶Education is generally regarded as a means for social development, democratic empowerment and the advancement of well-being and economic development of societies. The term “commodification” of education refers to the fact that education is increasingly understood as an economic factor, while students are looked upon primarily as consumers of education serving as human capital for the labor market.

educational policies needs to be based on a more aggregated measure. To this end, researchers usually resort to data for public spending on education. The impact of globalization on public education *expenditures* is primarily analyzed by economists and political scientists. The relevant theoretical contributions can be subdivided into two groups linking globalization with education expenditures through two distinct channels. The first strand of the literature is based on the tax competition perspective. In this view, globalization is understood to increase the mobility of the high-skilled, which impedes the government's ability to tax these high-income earners. The reduction of the tax base has in turn an influence on public education expenditures.

One example for the tax competition approach is a study by Anderson and Konrad (2003) that analyzes theoretically how globalization affects private education effort and public education policies under the assumption of a Leviathan government. In their model, governments can decrease the private costs of education by appropriate public policies (which can be understood as expenditures) and thus motivate individuals to acquire more education. More educated individuals earn a higher wage and thus provide a larger tax base, but they also have the ability to emigrate if the domestic tax rate is too high. The authors derive that, in general, it cannot be determined whether globalization induces the government to decrease the private costs of education. This would suggest that there is no theoretical link between globalization and total education expenditures.

A second contribution comes from Haupt and Janeba (2009) who assume that the government seeks to redistribute income from high- to low-skilled individuals. The income redistribution is indirectly achieved by providing the high-skilled with education subsidies. As a result, the future income of the high-skilled increases and this in turn causes the tax base to grow. The derivations suggest that globalization reduces public education subsidies since high-skilled individuals can emigrate more easily in a globalized world. This forces the government to lower the tax rate in equilibrium. To conclude, an increase in the tax base due to public education expenditures does not benefit the low-skilled as much as it does in a world with closed economies. This provides the government with an incentive to reduce total education spending in an increasingly globalized world.

Poutvaara (2008) provides an extension to the two studies mentioned above by drawing a distinction between different subjects that are taught in higher education institutions. He argues that governments are aware of the increasing difficulty of taxation due to the threat of emigration. Therefore, governments react to globalization by reducing funding for fields of studies where the skills acquired are internationally transferable such as engineering. At the same time, governments provide more financial resources for subjects that are country-specific, such as law. This shift of education spending between different fields of studies is a valuable extension to previous investigations. However, due to the difficulty of obtaining data for such a detailed analysis, there is so far no empirical evidence in favor of this hypothesis.

The empirical evidence regarding globalization's effect on total education expenditures is mixed, which is not surprising given the disagreements in the theoretical literature. Dreher et al. (2008) find that globalization has not affected the share of education spending in total public expenditures. In contrast, according to Avelino et al. (2005) trade openness was positively related to education spending in Latin America during the 1980 - 1999 period. Busemeyer (2007) uses trade openness as a control variable in a panel data study on the influence of partisan politics on education expenditures in 21 OECD countries. He finds that total education expenditures were positively related to openness during the nineties, and that globalization has increased expenditures for all stages of education, but primarily for tertiary education. Shelton (2007) tests a large number of determinants of public education expenditures simultaneously in order to avoid omitted variable bias. His analysis provides evidence that globalization does not have an effect on public education expenditures. One reason why most of these studies fail to identify a significant effect of global economic integration on educational policies is that these effects may only be observed at lower levels of aggregation.

The second strand of the theoretical literature emphasizes the effect of increased trade on wages for low- and high-skilled labor and discusses how this distortion in wages affects educational policies. Hence, this perspective suggests an analysis of globalization's influence on the composition of education expenditures rather than aggregate spending on education. Ansell (2008), as the only theoretical contribution on this question, bases the analysis entirely on the Heckscher-Ohlin model and derives that the impact of globalization on education expenditures differs between developed and developing countries. In developing countries, primary education expenditures are expected to increase relative to tertiary education expenditures, whereas the opposite effect is expected for developed countries.

Based on estimations with country averages over the 1990s, Ansell (2008) finds confirmation for the implications of the theoretical analysis. However, the investigation neglects the dynamics of both globalization and the composition of public education expenditures. In addition, given the large number of studies that refute the Heckscher-Ohlin theorem with regard to globalization's predicted influence on wages (Feenstra and Hanson, 1999; Goldberg and Pavenik, 2007), the theoretical foundation for Ansell's findings is rather weak.

The above literature review illustrates that the bulk of the literature examining globalization's influence on public education emphasizes the role of tax competition. In addition, it has to be noted that the studies in the tax competition literature focus on the effect of globalization on *total* education expenditures while neglecting potential effects on the composition of education expenditures. The only study analyzing globalization's influence on the composition of public education expenditures that we know of is exclusively based on the Heckscher-Ohlin theorem. However, this theorem hardly finds confirmation in the empirical literature. Moreover, evidence in favor of this theoretical model by Ansell is exclusively based on a cross-sectional investigation.

The contribution of our paper is that we address each of the aforementioned shortcomings. First, we derive a theoretical model that emphasizes increased tax competition due to global economic integration, while at the same time taking into account globalization’s effect on wages as identified in the empirical literature. Second, the implications of the theoretical model are tested by investigating globalization’s influence on the shares of primary, secondary and tertiary education rather than education as a whole. Third, we conduct our estimations with panel data and apply dynamic estimation techniques in order to make use of the variation over time in our dataset.

4.3 Theoretical model

In this section, we develop a theoretical model to study the link between globalization and public expenditures for different educational stages. More specifically, after setting up the basic structure of the model in sections 4.3.1–4.3.4, we explore in section 4.3.5 how globalization affects the endogenous variables in the model, i. e. public education expenditures and the domestic tax rate.

4.3.1 Individuals

Consider a country with a population mass of 1. An individual i has an exogenously given ability that theoretically qualifies her for one and only one type of labor, for example “high-skilled” or “low-skilled” work. The wage that this individual earns for one unit of effective labor is w_i . The effective labor supply of individual i depends on the amount of public expenditures g_i that the government invests in her education. Public education expenditures are hence assumed to be productivity-enhancing. Individual i ’s market income ν_i is consequently specified as $\nu_i(w_i, g_i)$ with $d\nu_i/dw_i > 0$, $d\nu_i/dg_i > 0$, $d^2\nu_i/dg_i^2 < 0$, and $d^2\nu_i/dg_i dw_i > 0$.

These assumptions imply (i) that increasing wages and an increasing effective productivity due to more funding for the relevant educational stages raise the market income of individual i ; (ii) that education expenditures have a declining marginal effect on income; and (iii) that the marginal effect of education expenditures on income rises with higher wages.

The idea behind these assumptions is that the ability and talents of the individuals in the model are not substitutable. An individual with academic abilities can only pursue an academic career, whereas an individual with practical skills can only work in “practical jobs”. However, possessing the respective abilities is not sufficient. Individuals have to receive an appropriate education before their talent can be productively applied. If they receive either no education at all or the wrong kind of education, they become unproductive. For example, an individual with innate academic talents will become completely unproductive if she does

not receive higher education (it cannot take a practical job instead). Similarly, an individual with practical skills will benefit from good primary and/or secondary secondary education, but does not benefit from higher education.

Emigration

One important constraint the government faces when formulating its fiscal policy is that individuals may emigrate if the tax burden is too high.⁷ To model the mobility decisions, we presume that every individual takes the tax rate into account when deciding whether to emigrate or not. Individuals will remain in the home country if the following condition holds:

$$(1 - t) + \epsilon_i \geq (1 - t^F) - x, \quad (4.1)$$

with t^F denoting the tax rate in case of emigration (the “foreign” tax rate), x denoting the costs that have to be incurred in the case of emigration, and ϵ_i a random parameter that measures the home attachment of a given individual. We assume that $\epsilon_i \sim U(0, 1)$, i. e., that home attachment is uniformly distributed over $[0, 1]$. An individual will emigrate if the difference between domestic and foreign tax rates is larger than her home attachment and the mobility costs.

Given that ϵ_i is random, every individual’s mobility decision is stochastic. The probability π_i that an individual will remain in the country can be expressed as a function of the domestic tax rate and the mobility costs:

$$\pi_i = \pi_i(t, x) = F(\epsilon_i \geq z) = 1 - z, \quad (4.2)$$

with $z = (t - t^F) - x$, $d\pi_i/dt = -1$, and $d\pi_i/dx = 1$.

4.3.2 The government

We follow Anderson and Konrad (2003) by modeling the government as a Leviathan. The government is therefore exclusively concerned with rents R , which are defined as tax receipts minus total expenditures for education. The objective function is:

$$\max_{g_i, t} R = \int_0^1 (t\pi_i\nu_i - g_i) di \quad (4.3)$$

with $g_i \geq 0, 0 \leq t \leq 1$.

⁷Assuming that the production factors are supplied endogenously would lead to an alternative tax base effect. We ignore this effect in order to keep the model tractable.

Thus, education expenditures that increase individuals' incomes are only of interest to the government as far as they lead to higher rents.

4.3.3 Equilibrium

Education expenditures and the tax rate are determined simultaneously in the model. The former are characterized in equilibrium by:

$$t\pi_i \frac{d\nu_i}{dg_i} - 1 = 0 \quad \forall i. \quad (4.4)$$

Thus, the government chooses education expenditures for every individual i such that the increase in expected tax revenues due to a marginal increase in education expenditures is equal to the costs, which are 1.

The equilibrium tax rate is determined by:

$$\int_0^1 \left(\pi_i \nu_i + t \frac{d\pi_i}{dt} \nu_i \right) di = 0. \quad (4.5)$$

This equation states that the tax rate is chosen such that in equilibrium the additional revenues due to the marginal increase in the tax rate are equal to the revenue loss due to emigration.

4.3.4 Economic effects of globalization

We now analyze how globalization affects the equilibrium characterized by equations (4.4)–(4.5). Prima facie, globalization is assumed to have two direct effects in this model. On the one hand, it affects wages for different skill-types. On the other hand, it reduces the costs of mobility. As stated previously, we refer to these effects as “economic” effects. By affecting wages and the costs of mobility globalization will also indirectly affect the tax rate and education expenditures that the government chooses in equilibrium, i. e. it will eventually have fiscal effects.

Globalization and wages

Trade theory suggests a link between the extent of economic integration and factor returns. The Heckscher-Ohlin model and the related Stolper-Samuelson theorem, for example, state that falling trade restrictions lead to an equalization of factor prices through an increase in the trade of goods (Krugman and Obstfeld, 2005).

We therefore model the wage of individual i as a function of globalization G :

$$w_i = w_i(G). \quad (4.6)$$

How does globalization affect the wage for individual i , i.e. what is the sign of dw_i/dG ? According to the Heckscher-Ohlin model, the sign of this expression depends on (i) the skill level of individual i and (ii) whether she lives in a developing or industrialized country. Given that industrialized countries are relatively abundant in high-skilled labor and developing countries have a relative abundance in unskilled labor, one prediction of the Heckscher-Ohlin model is that the returns to low-skilled labor increase in developing and decrease in industrialized countries with deepening globalization, and vice versa for high-skilled labor. The empirical evidence, however, confirms the predictions of the Heckscher-Ohlin model only partially. That is, globalization has led to a relative rise in wages for high-skilled labor in industrialized (Feenstra and Hanson, 1999) *and* developing countries (Goldberg and Pavenik, 2007).

Globalization and mobility costs

The mobility costs x can be understood as the monetary representation of the costs of losing contact or keeping in touch with one's social and professional networks, and as the costs of relocating physical assets. One effect of globalization is that it lowers transportation costs, which implies that it becomes easier to visit one's acquaintances in the home country, or to relocate physical assets. Another effect is the spread of English as a modern Lingua Franca and the emergence of a global culture, both of which might reduce the non-monetary costs when moving to a foreign country. It is therefore reasonable to assume that mobility costs are a decreasing function of the extent of globalization, i.e., $x = x(G)$ with $dx/dG < 0$.

4.3.5 Fiscal effects of globalization

By implicitly differentiating the system of equations given in (4.4)–(4.5) with respect to G , we can analyze the effect of globalization on education expenditures and taxation. After rearranging, we obtain⁸:

$$\frac{dg_i}{dG} = - \frac{\left(\pi_i \frac{d\nu_i}{dg_i} \frac{dt}{dG} + t \left(\frac{dx}{dG} - \frac{dt}{dG} \right) \frac{d\nu_i}{dg_i} + t \pi_i \frac{d\nu_i^2}{dg_i dw_i} \frac{dw_i}{dG} \right)}{\left(t \pi_i \frac{d^2 \nu_i}{dg_i^2} \right)} \quad \forall i, \quad (4.7)$$

$$\int_0^1 \left(\left(\frac{dx}{dG} - \frac{dt}{dG} \right) \nu_i + (\pi_i - t) \left(\frac{d\nu_i}{dg_i} \frac{dg_i}{dG} + \frac{d\nu_i}{dw_i} \frac{dw_i}{dG} \right) - \frac{dt}{dG} \nu_i \right) di = 0. \quad (4.8)$$

⁸In both equations, we have used the fact that $d\pi_i/dt = -1$, and $d\pi_i/dx = 1$. In equation (4.8), we have additionally used the fact that $d^2\pi_i/dt^2 = 0$ and $d^2\pi_i/dtdx = 0$.

Equation (4.7) describes the effect of globalization on education expenditures and equation (4.8) its effect on the tax rate. As argued previously, equation (4.7) reveals that globalization affects education expenditures for individual i through two channels: (i) by affecting the wage for the type of labor that individual i supplies (dw_i/dG) and (ii) by affecting mobility costs (dx/dG).

The wage effect varies between individuals. In particular, the sign of dw_i/dG will likely differ between high-skilled and low-skilled individuals. As argued previously, the available empirical evidence indicates that dw_i/dG is positive for high-skilled and negative for low-skilled individuals in both industrialized *and* developing countries. Thus, this effect of globalization provides governments with an incentive to increase expenditures for higher education and reduce expenditures for lower education in both developed and developing countries.

The effects of the declining mobility costs are the same for all i . First, it is easy to see from equation (4.7) that the reduction in mobility costs motivates the government to reduce expenditures for all educational stages since dx/dG is negative.

However, the overall impact of globalization on education expenditures depends on how it affects the tax rate as well. But the tax rate is an endogenous variable so that the sign of dt/dG has to be determined within the system described by equations (4.7)–(4.8). Unfortunately, it is neither possible to explicitly solve equation (4.8) for dt/dG , nor to determine whether this expression will be positive or negative.

More specifically, globalization has three effects on the domestic tax rate. First, it incentivizes the government to lower the tax rate to prevent emigration because of the smaller emigration costs ($dx/dG < 0$). Second, it affects national income through two channels. On the one hand, it has an effect on the wages of all individuals. On the other hand, it affects incomes indirectly through its effect on education expenditures (which is determined within the system). It is unclear how the effect on income will impact the tax rate in the new equilibrium. At a fundamental level, we cannot be even sure that globalization's effect on national income will be positive or negative in a given country.

But even if we are willing to assume that globalization increases national income in a given country, the government faces conflictive incentives regarding taxation. On the one hand, it has an incentive to increase taxation because the marginal returns for a one percentage point increase in taxes are higher if income becomes larger. On the other hand, the costs in terms of forgone rents are also higher if individuals decide to emigrate because of tax rate differentials. Thus, whether or not governments will increase or decrease the tax rate due to globalization cannot be determined in general. Rather, the government's decision will depend on the values of the model parameters at a particular equilibrium.

While this model hence establishes that there is a link between globalization, the equilibrium tax rate, and different types of education expenditures, it offers no unambiguous prediction regarding the sign of the effects. That is, because of its ambiguous effect on the

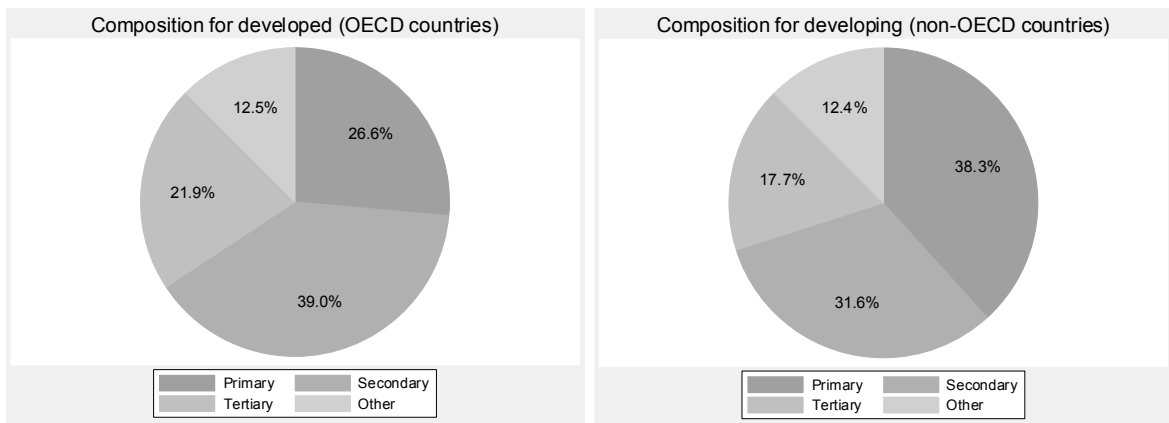
tax rate, the impact of globalization on absolute education expenditures for individual i is, irrespective of her skill-type, ambiguous as well. The discussion on the effect of globalization on the wage for different skill-types of labor, however, tentatively suggests that spending for higher education should increase relative to spending for lower education with deepening globalization in both developed and developing countries. This, then, is a theoretical hypothesis to be tested empirically.

4.4 Data and methodology

4.4.1 Data description

The education expenditure data is obtained from the World Bank's Edstats database, where the original source for this data is the UNESCO Institute of Statistics. The data is comprehensive in the sense that all education-relevant expenditures of public entities are covered, including expenditures by different tiers of government (Lassibille and Rasera, 1998). Figure 4.1 is based on averages for developing and developed countries across the period from 1992 till 2006. The two pie charts illustrate to what extent the allocation of education expenditures on average differs between these two country groups.

Figure 4.1: COMPOSITION OF PUBLIC EDUCATION EXPENDITURES, 1992 - 2006



Source: World Bank Edstats database

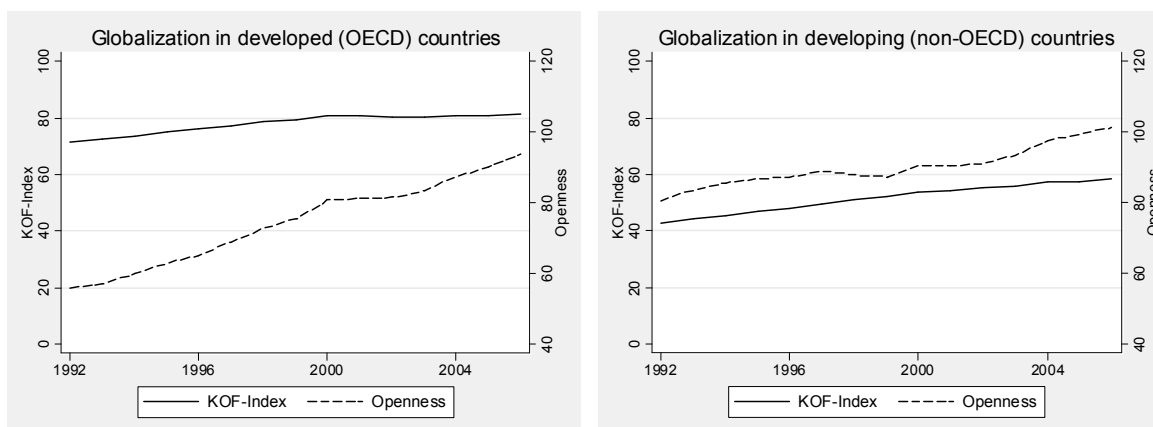
Figure 4.1 suggests that OECD countries spend a smaller share of total education expenditures (26.6%) on primary education than developing countries (38.3%). This can be attributed to the fact that the average level of education is lower in developing countries with a large share of the population only receiving basic education. This difference in education levels is also

confirmed with regard to the shares of secondary and tertiary education expenditures. While OECD countries spend on average 39.0% and 21.9% of the funds available for education on secondary and tertiary education, these shares only amount to 31.6% and 17.7% in developing countries, respectively.

To measure globalization, we use two proxies: the KOF-Index introduced by Dreher (2006a) and the trade openness measure (openness at constant prices) from the Penn World Tables. The KOF-Index is based on three sub-indexes which capture the extent of economic, social, and political globalization. The overall index of globalization is therefore based on a number of measures that capture actual economic flows, economic restrictions, data on information flows, data on personal contact, and data on cultural proximity. The KOF-Index therefore provides a more comprehensive picture than the traditionally used trade openness measure. Nonetheless, we also use the trade openness measure from the Penn World Tables as a second proxy for global economic integration to examine the robustness of the results. The evolution of the two measures of economic integration is plotted separately for developed and developing countries from 1992 onwards in figure 4.2.

Both the KOF-Index and the trade openness measure on average suggest increasing globalization for the two country groups, while the trade openness measure exhibits more variation over time than the KOF-Index. Moreover, the extent of trade openness is higher for developing than for developed countries throughout the entire period from 1992 to 2006. This observation can be attributed to the fact that poor countries are much more dependent on international trade. In contrast, the KOF-Index is generally by about 20 points higher in developed than in developing countries, which may imply that for instance in terms of cultural proximity and information flows wealthy countries are more globalized. The differences between the two globalization measures underline the rationale for including both of them in the regression analysis.

Figure 4.2: EVOLUTION OF GLOBALIZATION OVER TIME, 1992 - 2006



Sources: Penn World Tables and Dreher (2006a)

The first control variable that we include in the panel data estimations is the first lag of the dependent variable in order to capture dynamic effects in the composition of public education expenditures. Further control variables are: (i) the population share of each of the age groups relevant for the three educational programs, which represent the “theoretical demand” for the three types of education expenditures; (ii) GDP per capita, which captures how a country’s income level is related to the structure of education expenditures; (iii) a measure of government ideology, which controls for systematic partisan biases in education expenditures; and (iv) an index of democracy, which measures to what extent the government is accountable to the electorate.

We associate individuals aged 5 to 10 years with primary education, individuals aged 11 to 15 years with secondary education, and individuals aged 16 to 24 years with tertiary education. Even though this is only a rough approximation of the theoretical demand as the ages at which the three educational stages begin vary between countries, it should be sufficiently accurate. The ideology variable is a dummy that is 1 when the government is left-wing with respect to economic policy, and else 0.⁹ The democracy index is 1 when citizens have the highest and 7 when they possess the lowest amount of political rights. All control variables and their sources are listed in table 4.5.

The unbalanced dataset covers altogether 121 countries, both developing and developed, over the 1992 - 2006 period.¹⁰ Summary statistics for all variables used in the subsequent regressions are collected in table 4.6; a list of the countries that are considered in this study can be found in table 4.7. Both tables are in the appendix.

4.4.2 Empirical strategy

We estimate three dynamic panel data models to analyze the effect of globalization on the composition of public education expenditures. Since the three models take into account that the overall effect of globalization may differ between developing and industrialized countries, the estimations are specified as follows:

$$\begin{aligned} \text{Expshare}_{it} = & \alpha \text{Expshare}_{i,t-1} + \delta \text{Globalization}_{it} * \text{IND}_i + \gamma \text{Globalization}_{it} * \text{DEV}_i \\ & + \beta \mathbf{x}_{it} + \omega_t + \lambda_i + \epsilon_{it}, \end{aligned} \tag{4.9}$$

where Expshare_{it} is the share of public education expenditures allocated to either primary, secondary, or tertiary education, $\text{Expshare}_{i,t-1}$ represents the lag of the dependent variable,

⁹Note that this ideology variable is derived from the DPI dataset. Whereas this dataset distinguishes between right, center, left, and other governments, we use, for compactness, a 0 - 1 classification. We code observations with governments that are explicitly identified as left-wing as 1 and all other observations as 0.

¹⁰Since fixed effects are included in the empirical model (4.1), each of the included countries has at least two non-missing observations during the time frame of the analysis.

λ_i are the country fixed effects, ω_t are the year fixed effects, x_{it} represents a vector of control variables, and ϵ_{it} is the error term.

Note that analyzing these three expenditure categories simultaneously is not redundant since there are certain education expenditures that cannot be allocated to any of these three categories, so that the shares of primary, secondary, and tertiary education expenditures in total education expenditures generally do not add up to 100% (see figure 4.1).

Two variables are used in model 4.1 to explore the effect of globalization in industrialized and developing countries. The first variable is constructed by interacting a measure of globalization with a dummy variable, IND_i , that is 1 for industrialized countries and else 0. The second variable is constructed by interacting the same measure of globalization with a dummy variable, DEV_i , that is 1 for developing countries and else 0. We classify all countries as either industrialized or developing (see table 6).¹¹ We are interested in the estimates for δ and γ , the coefficients on the interaction variables: δ measures the effect of globalization in industrialized countries, whereas γ measures its effect in developing countries.

Note that we do not include the industrialized and developing country dummies, i.e., the “lower-order” effects of these dummies, as separate control variables in equation 4.1 because they are multicollinear with the country fixed effects. We also do not include a lower-order effect for the globalization variable because it is multi-collinear with a linear combination of the interaction effects. It may seem that the non-inclusion of the lower-order effects leads to an omitted variable bias (Braumoeller, 2004). This concern is, however, unwarranted.¹²

Due to the presence of fixed effects and the lagged dependent variable in equation 4.1, pooled OLS estimations are inconsistent. However, it is a well-known fact that the application of the within-estimator to dynamic models also yields biased estimates (Nickell, 1981). While the within-estimator is consistent and the Nickell-bias can be ignored when T is large, this bias may be serious in panels with a small time dimension. In order to shed light on the question what a large T means in the given context, Judson and Owen (1999) find that even in panels with $T = 30$, the estimated coefficient may have a bias of up to 20% of the true value. Since T is equal to 15 in our dataset, it is obvious that more sophisticated estimation methods are required for the empirical analysis.

Several IV and GMM estimators have been developed in order to deal with the bias in dynamic panel data models. For models where it cannot be assumed that disturbances

¹¹ Any classification of countries as industrialized or developing is of course arbitrary. We classify only OECD countries as industrialized. Therefore, the term developing as used in this paper should not be understood as being synonymous with, for example, the Least Developed Countries (LDC). It should rather be understood as encompassing all countries except the most wealthy.

¹² To see why, note that the complete specification of a model with country fixed effects and interactions of a continuous control variable with a dummy variable is: $y_{it} = \alpha_i + \beta_1 d_i + \beta_2 x_{it} + \beta_3 d_i x_{it} + \epsilon_{it}$, with $d_i \in \{0, 1\}$ (we omit other control variables for brevity). Thus, β_2 is the marginal effect of x when $d_i = 0$ whereas $\beta_2 + \beta_3$ is the marginal effect when $d_i = 1$. This expression is equivalent to $y_{it} = \alpha_i + \beta_1 d_i + \beta_2 (d_i x_{it} + (1 - d_i) x_{it}) + \beta_3 d_i x_{it} + \epsilon_{it}$, which can be rewritten as $y_{it} = \alpha_i + \beta_1 d_i + \beta_2 (1 - d_i) x_{it} + (\beta_2 + \beta_3) d_i x_{it} + \epsilon_{it}$, or $y_{it} = z_i + \gamma c_i x_{it} + \delta d_i x_{it} + \epsilon_{it}$, with $z_i = \alpha_i + \beta_1 d_i$, $c_i = (1 - d_i)$, $\gamma = \beta_2$, $\delta = (\beta_2 + \beta_3)$. This last expression has the same structure as equation 4.1. Since it is equivalent to the complete specification, the same is true for equation 4.1.

are spherical, the Arellano-Bond Difference GMM and Blundell-Bond System GMM estimators outperform their alternatives (Roodman, 2009b). Between these two, the choice of the appropriate estimator depends on whether the dependent variable is persistent or not. For persistent dependent variables, there is evidence that the Difference-GMM estimator gives rise to finite sample biases. In this case, the System-GMM estimator is recommended (Blundell and Bond, 1998; 2000). Since education expenditures are likely to be persistent, we apply the robust one-step System-GMM estimator. Moreover, we use a collapsed “GMM-style” instruments set to address the instrument proliferation problem (Roodman, 2009a).¹³

4.5 Estimation results

4.5.1 Baseline regressions

The results for the System-GMM estimations of model 4.1 are collected in table 4.1. In the first three models (column 2 to 4), the KOF-Index is used as the proxy for globalization, while the last three models (column 5 to 7) are estimated using the trade openness measure. There are three models for each globalization proxy due to the fact that we use three different dependent variables: the share of primary, secondary, and tertiary education spending.

First, note that the diagnostic tests reported at the bottom of table 4.1 confirm the validity of the set of instruments for all models. This can be deduced from the fact that the Hansen-J overidentification test is never rejected, while in addition second-order autocorrelation in the differenced errors is not found for any of the models (first-order autocorrelation in the differenced errors is expected and does not invalidate the estimates). The number of instruments is also smaller than the number of cross-sections, so that a bias due to instrument proliferation is not likely (see also section 4.5.2 for the findings from robustness checks).

The estimates suggest that deepening globalization leads to lower spending for primary relative to tertiary education in both industrialized and developing countries. The coefficients for the interaction variables, irrespective of whether the KOF-Index or the openness variable is used, is negative in the model for primary and positive in the model for tertiary education expenditures. The coefficients are, with one exception, at least significant at the 10% level and in some cases even significant at the 1% level. Generally, it can be said that the significance levels for the globalization coefficient are higher when using the KOF-index. This is in line with our expectations since it is more comprehensive than the trade openness measure.

¹³Without collapsing, the instruments count can be as high as 240.

Table 4.1: BASELINE RESULTS: SYSTEM GMM ESTIMATIONS, 1992 – 2006

Dependent variables:	KOF - Globalization Index			Openness (Penn World Tables)		
	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures
Primary education expenditures in $t - 1$	0.419*** (2.959)			0.443*** (3.073)		
Secondary education expenditures in $t - 1$		0.610*** (5.849)			0.608*** (5.759)	
Tertiary education expenditures in $t - 1$			0.455*** (3.724)			0.514*** (3.187)
KOF-Index \times IND	-0.135** (-2.234)	0.013 (0.405)	0.112*** (2.891)			
KOF-Index \times DEV	-0.141** (-2.196)	0.022 (0.671)	0.106*** (2.652)			
Openness \times IND				-0.036** (-2.280)	0.002 (0.206)	0.013* (1.654)
Openness \times DEV				-0.020* (-1.744)	0.005 (0.805)	0.003 (0.525)
Primary population	1.328*** (2.916)	-1.036*** (-3.537)	0.316 (1.525)	1.123*** (2.761)	-0.979*** (-3.631)	0.177 (1.050)
Secondary population	-1.286 (-1.187)	1.961*** (2.822)	-0.841 (-1.431)	-0.437 (-0.449)	1.780*** (2.715)	-0.768 (-1.525)
Tertiary population	0.473 (1.151)	-0.725** (-2.514)	0.241 (1.115)	0.191 (0.530)	-0.583** (-2.206)	0.208 (1.187)
GDP per capita	0.036 (0.599)	-0.021 (-0.524)	0.067 (1.265)	-0.006 (-0.126)	-0.004 (-0.085)	0.104** (2.060)

Democracy	-0.880** (-2.167)	0.385** (1.980)	0.321* (1.729)	-0.519* (-1.663)	0.190 (1.046)	0.162 (1.190)
Government ideology	-1.185 (-1.643)	0.296 (0.591)	0.413 (0.929)	-0.873 (-1.300)	0.148 (0.290)	0.178 (0.422)
Observations	587	650	754	603	666	775
χ^2	767.071	1085.849	418.184	713.561	997.463	473.261
Hansen-test (p-value)	0.809	0.283	0.374	0.849	0.392	0.445
AR(1)-test (p-value)	0.003	0.001	0.000	0.003	0.001	0.000
AR(2)-test (p-value)	0.143	0.808	0.179	0.126	0.849	0.247
Number of instruments	51	53	53	51	53	53

¹ Stars indicate significance levels at 10%(*), 5%(**) and 1%(***) ² t-statistics are in parentheses ³ Time fixed effects are included in all models

⁴ The GMM-style instruments set has been collapsed ⁵ Hypothesis tests are based on robust one-step standard errors

⁶ p-values for the Hansen overidentification test and the Arellano-Bond AR(1) and AR(2) tests as well as the number of instruments are reported at the bottom of the table. ⁷ Primary, secondary and tertiary education expenditures are measured as a share of total education expenditures

The magnitudes of the estimated coefficients for the three education expenditure shares are remarkably similar for industrialized and developing countries. A ten-point increase in the KOF-Index reduces the share of primary education expenditures by around 1.35 percentage points in industrialized and by about 1.41 percentage points in developing countries. At this point one should bear in mind that figure 4.1 illustrates an average increase in the KOF-Index of about ten points for industrialized and a little less than twenty points for developing countries over the 1992 - 2006 period. At the same time, a ten-point increase in the KOF-Index is associated with a rise in the share of tertiary education expenditures by 1.12 and 1.06 percentage points, respectively.

With regard to the trade openness measure, the coefficients appear much smaller at first sight. However, as figure 4.1 points out this measure has a much wider value range than the KOF-Index. The fifty-point and thirty-point increases in the trade openness measure over the 1992 - 2006 period suggest a reduction in the share of primary education expenditures by around 1.8 percentage points in industrialized and by about 0.6 percentage points in developing countries. Moreover, the observed increases in the trade share have induced *ceteris paribus* an increase in the share of tertiary education expenditures of 0.65 for industrialized countries, whereas the coefficient is insignificant for developing countries.

The remaining control variables perform reasonably. The lagged dependent variable is significantly positive with a coefficient between 0.4 and 0.6 for all expenditure categories, suggesting a high degree of persistence in the composition of education expenditures. In addition, we find that there is a positive relationship between the population share aged 5 to 10 and 11 to 15 years and expenditures for primary and secondary education, whereas an increase in the population share aged 16 to 24 years has no effect on expenditures. This is consistent with the notion that primary and the earlier parts of secondary education are usually compulsory, so that a larger number of children in the age group relevant for these education levels directly increases spending needs.

Another variable that is significant in some models is the democracy index which is consistently negative in the model for primary education and positive in the models for secondary and tertiary education. Taking into account that the democracy index is 1 when citizens possess the highest and 7 when they possess the lowest amount of political rights, we find that *ceteris paribus* more democratic countries spend more on lower relative to higher educational programs. This can be attributed to the fact that a deepening of democracy usually suggests an extension of political rights to the less wealthy part of society. These groups in turn benefit more from primary than from tertiary education.

The coefficient for GDP per capita is insignificant in all models but one. In the regressions using tertiary education expenditures as the dependent variable and openness as a proxy for globalization (last column of table 4.1), it has a positive coefficient significant at the 5% level. This would suggest that the more wealthy a country is the higher is the share

of public resources intended for education that this country allocates to higher education. Finally, the coefficient for government ideology is insignificant suggesting that there are no systematic partisan biases in the allocation of public education expenditures. This is not surprising given that the evidence in favor of partisan biases at higher levels of aggregation of public expenditures is generally quite weak.

4.5.2 Sensitivity analysis

This section provides the results for three robustness checks that are conducted in addition to using two different globalization measures. The estimations in tables 4.2 and 4.3 address potential deficiencies of the baseline estimations from an econometric viewpoint. The first robustness check involves a re-estimation of the models in table 4.1 by means of a two-step procedure using the Windmeijer-correction instead of the robust one-step procedure. While the two-step procedure is asymptotically efficient and robust to arbitrary forms of heteroscedasticity and autocorrelation, the Windmeijer-correction has been designed to deal with a potential finite sample bias in the calculation of the associated standard errors. Without the correction, a downward bias in the standard errors is possible (Windmeijer, 2005).

Generally, we find that the results in table 4.2 confirm the conclusions drawn with regard to the estimation results in table 4.1, even though the overall significance of the coefficients is lower. In the regressions using the KOF-Index as a proxy for globalization (columns 2 to 4), the coefficient for globalization is insignificant in the primary education expenditure model, but continues to be significantly positive for tertiary education expenditures. The size of the coefficient is also very similar to the results in table 4.1. This suggests that expenditures are still shifted towards higher education, even though it is not clear at the cost of which other category this occurs. The coefficient for primary expenditures continues to be negative, even though the t-statistic is now only at around -1.2 to -1.3.

When the trade openness variable is used (column 5 to 7), the coefficient for globalization is less significant than in columns 2 to 4. This coincides with our findings in table 4.1 and can be explained by the fact that the KOF-Index is the more appropriate and more comprehensive measure. In the regressions based on the trade openness measure, the globalization coefficient is only significantly negative for industrialized countries in the model for primary education expenditures. Hence, according to this measure, globalization does not affect the share of expenditures on primary education in developed countries and the tertiary expenditure share in any of the two country groups. Finally, it should be noted that the signs and levels of significance of the remaining control variables is very similar to the results presented in the baseline estimations.

Table 4.2: ROBUSTNESS CHECK I: SYSTEM GMM ESTIMATIONS WITH TWO-STEP STANDARD ERRORS, 1992 – 2006

Dependent variables:	KOF - Globalization Index			Openness (Penn World Tables)		
	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures
Primary education expenditures in $t - 1$	0.492*** (4.315)			0.477*** (4.097)		
Secondary education expenditures in $t - 1$		0.595*** (4.639)			0.614*** (4.597)	
Tertiary education expenditures in $t - 1$			0.391*** (3.232)			0.392** (2.462)
KOF-Index × IND	-0.092 (-1.291)	0.008 (0.193)	0.105*** (2.714)			
KOF-Index × DEV	-0.085 (-1.170)	0.013 (0.311)	0.102** (2.388)			
Openness × IND				-0.036** (-2.127)	0.002 (0.222)	0.013 (1.577)
Openness × DEV				-0.017 (-1.423)	0.005 (0.711)	0.003 (0.437)
Primary population	1.573*** (4.096)	-1.052*** (-2.716)	0.285 (1.356)	1.393*** (3.727)	-0.994*** (-2.855)	0.191 (1.003)
Secondary population	-1.675* (-1.946)	1.603* (1.777)	-0.906 (-1.474)	-1.060 (-1.281)	1.617* (1.868)	-0.874 (-1.481)
Tertiary population	0.437 (1.461)	-0.545 (-1.467)	0.243 (1.000)	0.285 (0.987)	-0.554 (-1.545)	0.198 (0.984)
GDP per capita	0.078 (1.230)	-0.055 (-1.101)	0.086* (1.648)	0.042 (0.859)	-0.039 (-0.718)	0.123** (2.278)

Democracy	-0.764** (-2.404)	0.265 (1.199)	0.345 (1.526)	-0.470* (-1.670)	0.157 (0.712)	0.179 (1.120)
Government ideology	-0.561 (-0.835)	0.001 (0.002)	0.386 (0.840)	-0.717 (-1.094)	0.014 (0.028)	0.292 (0.641)
Observations	587	650	754	603	666	775
χ^2	882.706	1042.405	373.045	850.113	883.511	381.440
Hansen-test (p-value)	0.809	0.283	0.374	0.849	0.392	0.445
AR(1)-test (p-value)	0.017	0.006	0.016	0.016	0.006	0.046
AR(2)-test (p-value)	0.174	0.873	0.173	0.159	0.908	0.238
Number of instruments	51	53	53	51	53	53

¹ Stars indicate significance levels at 10%(*), 5%(**) and 1%(***) ² t-statistics are in parentheses ³ Time fixed effects are included in all models

⁴ The GMM-style instruments set has been collapsed ⁵ Hypothesis tests are based on two-step standard errors with Windmeijer correction

⁶ p-values for the Hansen overidentification test and the Arellano-Bond AR(1) and AR(2) tests as well as the number of instruments are reported at the bottom of the table ⁷ Primary, secondary and tertiary education expenditures are measured as a share of total education expenditures

The second robustness check addresses the instruments proliferation bias problem. Roodman (2009a) argues that when too many instruments are used Sargan and Hansen J-tests used for testing instrument validity become weak and unreliable. In tables 4.1 and 4.2 we have already addressed this issue by collapsing the instruments matrix. Another approach would be to only use the first lags as instruments. This is the approach pursued in table 4.3.

The estimation results in table 4.3 are based on the same models as in tables 4.1 and 4.2. With regard to the estimations using the KOF-Index, we can say that the coefficients for primary and tertiary education expenditures have the same sign and are significant both for developing and developed countries. While the size of the globalization coefficient for primary education expenditures is still at around -0.1, it is by about 50% smaller for tertiary education expenditures compared to the results in table 4.1. However, the coefficient is still quite large since a ten-point increase in the KOF-Index would lead to an increase in the share of higher education expenditures by 0.6 percentage points.

In columns 5 to 7 (based on the openness measure), only the coefficient for primary education expenditures continues to be significant, while in column 7, the t-statistic for tertiary education expenditures is -1.62, which almost corresponds with significance at the 10% level. Finally, it should be noted that the results for the control variables are again very similar to those in table 4.1. The only difference that emerges is that the coefficient for GDP per capita is now even insignificant in column 7.

The third and final robustness check uses primary, secondary and tertiary education expenditures as a share of GDP rather than the respective shares vis-à-vis total education expenditures. Given that the theoretical analysis in section 4.4 lead us to conclude that globalization's effect on "absolute" expenditures cannot be determined analytically (see section 4.3.5), we attempt to resolve this question empirically.

Table 4.4 summarizes the results for these additional estimations. Generally, it is the case that the coefficients for the three expenditure types are much less significant than in tables 4.1 to 4.3. This is of course not surprising given the theoretical ambiguity of globalization's influence on "absolute" education expenditures. In fact, only for tertiary education expenditures is the coefficient significant at the 10% level in the regressions that rely on the KOF-Index. A ten-point increase in this index would imply that tertiary education expenditures increase by 0.04 percentage points for both developing and industrialized countries.

Table 4.3: ROBUSTNESS CHECK II: SYSTEM GMM ESTIMATIONS WITH RESTRICTED LAG LENGTH, 1992 – 2006

Dependent variables:	KOF - Globalization Index			Openness (Penn World Tables)		
	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures
Primary education expenditures in $t - 1$	0.601*** (6.271)			0.586*** (5.681)		
Secondary education expenditures in $t - 1$		0.789*** (11.571)			0.788*** (11.112)	
Tertiary education expenditures in $t - 1$			0.750*** (7.333)			0.738*** (6.453)
KOF-Index \times IND	-0.094** (-2.298)	0.011 (0.485)	0.058** (2.132)			
KOF-Index \times DEV	-0.098** (-2.254)	0.017 (0.818)	0.054* (1.879)			
Openness \times IND				-0.027** (-2.247)	-0.000 (-0.097)	0.008 (1.618)
Openness \times DEV				-0.015* (-1.717)	0.003 (0.836)	0.001 (0.204)
Primary population	0.955*** (2.943)	-0.657*** (-3.402)	0.100 (0.763)	0.876*** (2.923)	-0.641*** (-3.525)	0.069 (0.615)
Secondary population	-0.863 (-1.114)	1.380*** (3.067)	-0.356 (-1.049)	-0.326 (-0.446)	1.302*** (3.033)	-0.442 (-1.358)
Tertiary population	0.282 (0.966)	-0.455** (-2.363)	0.120 (1.053)	0.117 (0.437)	-0.382** (-2.171)	0.127 (1.202)
GDP per capita	0.034 (0.809)	-0.015 (-0.575)	0.028 (0.982)	0.002 (0.065)	-0.003 (-0.127)	0.055 (1.642)

Democracy	-0.579** (-2.103)	0.145 (1.078)	0.191* (1.812)	-0.367 (-1.607)	0.030 (0.256)	0.139* (1.694)
Government ideology	-0.759 (-1.384)	0.300 (0.780)	0.058 (0.205)	-0.618 (-1.155)	0.229 (0.589)	-0.015 (-0.055)
Observations	587	650	754	603	666	775
χ^2	1560.962	2618.706	1524.013	1331.519	2528.220	1232.484
Hansen-test (p-value)	0.159	0.858	0.514	0.191	0.860	0.506
AR(1)-test (p-value)	0.003	0.001	0.000	0.003	0.001	0.000
AR(2)-test (p-value)	0.165	0.880	0.272	0.156	0.912	0.327
Number of instruments	40	48	48	40	48	48

¹ Stars indicate significance levels at 10%(*), 5%(**) and 1%(***) ² t-statistics are in parentheses ³ Time fixed effects are included in all models

⁴ The GMM-style instruments have been restricted to the first lag ⁵ Hypothesis tests are based on one-step standard errors

⁶ p-values for the Hansen overidentification test and the Arellano-Bond AR(1) and AR(2) tests as well as the number of instruments are reported at the bottom of the table. ⁷ Primary, secondary and tertiary education expenditures are measured as a share of total education expenditures

Table 4.4: ROBUSTNESS CHECK III: SYSTEM GMM ESTIMATIONS WITH EDUCATION EXPENDITURES/GDP, 1992 – 2006

Dependent variables:	KOF - Globalization Index			Openness (Penn World Tables)		
	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures	Primary education expenditures	Secondary education expenditures	Tertiary education expenditures
Primary education expenditures in $t - 1$	0.348*** (2.643)			0.386** (2.358)		
Secondary education expenditures in $t - 1$		0.732*** (4.218)			0.755*** (4.644)	
Tertiary education expenditures in $t - 1$			0.711*** (4.925)			0.823*** (7.446)
KOF-Index × IND	0.001 (0.149)	0.004 (1.129)	0.004* (1.734)			
KOF-Index × DEV	0.001 (0.271)	0.005 (1.217)	0.004* (1.742)			
Openness × IND				-0.000 (-0.314)	0.001 (0.748)	0.000 (1.026)
Openness × DEV				0.001 (1.042)	0.001 (1.296)	0.000 (0.721)
Primary population	0.070*** (3.438)			0.047** (2.160)		
Secondary population		-0.007 (-0.374)			-0.030 (-1.432)	
Tertiary population			0.004 (0.534)			-0.006 (-1.151)
GDP per capita	0.007 (1.365)	0.000 (0.059)	0.003 (1.210)	0.006 (1.130)	0.001 (0.243)	0.003 (1.025)

Democracy	-0.049 (-1.534)	-0.003 (-0.180)	0.006 (0.735)	-0.027 (-0.718)	-0.003 (-0.212)	0.005 (0.778)
Government ideology	0.037 (0.556)	0.060 (1.408)	0.020 (0.751)	0.080 (1.052)	0.072 (1.643)	0.012 (0.568)
Observations	583	644	748	608	659	768
χ^2	133.648	1584.918	885.862	144.406	1559.582	1752.046
Hansen-test (p-value)	0.715	0.590	0.383	0.568	0.484	0.249
AR(1)-test (p-value)	0.032	0.020	0.001	0.035	0.018	0.000
AR(2)-test (p-value)	0.383	0.168	0.198	0.518	0.172	0.200
Number of instruments	49	51	51	49	51	51

¹ Stars indicate significance levels at 10%(*), 5%(**) and 1%(***) ² t-statistics are in parentheses ³ Time fixed effects are included in all models

⁴ The GMM-style instruments have been restricted to the first lag ⁵ Hypothesis tests are based on one-step standard errors

⁶ p-values for the Hansen overidentification test and the Arellano-Bond AR(1) and AR(2) tests as well as the number of instruments are reported at the bottom of the table. ⁷ Primary, secondary and tertiary education expenditures are measured as a share of GDP

The estimation results collected in tables 4.1 to 4.3 suggest that the share of higher education expenditures has increased due to globalization. Some of the estimation models, especially those in table 4.1, suggest that this shift in educational priorities has occurred at the expense of primary education expenditures. The effect is larger and more robust in terms of statistical significance when the KOF-Index is used as a proxy for globalization instead of the more traditional trade openness measure. This is not surprising given that the dimensions of globalization captured by the KOF-Index coincide more strongly with our theoretical considerations in section 4.3. It is obvious that an individual's decision to emigrate or not is not affected by trade flows but rather by issues such as cultural proximity, language competencies or the difficulty of obtaining a work permit in a foreign country. In terms of "absolute" education expenditures we find weak evidence that tertiary education spending has increased due to globalization, while the other two categories have not been affected significantly.

4.6 Conclusion

In this paper, we have analyzed the link between globalization and public education expenditures. We first derived theoretically that globalization affects public education expenditures through two separate channels. On the one hand, globalization changes the wages for different types of labor. This effect incentivizes governments to spend more on those educational stages for whose graduates wages increase. On the other hand, globalization affects education expenditures, *inter alia*, through its effect on the equilibrium tax rate. It was, however, not possible to determine the sign of this effect theoretically. Due to this indeterminate effect on tax rates, the effect of globalization on absolute education expenditures for different educational stages was indeterminate as well. However, the theoretical discussion suggested that governments will spend less on lower relative to higher education with deepening globalization.

We explored in a second step the effect of globalization on public expenditures for primary, secondary, and tertiary education empirically with data from 121 countries over the 1992 - 2006 period. The estimation results suggest that globalization has increased tertiary education expenditures both as a share of total education expenditures and as a share of GDP during the time-frame of the analysis. This increase has occurred at the expense of the share of education spending allocated to primary education.

It is clear that educational policies have distributional consequences by affecting the incomes of individuals. While the theoretical model is based on a Leviathan government that is exclusively interested on the rents to itself, real-world governments have a wider set of goals, among which distributional equity is presumably one of the more important ones. The fact that globalization shifts the educational priorities toward higher education may therefore be perceived as problematic from a policy perspective. Most likely, students from

socio-economically disadvantaged backgrounds benefit predominantly from primary education expenditures, while students with a wealthy background benefit from tertiary education expenditures (Hansen and Weisbrod, 1969; Blanden and Machin, 2004). Thus, the effect of globalization on public education expenditures found in this paper may widen the gap between rich and poor in the long-run. Consequently, governments may want to develop strategies to counteract this potential source of future inequality in order to sustain support for increased economic openness.

While this paper provides insights on the relationship between globalization and educational policies, its scope is limited to public education expenditures. This paper can therefore be extended in several ways. First, the interactions between globalization and private education expenditures could be analyzed in more detail given that private educational institutions play an important role in many countries. Second, it might also be worthwhile to analyze whether globalization and related processes such as immigration have led to institutional reforms of public education systems, such as the extent to which academic tracking takes place (Hanushek and Woessmann, 2006), and whether such reforms have been successful in addressing the educational challenges due to globalization. Extending this paper along these lines is therefore a promising avenue for future research.

4.7 Appendix

Table 4.5: DEFINITIONS AND SOURCES OF VARIABLES

VARIABLE	DESCRIPTION	SOURCE
Dependent variables		
Primary education expenditures /TOT	Primary education expenditures as a share of total public expenditures on education	{ World Bank Edstats database
Secondary education expenditures /TOT	Secondary education expenditures as a share of total public expenditures on education	
Tertiary education expenditures /TOT	Tertiary education expenditures as a share of total public expenditures on education	
Proxies for globalization		
Globalization	KOF-Index of globalization	Dreher (2006a)
Openness	(Exports + Imports / GDP) in constant prices	Penn World Tables 6.3
Control variables		
Primary population	Share of total population aged 5 to 10 years	{ World Bank Edstats database
Secondary population	Share of total population aged 11 to 15 years	
Tertiary population	Share of total population aged 16 to 24 years	
GDP per capita	PPP-adjusted GDP per capita in thousands and in constant prices	Penn World Tables 6.3
Government ideology	Index of government ideology with respect to economic policy (left-wing = 1, else = 0)	Own collection based on DPI (Beck et al., 2001)
Democracy	Index of political rights scaled from 1 = most free until 7 = least free	Freedom House
Alternative dependent variables (see table 4.4)		
Primary education expenditures /GDP	Primary education expenditures as a share of GDP	{ World Bank Edstats database
Secondary education expenditures /GDP	Secondary education expenditures as a share of GDP	
Tertiary education expenditures /GDP	Tertiary education expenditures as a share of GDP	

Table 4.6: SUMMARY STATISTICS

Variable		Mean	Minimum	Maximum	Std. dev.	Observations
Primary education expenditures /TOT	Overall	32.5	9.28	74.36	11.49	603
	Between		14.68	69.47	11.95	97
	Within		16.13	50.95	4.09	6.22
Secondary education expenditures /TOT	Overall	35.24	1.9	73.12	10.51	666
	Between		2	68.14	11.13	101
	Within		7.78	51.57	4.47	6.59
Tertiary education expenditures /TOT	Overall	19.3	2.67	36.82	6.86	775
	Between		5.15	34.81	6.58	112
	Within		2.49	35.34	3.3	6.92
KOF-Index	Overall	63.38	22.57	92.14	15.96	798
	Between		27.82	90.89	15.22	116
	Within		41.48	76.93	4.93	6.88
Openness	Overall	81.83	16.64	328.81	41.68	821
	Between		22.9	311.65	43.17	121
	Within		27.49	140.01	12.38	6.79
Primary population	Overall	13.09	6	22.38	4.68	821
	Between		6.76	21.7	4.64	121
	Within		8.19	18.42	0.89	6.79
Secondary population	Overall	7.29	3.78	11.58	2.05	821
	Between		4.12	11.15	2.01	121
	Within		5.95	8.95	0.37	6.79
Tertiary population	Overall	15.29	9.05	22.89	2.87	821
	Between		10.33	21.84	2.68	121
	Within		11.76	18.4	0.81	6.79
GDP per capita	Overall	13.95	0.59	47.25	11.14	821
	Between		0.62	42.9	10.58	121
	Within		1.54	24.49	2.15	6.79
Government ideology	Overall	0.35	0	1	0.48	821
	Between		0	1	0.4	121
	Within		-0.55	1.24	0.3	6.79
Democracy	Overall	2.84	1	7	2.12	821
	Between		1	7	2.11	121
	Within		0.34	6.34	0.51	6.79
Primary education expenditures /GDP	Overall	1.60	0.33	5.65	0.75	598
	Between		0.81	4.87	0.49	97
	Within		0.28	2.92	0.23	6.16
Secondary education expenditures /GDP	Overall	1.76	0.09	5.64	0.80	659
	Between		0.09	4.43	0.84	101
	Within		0.67	3.39	0.30	6.52
Tertiary education expenditures /GDP	Overall	0.97	0.07	5.07	0.54	768
	Between		0.14	2.30	0.49	112
	Within		-0.12	3.74	0.24	6.86

¹The number of observations reported here is larger than in the regression tables because we used lags

Table 4.7: COUNTRIES INCLUDED IN THE SAMPLE

Argentina	Greece (I)	Norway (I)
Australia (I)	Guatemala	Oman
Austria (I)	Guinea	Pakistan
Azerbaijan	Guyana	Panama
Bahrain	Hungary (I)	Paraguay
Bangladesh	Iceland (I)	Peru
Barbados	India	Philippines
Belarus	Indonesia	Poland (I)
Belgium (I)	Iran	Portugal (I)
Belize	Ireland (I)	Romania
Bolivia	Israel	Russia
Brazil	Italy (I)	Samoa
Bulgaria	Jamaica	Saudi Arabia
Burundi	Japan (I)	Senegal
Cambodia	Jordan	Singapore
Cameroon	Kazakhstan	Slovak Republic (I)
Canada (I)	Kenya	Slovenia
Cape Verde	Korea, Republic of (I)	South Africa
Chad	Kuwait	Spain (I)
Chile	Kyrgyzstan	Sri Lanka
China	Laos	St. Lucia
Colombia	Latvia	Swaziland
Congo, Republic of	Lebanon	Sweden (I)
Costa Rica	Lesotho	Syria
Cote d'Ivoire	Lithuania	Tajikistan
Cuba	Macedonia	Thailand
Cyprus	Madagascar	Togo
Czech Republic (I)	Malawi	Trinidad & Tobago
Denmark (I)	Malaysia	Tunisia
Dominican Republic	Maldives	Turkey (I)
Ecuador	Mauritania	Ukraine
Egypt	Mauritius	United Arab Emirates
El Salvador	Mexico (I)	United Kingdom (I)
Eritrea	Mongolia	United States (I)
Estonia	Morocco	Uruguay
Ethiopia	Namibia	Vanuatu
Fiji	Nepal	Venezuela
Finland (I)	Netherlands (I)	Vietnam
France (I)	New Zealand (I)	Zambia
Gambia, The (I)	Nicaragua	
Germany (I)	Niger	

¹ This table lists all countries that are included in at least one of the estimated models

² Countries classified as "industrialized" are indicated with an "I" in parentheses (see footnote 7 for an explanation of the criteria according to which a country is classified as developing or industrialized)

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