Economic development and growth in transition countries

Rusinova, D.T.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
The countries of Central and Eastern Europe and the former Soviet Union, commonly referred to as “transition countries”, have undergone transformations unparalleled in recent economic history. This book concentrates on three aspects of the transition process: the factors driving growth, the effect of foreign capital and the interplay between the profound institutional reform and economic performance in transition countries. The growth factors are different in the initial phase, when overcoming the initial inefficiencies from the old system play the major role, and the later phase, when growth determinants resemble those of the established market economies. Opening to international trade and foreign direct investment exercises a long-run positive effect on labour productivity through transfer of superior technology and more general knowledge, thereby helping transition countries to bridge their technological gap. The effect is particularly strong if foreign capital stems from technologically leading economies and is targeted to the manufacturing sector. Another important factor is the process of institutional reform through its complex link to economic performance: not only are institutions important for the economic outcomes, but there might exist a feedback loop from capital and output to the institutions, where countries performing better economically might end up locked in a state with poor institutions, high levels of corruption and inequality.
ECONOMIC DEVELOPMENT AND GROWTH IN TRANSITION COUNTRIES
ISBN 978 90 3610 185 1

Cover design: Crasborn Graphic Designers bno, Valkenburg a.d. Geul

This book is no. 479 of the Tinbergen Institute Research Series, established through cooperation between Thela Thesis and the Tinbergen Institute. A list of books which already appeared in the series can be found in the back.
ECONOMIC DEVELOPMENT AND GROWTH IN TRANSITION COUNTRIES

ACADEMISCH PROEFSCHRIFT
ter verkrijging van de graad Doctor aan
de Universiteit van Amsterdam,
op gezag van de Rector Magnificus
prof. dr.D.C. van den Boom,
in het openbaar te verdedigen
ten overstaan van een door het college voor promoties
ingestelde commissie, in het openbaar te verdedigen
in de Agnietenkapel

op 1 juni 2010

door

Desislava Todorova Rusinova
Promotor: Prof. Michael Ellman

Overige leden:
Prof. Nauro Campos
Prof. H.L.F. de Groot
Prof F.J.G.M. Klaassen
Prof. F. van der Ploeg
Prof. Dr. S.J.G. van Wijnbergen
ACKNOWLEDGMENTS

Writing of this PhD thesis was a long and sometimes very challenging experience, and I would like to thank the people without whom it would not have come to a successful end.

First of all, I am very grateful to my supervisor, Prof. Michael Ellman, for his very professional and competent guidance, for sharing his impressive expertise on transition countries, but also for giving me all the freedom in choosing topics of interest and methods to approach them. He also encouraged me in developing a critical view on conventional models and methods and I truly appreciate his great understanding and patience when my balance between academic work and other priorities in life became fragile, leading to delays in writing and the need to work from a distance.

I am very grateful to my husband Vilen Lipatov for his continuous support and numerous enlightening discussions, particularly when I felt stuck with a research problem. His parents and sister offered us selfless help in taking care of our two young daughters during most of the time since they were born, and allowing me to devote more time to research.

Further, I am also grateful to the colleagues from the University of Amsterdam and the Free University Amsterdam with whom I had chance to discuss my research. In particular, I am grateful to Henri de Groot, Wouter den Haan, Ruud Knaack, Koen Vermeylen, Massimo Giuliodori. The time I spent in Amsterdam was very useful and enjoyable not only due to the high-level graduate course program at the Tinbergen Institute and the NAKE program in Utrecht, but also due to all the activities I shared with my TI colleagues and friends: discussing, solving problem sets, discovering Amsterdam, and partying. They continued providing me with generous logistic and moral support whenever it was needed. I would particularly like to mention Marcos Poplawski-Ribeiro, Pietro Dindo, Valentyn Panchenko, Ana Babus, Haris Munandar, Jose Carlos Melendez Hidalgo (RIP), Yin Yen Tseng, Rute Mendes, Naomi Leefmans and many others. Robert Helmink and his colleagues from the UvA administration provided excellent assistance, including in some complex administrative and logistic matters. Going further back in time, I am also grateful to my parents, who instilled in me the desire to explore the world, but also taught me to set and pursue goals in spite of hindrances and challenges.

Teaching was part of my graduate program at the University of Amsterdam. I taught the Transition Economics course for undergraduate students in the period 2004 – 2006. I would like to sincerely thank the students who took this course, since each time it evolved as a mutual teaching experience: the students taught me alternative ways of viewing certain phenomena, and we enjoyed interesting discussions, particularly in the seminars.

From April until September 2008 I completed an internship in the EU Countries division of Directorate General Economics at the European Central Bank in Frankfurt, which was a truly invaluable research experience. I learnt a great deal about policy-oriented ap-
plied research and real-world economic developments. It was in this rich and stimulating environment where I got the idea and resources for the third chapter of the thesis. I enjoyed great cooperation and very friendly attitude from my colleagues, in particular Olga Arratibel and Frigyes Ferdinand Heinz. This experience helped me reassess my research abilities and determine more clearly my preferred area of work after graduation.
# CONTENTS

**LIST OF TABLES**

x

**LIST OF FIGURES**

xi

## 1 INTRODUCTION

1.1 Is transition just a historical concept? .......................... 1
1.2 What drives economic growth? ..................................... 2
1.3 Have trade and FDI helped transition countries? ............... 4
1.4 The key to the difference: institutions .......................... 6

## 2 GROWTH IN TRANSITION: RE-EXAMINING THE ROLE OF FACTOR INPUTS AND GEOGRAPHY

2.1 Summary ..................................................................... 9
2.2 Introduction .................................................................. 9
2.3 Literature review ....................................................... 11
2.4 The need for spatial economic models ............................. 11
2.5 Data ........................................................................... 13
2.6 Estimation strategy ..................................................... 16
2.7 Results ....................................................................... 18
2.8 Discussion ................................................................... 23

## 3 TECHNOLOGY TRANSFERS THROUGH FDI AND IMPORTS AND LABOUR PRODUCTIVITY IN THE CENTRAL AND EASTERN EUROPEAN COUNTRIES

3.1 Introduction ............................................................... 26
3.2 Literature review ....................................................... 27
3.3 Choice of the theoretical model .................................... 29
3.3.1 Solow-type model .................................................... 29
3.3.2 Endogenous growth model ..................................... 30
3.3.3 Bilaterally-weighted model (Coe and Helpman type model) .. 31
3.4 Long-run vs. short-run relationships ............................. 33
3.5 Estimation and data ..................................................... 34
3.5.1 Econometric methodology ...................................... 34
3.6 Data ........................................................................... 35
3.7 Results ....................................................................... 36
3.8 Discussion and conclusions ......................................... 41

## 4 RENT-SEEKING, STATE CAPTURE AND INSTITUTIONAL REFORM IN TRANSITION COUNTRIES

4.1 Summary ................................................................. 44
4.2 Introduction ............................................................. 44
4.3 Rent-seeking and state capture in transition ................... 45
4.3.1 General considerations .......................................... 45
4.3.2 The case of Bulgaria .............................................. 46
## CONTENTS

4.4 Related literature and modeling considerations .................................. 48  
4.4.1 Political influence and lobbying .................................................. 48  
4.4.2 Administrative corruption, lobbying and state capture ..................... 50  
4.4.3 Agent heterogeneity ................................................................. 51  
4.4.4 Rent-seeking as a separate economic sector .................................. 51  
4.5 Stylized facts .................................................................................. 52  
4.5.1 State capture index and Hellman’s stylized facts ............................. 52  
4.5.2 Stylized facts with institutional measures ...................................... 53  
4.5.3 Inequality .................................................................................... 54  
4.6 The model setup .............................................................................. 56  
4.6.1 The firms .................................................................................... 56  
4.6.2 The households ............................................................................ 58  
4.6.2.1 Workers .................................................................................. 58  
4.6.2.2 Rent-seekers .......................................................................... 59  
4.6.2.3 Double rent-seeking ............................................................... 60  
4.6.2.4 Double work ........................................................................... 60  
4.6.2.5 Rent-seek first, work afterwards ............................................. 60  
4.6.3 The equilibrium .......................................................................... 61  
4.6.3.1 Arbitrage conditions ............................................................... 61  
4.6.3.2 Capital market ....................................................................... 61  
4.6.3.3 Labor market .......................................................................... 62  
4.6.3.4 Prices ...................................................................................... 62  
4.7 Endogenizing institutions ................................................................. 64  
4.8 Parameterization ............................................................................ 66  
4.9 Comparative statics .......................................................................... 68  
4.9.1 Initial institutional level ............................................................... 69  
4.9.2 Initial capital ............................................................................... 70  
4.9.3 Total factor productivity ............................................................... 71  
4.9.4 Costs of political influence ......................................................... 73  
4.9.5 Reform step ............................................................................... 74  
4.9.6 Explanation of the stylized facts ................................................... 75  
4.9.7 Rent-seeking ability S and the measure of potential rent-seekers .... 76  
4.10 Conclusions and discussion ............................................................. 76  

5 SUMMARY OF THE FINDINGS ......................................................... 78  
5.1 On growth determinants... ............................................................... 78  
5.2 ...On international economic linkages... .......................................... 78  
5.3 ...and the role of institutions .......................................................... 79  
5.3.1 What is left unexplained? ............................................................. 80  

APPENDICES  
A. A short review of the cross-sectional spatial econometric models .......... 82  
A.1. Basic spatial dependence models ................................................... 82  
A.2. Estimation methods ....................................................................... 83
## LIST OF TABLES

1.1 Openness and foreign direct investment in new EU member states .......................... 4

2.1 First year of official positive growth .................................................. 12
2.2 Overview of the original variables ....................................................... 14
2.3 Global and local Moran’s I test for spatial autocorrelation of the GDP growth (normal approximation) .................................................. 19
2.4 Spatial diagnostics of the growth regression .......................................... 20
2.5 OLS and spatial error model for growth determinants in recession ............... 20
2.6 Spatial lag models for growth determinants in recession ............................ 21
2.7 OLS and spatial error model for growth determinants in recovery ............... 21
2.8 Panel data estimations for both periods ................................................ 22

3.1 Long-term relationships: Solow-type model ........................................... 37
3.2 Error-correction equations: Solow-type model, OLS ................................. 38
3.3 Error correction equations: Solow-type model, GMM ............................... 39
3.4 Short-run Borensztein-type model, OLS and GMM ................................. 40
3.5 Long-term relationships: bilaterally-weighted model ................................. 41

4.1 Cross-country comparison of the institutional, state capture indicators and inequality .............................................................................................................. 57
4.2 Overview of the model parameters ......................................................... 68
4.3 Variable values in the benchmark case .................................................... 69
4.4 Comparative statics for varying initial institutions .................................... 70
4.5 Comparative statics for varying initial capital .......................................... 72
4.6 Comparative statics with varying values of A ......................................... 72
4.7 Comparative statics with varying costs of political influence B .................... 74
4.8 Comparative statics with varying reform step ......................................... 75
4.9 Comparative statics with varying parameters lambda and S ........................ 76

5.1 Extreme bounds analysis for the recession period .................................... 87
5.2 Extreme bounds analysis for the recovery period .................................... 87
# LIST OF FIGURES

4.1 Rule of Law (X) vs. capture economy index (Y) .......................... 54
4.2 Rule of law (X) vs. inequality (Y) ......................................... 55
4.3 Total productive investment (Y) vs. initial institutions (X) ........ 71
4.4 Productive investment I as a function of the cost B. ................. 74
CHAPTER 1

INTRODUCTION

1.1 Is transition just a historical concept?

The countries of Central and Eastern Europe and the former Soviet Union, commonly referred to as “transition countries”, have undergone developments and transformations unparalleled in recent economic history. The largest part of these transformations took place before 2005. At present, referring to “transition” or “transition countries” often bears a historical connotation, implying that transition is considered to be a completed experience. What appeared as a result of transition seems to be an array of countries which are very heterogeneous in terms of degree of development and political systems. There are countries with authoritarian regimes at one extreme and others that have been members of the European Union for five years at the other.

In order to get an idea of the dispersion of the countries by economic characteristics, it is sufficient to have a look the UN human development index, an influential indicator of human well-being\(^1\) in 179 countries. The highest-ranked transition countries have index values comparable to those of the developed economies (26th position for Slovenia and 35th for the Czech Republic). Russia and Ukraine are around the middle of the world list with positions 73 and 82 respectively. At the other end, Kyrgyzstan and Tajikistan occupy positions 122 and 124, and are therefore classified as countries with medium to low levels of human development.

There is a lot of evidence that currently transition countries are a much more heterogeneous group than when they started the transition process. This suggests that if we search for the reasons of the current huge differences between countries, we should consider the possibility that they are rooted in the transition process, for example in some historical circumstances or political and economic decisions with far-reaching consequences (for example, the decisions about the reform course and sequence taken at the onset of transition). In addition, multiple equilibria and poverty traps might also be relevant phenomena for shaping the final outcome. In turn, this would imply that these initial events could continue to play an important role for the fate of the countries for some more time to go.

But in spite of the differences, there is evidence that transition countries also share some common characteristics. For instance, in many countries the reforms in certain important areas like institutional development are still to be completed (Gros and Steinherr, 2003). Even for new EU members like Bulgaria and Romania, recent critical reports of the European organizations suggest that there is still a lot to be accomplished in the area of judicial system, the public administration or the fight against organized crime.

Finally, although transition countries have grown fast and achieved a lot of progress

\(^1\)The Human Development Index (HDI) is a composite index, composed of measures of life expectancy, literacy, education and standard of living, which makes it a broad measure of human well-being. The index is comparable across-countries and is the basis of yearly world rankings.
1.2. WHAT DRIVES ECONOMIC GROWTH?

in the last decade, the recent economic downturn has revealed substantial vulnerabilities in their economies – large debts, too large reliance on foreign capital, and lack of fiscal discipline. These have caused recessions in Latvia, Estonia, Ukraine, Hungary, Romania, more severe than those in the Western European countries.

These factors might suggest that after all, the transition economies might still possess characteristics that on the one hand, distinguish them from the rest of the world and on the other hand, allow their consideration as one group. Therefore, being aware of the transition developments and their consequences continues to be important since this could help for much better understanding of many phenomena today and in the future.

My work concentrates on the question about the possible reasons for the large differences among the countries, and tries to relate them to some transition phenomena. Due to the relatively formal and technical character of the research I look for general relationships and pay limited attention to country-specific factors. I consider three different but related aspects of the transition experience, each contributing some details to the general picture. First, I identify the factors playing a role in each of the two transition phases of reorganization and recovery. Second, I investigate the way international economic relations have supported the recovery of the transition countries by improving labour productivity. Third, I take a more detailed look at the institutions in transition and how they work, which can shed light on some transition puzzles and individual country patterns that deviate from the general pattern. Now, let us review each of these aspects in more detail.

1.2 What drives economic growth?

One of the keys to explaining the differences among countries is understanding, which factors have played a role for the economic development, and how relevant they are empirically. Traditionally, researchers look at the growth rates of the gross domestic product as an important measure of economic development. They have found that a large number of factors influence economic growth, including the so-called factor inputs, namely capital and labour, but also the level of human capital, and various political and institutional factors. We are aware that transition is a very particular period of recent economic history, characterized by profound changes in the way the economy functions, and therefore there might be forces at work that are quite different than those in the “normal” market economies.

It is worth briefly reviewing the starting position of the post-communist countries. Their economies were distorted to various extents, since economic development was not the result of conventional economic logic, but of central planning which had other types of considerations

Prices did not reflect the economic value of goods and were not able to move in order to equate demand and supply. Instead, they were fixed, often at too low levels causing shortages of many products. Shortages were associated with substantial loss for society due to the time lost for queuing and efforts to acquire the products in an alternative, non-market way. Furthermore, capital and labour were not allocated to the sectors where they would be most useful, but their allocation was driven by the decisions of the central

\footnote{For a detailed analysis of socialist central planning, see for instance M. Ellman (1989): Socialist Planning, Cambridge University Press.}
planners.

All these distortions led to situations that would not be sustainable under a market economy, like for instance the long existence of production processes where the value of the end product was lower than the value of the inputs. A drastic example was the evaluation by Western experts of the industry of the former German Democratic republic, which revealed that the net value of the entire GDR industry was negative at world market prices (Gros and Steinherr, 2003).

Another peculiarity was that the technology level in transition countries lagged substantially behind that in the leading economies due to the trade and political isolation (Campos and Coricelli, 2002), which represented a substantial disadvantage. The degrees of these distortions varied a lot across countries, but their presence suggested that there was substantial scope for improvement and increasing output through reallocation and reorganization alone, without increasing the amount of inputs. This could be achieved, for instance, by redirecting capital and labour to more profitable industries, and by opening to trade. With such efficiency-improving measures, growth would not depend on the amount of inputs, but rather on other factors like speed and success of the reforms.

We consider two phases in the transition period up to 2001: recession period (we consider the period up to 1995, although for some countries this is not the end of transition recession) and a recovery period after 1995, when most of the transition countries have already recorded at least a year of positive growth.

In addition, we pay attention to one further issue, namely the fact that the economic characteristics of neighbouring countries may be related to each other. For instance, this can be the case when a common shock, say war or a crisis) affects an area which includes more than one country. Moreover, even a shock originating from one particular country is also very likely to affect other countries, which are immediate neighbours or are related through trade and other links. Finally, if a country is split into two or more new independent countries, many characteristics of the new parts including even the statistical errors of measuring and aggregating the data are likely to remain correlated for some time.

If such interdependencies are not controlled for, some of their effects can be erroneously attributed to other factors. With appropriate statistical methods, we can control for their influence and therefore also estimate more precisely the effect of the other factors on economic growth. We find several countries which show strong interdependencies of their own economic data with that of their neighbours. For the first period, these countries are Armenia, Georgia and Azerbaijan, most likely due to the armed conflicts in the Caucasus in the 1990s, and in the second period it is Russia, related to the Russian crisis from 1998, which has had a profound impact on the many countries from the former Soviet Union (FSU), including the Baltic states and many other FSU countries.

To sum up, our results show that the transition period should be considered as consisting of two sub-periods. The first phase has likely been the period for removing the initial inefficiencies and developing of the fundamentals of the market economy. In this period, we can find no link between the stock of capital a country uses and the growth rate. In the second period, however, the growth pattern of transition countries starts to resemble the one of the established market economies. The two factors that appear to be important throughout the whole transition period (or at least for the period we consider) are the level of education and the legacy of the former Soviet Union.
1.3 HAVE TRADE AND FDI HELPED TRANSITION COUNTRIES?

Having established the significance of the classical factors for the second transition period, we devote more attention to two particular factors which in theory have positive influence on the economic performance of the countries. These are international trade and foreign direct investment by multinational enterprises.

These factors are of particular importance for the transition countries. Indeed, the speed and scope of the opening of the economies to the rest of the world varied substantially between the countries. The increase and reorientation of trade took place relatively early in transition, and already in the beginning of the 1990s the countries (particularly the smaller ones) became relatively open economies. The increase in FDI has been remarkable too, although it took somewhat more time to materialize.

In the last decade there has been a real surge of foreign investment to transition countries, in particular to the new EU member states from the core EU members. A significant factor for the large amount of FDI and the number of foreign-owned enterprises has been the privatization process, where many enterprises have been purchased by foreign investors. In many countries, all major commercial banks are foreign owned (e.g. by Italian and Austrian banks in Bulgaria and by Scandinavian banks in the Baltic states).

The following table presents an overview of the international trade and FDI investment as a share of GDP for nine of the countries we cover in our study (excluding Croatia and Slovenia).

If we measure the degree of openness as the sum of the exports and imports of goods and services divided by GDP, we see that these countries are extremely open – with up to 158% of GDP for the Czech Republic and Hungary. In comparison, the share of trade in USA is about 24 percent and in France around 56 percent.\(^3\)

Many have asked the question what is the nature of the incoming foreign capital in a

---

1.3. **HAVE TRADE AND FDI HELPED TRANSITION COUNTRIES?**

country? Is it only another source of capital identical to the national one, or is it in some way superior to it? A foreign enterprise entering a local market expects superior profits as compared to the local firms and these expectations are based on some advantage as compared to the domestic firms. A foreign firm might have a better technology that has not been used in the host country yet and which might allow producing with large cost advantage; it might have better organization of the production process or be aware of other cost-saving and efficiency-improving methods. Also, its managers and specialists may possess some specific knowledge resulting from the firm’s experience in its field. Therefore, FDI can also be regarded as carrier of new technology and new knowledge in a fairly broad sense (technological or organizational). Then, if there is sufficient amount of FDI, it should have a beneficial effect on the efficiency of the whole economy.

However, exactly this generalization of the benefits from the firm level to the economy level seems problematic. It is clear, both theoretically and empirically, that FDI affects positively the performance and profits of the firm receiving it, but the aggregate effect is hard to detect. Some studies have identified it, but not for all country groups, and not for all economic sectors, while others concluded that it does not exist. One explanation is that although FDI improves the performance of the receiving firm and all firms vertically related to it (its suppliers and buyers) it might even affect negatively the competitor firms by squeezing their profits and decreasing their market share, which might outweigh the positive effect.

Transition countries can contribute to circumventing this problem since they have certain features which are considered to give optimal conditions for showing the positive effect of the FDI. Firstly, they have (or at least had at the beginning of transition) very good level of education, comparable to the developed countries, which suggests easy and smooth adoption of new know-how. Second, due to the long technological isolation, these countries had a technological level which was far from the world level, meaning that they had a lot to catch up with. Therefore, it seems that they would quickly bridge the technological gap and the improvement in productivity would be easy to notice in the aggregate statistical data. We consider labour productivity, or the amount of output per worker, as our measure of the efficiency of the economy, since this will give us an idea of how much can be produced by a unit of labour. We concentrate on a subset of all transition countries, namely the new EU members, due to better data availability and the particularly high levels of FDI.

Apart from FDI, we can expect to see a similar positive effect on productivity from imports of capital goods, i.e. the machines and equipment imported by domestic firms, which they need for the production process of other goods.

We can intuitively expect that the positive effect both does not take place instantaneously, i.e. that a certain time passes between the moment when the multinational enterprise enters the country and the moment when we are able to measure the positive effect on productivity. This has to do with the fact that it takes time before changes are implemented, staff is hired or re-trained and production is organized along the new lines.
1.4. THE KEY TO THE DIFFERENCE: INSTITUTIONS

1.4 The key to the difference: institutions

In the first two chapters, we concentrated rather on general relationships, established statistically for a large group of transition countries, leaving aside the country-specific factors. Devoting the necessary attention to country-specific factors in a formal analysis would be hard due to the small amount of data we have for individual countries. At the same time, although traditional factors like physical and human capital do play a role, they can only explain a relatively small part of the differences across countries. Initial conditions also cannot account for the vast differences among the transition countries we are observing.

Hence, let us return to one of the main questions of interest, namely why countries are so different in terms of economic performance. Searching for the answer, we look here at “Institutions” which is a fairly broad category of country characteristics comprising “the rules of the game” under which the economic agents make their decisions and act to implement them. This includes some measure of to what extent the citizens of a country enjoy political and economic freedom, whether proper laws are in place, to what extent the implementation of these laws is secured, whether the public administration responsible for providing public services to the citizens is efficient and non-corrupt, if the decisions and actions of public officials are transparent, etc. Institutions are usually measured using subjective data (how the institutions of a country are perceived by its citizens) collected by various international organizations (e.g. the World Bank, Transparency International, Heritage Foundation etc.).

One prominent empirical result that emerged after the first ten years of transition is that institutions play a role for explaining cross-country differences in output and growth. Countries with better developed institutions have higher output and grow faster. However, little is known about the nature of this effect. How exactly do institutions affect the economic performance and what is the channel through which this influence works? What determines the institutions themselves? Why have some countries achieved relatively fast institutional progress while others have remained with persistently undeveloped institutions, with high levels of corruption and organized crime? The formal research has provided an empirical confirmation to facts that are actually quite intuitive and each of us can observe daily in our life. If bureaucrats are corrupt and inefficient, we waste more time and more money (for a bribe) in order to obtain a certificate. We have to invest in security systems for our property if the police are unreliable. The public hospitals and schools are in a worse condition if bureaucrats loot money from the budget.

But if the benefits of better-developed institutions are clear both to citizens and to policy-makers, and if institutions are determined by them in elections, then why is there a lack of will to design and implement reforms which would improve the existing institutions and everybody’s welfare? The answer is that if some interest group can privately benefit from the state of undeveloped institutions and has political power, it might use the power to preserve the status quo. This group might include individuals with connections and control over assets from the previous system, who can receive income that does not result from any productive activity, but from looting of funds that would normally constitute the income of someone else. This type of income is also known as rent-seeking, therefore we also call such individuals rent-seekers. We can think of this looting in a direct or indirect way – in terms of lower personal income or inferior public goods in quality and quantity.
1.4. THE KEY TO THE DIFFERENCE: INSTITUTIONS

For instance, if an official loots money from the local budget, allocated to the construction of a new public school, it might not be constructed at all or at a much higher cost than otherwise. This would then drain the budget of funds for other important projects to the detriment of all citizens. On the other hand, an insider manager who strips assets in a firm would decrease its revenue and therefore also directly the salary received by its workers.

Countries with deficient institutions are usually also characterized by low transparency and accountability of decision-making, which allows for the group’s interference with the political decision-making in order to promote their own interests. By lobbying, bribing, and illegal deals rent-seekers can influence the way laws and regulations are formulated or the way they are implemented, and also block undesired laws, which could limit their opportunities to extract profits. For example, a law establishing clear procedures and control for assignment of public projects would prevent connected firms from receiving these projects. If this interference is wide-spread, the result might be that the passed laws have many built-in loopholes, ambiguities and hard-to-implement regulations, and leave a lot of discretion to corrupt bureaucrats to decide on the particular cases. In addition, their implementation might be poor and selective. This makes institutions as a whole dysfunctional and is a situation very hard to remedy since once rent-seekers have established their influence in politics, it is hard to remove them.

In order to be able to create a model of reality, we have to somehow express all these concepts quantitatively. This is done in the following way. We assume that there are two categories of people in the economy: a small share of the people have connections (often inherited from the old system) and control over assets that provide them with niches for rent-seeking, but they can also choose to work, depending on which of the two activities brings them more income. The rest of the population does not have access to rent-seeking; hence all they can do is work. Prevailing institutions (measured by an institutional index), and more specifically, the quality of law enforcement and the degree of protection of property rights, determine what fraction of the output can be looted by the rent-seekers. If appropriate laws are in place and there is strong law enforcement, then looting would not be possible at all, so even the most influential rent-seeker would give up looting and prefer working. If the institutional quality is very poor, then the rent-seekers would be able to extract a substantial part of the workers’ income with small effort until the latter are left with a minimum subsistence income.

What do the rent-seekers do with the extracted income? They spend it on a luxurious lifestyle (one can think of the notorious oligarchs), but they are also interested to be able to receive similar income in the future. Therefore they invest in organized activity which aims at preserving as much as possible the current state of underdeveloped institutions – by political influence to block reform efforts, to prevent the laws that would limit their possibilities for rent-seeking from coming into power. In this way, we obtain a complex feedback mechanism - institutions determine the decisions of rent-seekers and the degree of looting in the economy, but are also a function of these two factors. This is the key to explaining the existence of countries which perform relatively well economically, but have underdeveloped institutions, high levels of corruption and huge income inequality.

We can imagine that this type of political influence is a substantial effort that requires a large investment – rent-seekers not only want to influence laws, but also have to “cover
their traces” so that the process is invisible for the public or at least it appears legitimate, in order to avoid protests and revolts. The size and scope of such a task does not allow it to be performed by a single individual. The rent-seekers take their decision collectively, as an organized group with coordinated strategy and shared expenses for realization. Moreover, we assume that the coordination requires such a degree of information exchange that rent seekers observe perfectly who has benefited from the coordinated action and how much. In this way any organization member who has not paid an adequate contribution can be detected and effectively excluded (similarly to Mancur Olson’s "Logic of collective action - Olson, 1971").

What determines how much rent-seekers contribute for political influence? First, it depends on the amount “stolen”, which determines how much is available for spending. Secondly, it depends on how costly it is to organize actions on the highest political levels. In turn, the cost depends again on the quality of institutions (measured by our institutional index). The worse the institutions are, the easier for the rent-seekers to transform their economic power into political power.
CHAPTER 2

GROWTH IN TRANSITION: RE-EXAMINING THE ROLE OF FACTOR INPUTS AND GEOGRAPHY

2.1 Summary

In this chapter we reconsider the role of factor inputs in determining long-run growth for transition countries. For this purpose, we estimate cross-sectional growth equations using spatial econometric models. Investments in physical and human capital are found to be significant growth factors for the period after 1994. The estimated coefficients are very similar to those obtained in the literature for developed market economies. We also find evidence for spatial autocorrelation of growth, due mostly to the wars and financial crises in the region. Correction for such correlation increases the significance of the explanatory variables.

2.2 Introduction

The pioneering studies in empirical growth analysis (Barro, 1991, Mankiw et al., 1992) identified a number of factors explaining cross-country differences in long-term growth. As predicted by the neoclassical growth models, an important role is played by the so-called factor inputs: the investments in physical and human capital.

A large empirical literature on the determinants of growth in transition countries appeared in the 1990s. A broad agreement emerged that factor inputs do not play a role. Instead, cross-country differences in growth are explained by peculiarities of the transition process: initial conditions, reforms and institutions (Havrylyshin, 2001). As a consequence, all recent empirical studies of growth in transition have left factor inputs out of their attention and concentrated only on the transition-specific determinants. However, as the transition economies gradually transform into market economies, we can ask whether it is still justified to assume that factor inputs do not affect growth.

In this chapter we aim at contributing to the analysis of growth in transition by extending the existing empirical literature in two ways. First, we attempt to answer the question whether after more than a decade of transition, factor inputs are still not relevant for growth. In order to answer this question we return to the classical cross-sectional framework of studying empirical growth as introduced by Barro (1991) or Mankiw, Romer and Weil (1992). Second, the chapter addresses the so far neglected issue of possible spatial interdependence among countries, or the possibility that growth in an individual country depends on the growth of its neighbours. For this purpose we apply spatial econometric techniques which pay explicit attention to the spatial autocorrelation, and trace how

---


2An extensive description of works published in the 1990s is available in a comprehensive survey by Havrylyshyn (2001).
incorporating it into the analysis changes the inference from the growth regressions.

There are two major findings emerging from the analysis. The most important is that investments in physical and human capital do matter for per capita growth in transition, if we abstract from the initial period of “disorganization”. This result is robust to changing control variables. In fact, apart from the lagged growth (and in some cases the FSU dummy), factor inputs are the only variables that have explanatory power for the cross-country differences in GDP growth per capita. The estimated coefficients are positive and similar in magnitude to the ones found in the general empirical growth literature. The result for human capital implies a 0.04 - 0.05 percentage points gain in per capita growth for every percent increase in enrolment. For physical capital we have 0.08 p. p. gain resulting from a one percent increase in the investment/GDP ratio.

Second, our analysis reveals some evidence for the presence of spatial dependence in the transition dataset which has been neglected in earlier works. The correction for it increases the significance of all explanatory variables including factor inputs. Moreover, for the early transition it does not suffice to consider a country’s initial conditions and involvement in wars. Rather, these attributes for the neighbours have to also be accounted for. These results are important since the failure of the earlier literature to find significant factor inputs might lie in the absence of spatial dependence consideration.

The result of the significance of factor inputs is in fact very intuitive if we keep in mind the nature of the transition process. Transition is not a usual cyclical recession, but a profound change of the economic system involving the incentives faced by economic agents, the coordinating mechanisms and the structure of the economy. We can expect that over the relatively short period, while the initial distortions in the economies are not eliminated, efficiency- and allocation improving factors play a dominant role, concealing the effect of the long-run growth determinants (Fischer et al., 1996; Staehr, 2003). We can think of these factors as affecting the total factor productivity in the neoclassical growth model (Durlauf and Quah, 1998; Islam, 1995). However, as the transition process unfolds, it is natural that factor inputs come into action in explaining growth. The major result of the transition process is that the countries gradually turn into market economies. We can therefore expect the efficiency-enhancing factors to diminish their role, and the growth determinants of the transition countries to start resembling those of the established market economies. Moreover, gradually longer series of data on transition countries become available, which allows the effects of the long-run growth determinants to become discernible.

The rest of the chapter is organized as follows. The second section summarizes the conclusions of the cross-country growth studies on transition countries. The third section discusses in more detail the motivation for implementing spatial econometric techniques in this field. Section four and five contain correspondingly descriptions of the data and the estimation strategy, and section six describes the empirical results. The seventh section is devoted to a discussion of the robustness of the results with respect to several alternative setups. Conclusions follow. A brief theoretical review of the relevant spatial econometric models, spatial tests and spatial weighting matrices used in the present analysis can be found in Appendix A, and the intermediate results from the extreme bounds analysis are contained in Appendix B.
2.3 Literature review

This section provides an overview of the empirical literature on transition and the reasons why factor inputs have been neglected by the work in this area. For detailed comments of the findings of the empirical work from 1990s, the reader may refer to the detailed surveys of Havrylyshyn (2001), or Havrylyshyn et al. (1998).

There is broad agreement in the literature that traditional factor analysis plays no role for growth in transition since studies using long-term growth determinants (investment in physical and human capital, population growth) found that these were not significant (Campos, 2001; Staehr, 2003). For this reason, the majority of studies do not consider factor inputs at all.

Instead, growth in transition appears to be explained well by four clusters of transition-specific factors. The first relates to what is called “short-run macroeconomics” (Temple, 1999) or macroeconomic policies measured by inflation, fiscal deficits etc. The second cluster includes indicators of initial distortions like the degree of over-industrialization of the economy, repressed inflation or number of years under communism, first used in de Melo et al. (1997). The third cluster comprises economic reforms like internal or external liberalization, privatization and financial sector reform, measured usually by the EBRD reform indicators. In the fourth place, a relatively new strand of empirical literature has found significant institutional factors like economic freedom, protection of property rights, corruption etc. Further controls found to be significant are regional dummies, war dummies and geographical factors like distance from Western Europe (e.g. Aslund et al., 1996). Apart from these, more recent works have identified such factors as increase in oil prices for the oil-producing countries and the convergence to the country’s potential output level (Falcetti et al., 2005).

2.4 The need for spatial economic models

A possible reason for the failure of the literature to find factor inputs significant is the absence of spatial dependence considerations. Put simply, the spatial autocorrelation (one of the forms of spatial dependence) means that the spatial units (in our case, countries) are not independent of each other (Abreu et al., 2005). Correction for spatial dependence is important since failure to consider it can result in serious model misspecification (Abreu et al., 2005; Anselin, 1992). Spatial econometrics provides us with rigorous tools to account for the spatial dependence between countries.

The composition and the characteristics of the transition sample give us ample reasons to expect the presence of spatial dependence. First, growth rates in neighbouring economies are correlated because of the natural links between them: trade, capital flows, labour mobility, technology diffusion (Abreu et al., 2005) etc. In addition, spatial correlation should be expected when the spatial units are affected by substantial common shocks (Anselin, 1988; Rey and Montouri, 1999). Examples of common shocks abound in the case of transition economies: in early transition, the collapse of the CMEA trading...
Table 2.1: First year of official positive growth

<table>
<thead>
<tr>
<th>Country</th>
<th>First year with positive growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>1993</td>
</tr>
<tr>
<td>Armenia</td>
<td>1994</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>1997</td>
</tr>
<tr>
<td>Belarus</td>
<td>1996</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1994</td>
</tr>
<tr>
<td>Croatia</td>
<td>1994</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>1993</td>
</tr>
<tr>
<td>Estonia</td>
<td>1994</td>
</tr>
<tr>
<td>Georgia</td>
<td>1995</td>
</tr>
<tr>
<td>Hungary</td>
<td>1994</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>1996</td>
</tr>
<tr>
<td>Kyrgyz Republic</td>
<td>1996</td>
</tr>
<tr>
<td>Latvia</td>
<td>1994</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1995</td>
</tr>
<tr>
<td>FYR Macedonia</td>
<td>1996</td>
</tr>
<tr>
<td>Moldova</td>
<td>1997</td>
</tr>
<tr>
<td>Poland</td>
<td>1992</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>1997</td>
</tr>
<tr>
<td>Romania</td>
<td>1993</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>1994</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1993</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>1998</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>1998</td>
</tr>
<tr>
<td>Ukraine</td>
<td>1999</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>1996</td>
</tr>
<tr>
<td>Yugoslavia (Serbia)</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Source: World Bank World Development Indicators, 2004
block had strong negative consequences for both trade and production of all transition countries due to the heavy intra-bloc trade dependence. Later on, the Russian financial crisis of 1998 influenced also the neighboring countries with strong economic relations with Russia.

A similar cross-border shock effect can be exercised by wars and conflicts. A traditional way to handle these effects is through a war dummy. However, it is insufficient to describe the entire effect of wars, since it only distinguishes the countries immediately involved, while neighboring countries are likely to be affected as well via the collapse of trade, economic embargoes, etc. For instance, the economy of Bulgaria was adversely affected by the war in former Yugoslavia, although the country itself was not involved in it (Christoffersen and Doyle, 1998).

Second, since the data are gathered only at an aggregate scale, there may be a discrepancy between the spatial scope of an economic phenomenon and the formally drawn borders of spatial units. In this case, the measurement errors are likely to “spill over” the border of the units and give rise to a spatial residual autocorrelation (Anselin, 1988). In our sample, there are countries which were parts of a single country or federation, and the statistical data for them for this period has been artificially “split”. Therefore, the measurement and aggregation errors of the new separate series are likely to be correlated since these activities were performed by the same institution with the same methodology. Examples are the former Soviet Union, former Yugoslavia, and Czechoslovakia. Some earlier works (e.g. de Melo et al., 1997) have corrected for this through including a categorical variable, indicating whether the country has been an independent state or a part of a larger formation at the beginning of the period. However, the spatial approach handles the issue in a substantially more advanced and theoretically sounder way.

Next to these reasons, there is increasing evidence in the literature that spatial interdependence exists among countries or regions (Abreu et al., 2005). More specifically, GDP levels or growth tend to exhibit clustering in space: if a country is experiencing strong growth, it is likely to be situated close to countries where growth performance is also strong (Cannon et al., 2000; Ramirez and Loboguerrero, 2002). Therefore, we can expect to find a similar effect in our case.

2.5 Data

The data are gathered from a variety of sources. Table 2.2 gives an overview of the variables used, the source, and period covered. The major data sources are the World Development Indicators, published annually by the World Bank.

In contrast to many transition studies, which take aggregate GDP growth as the dependent variable, we remain in the stream of traditional empirical growth and employ the growth of per capita GDP. This does not only ensure better comparability with the studies in general growth empirics, but also gives a better measure of the relative change in living standards than total GDP.

\textsuperscript{5}Apart from spatial dependence, there is also another way in which the value of an economic indicator can depend on the location of a country – spatial heterogeneity. This comes when the economic characteristics of the countries vary systematically according to a characteristic with a spatial dimension like the geographical position (Abreu et al., 2004). In our case however, spatial dependence is more relevant than spatial heterogeneity. For details see appendix A.4.
### Table 2.2: Overview of the original variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
<th>Period covered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita</td>
<td>Average annual percentage growth of GDP per capita</td>
<td>World Bank</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population growth</td>
<td>Average annual percentage growth of population</td>
<td>World Bank</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td>Investment Schooling</td>
<td>Gross domestic capital formation as % of GDP</td>
<td>World Bank</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td><strong>Macroeconomic stabilization</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log inflation</td>
<td>Natural logarithm of the annual percentage growth of the GDP deflator</td>
<td>World Bank, EBRD</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td><strong>Measures of economic reforms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal liberalization</td>
<td>Annual index of progress in price liberalization</td>
<td>EBRD</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td>External liberalization</td>
<td>Annual index of trade and foreign exchange liberalization</td>
<td>EBRD</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td>Small scale privatization</td>
<td>Index of progress in small-scale privatization</td>
<td>EBRD</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td>Large scale privatization</td>
<td>Index of progress in large-scale privatization</td>
<td>EBRD</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td>Enterprise restructuring</td>
<td>Index of enterprise restructuring and reform</td>
<td>EBRD</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td><strong>Initial conditions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-industrialization</td>
<td>Difference between the actual share of industry in GDP and predicted share</td>
<td>De Melo et al. (1996)</td>
<td>1989</td>
</tr>
<tr>
<td>Suppressed inflation</td>
<td>Difference between growth in real wages and real GDP</td>
<td>De Melo et al. (1996)</td>
<td>1989</td>
</tr>
<tr>
<td>Years under communism</td>
<td>Number of years under communism</td>
<td>De Melo et al. (1996)</td>
<td>1989</td>
</tr>
<tr>
<td>Share of CMEA trade</td>
<td>Share of country's trade with CMEA countries</td>
<td>De Melo et al. (1996)</td>
<td>1989</td>
</tr>
<tr>
<td><strong>Institutional variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corruption</td>
<td>Index of corruption</td>
<td>Freedom House</td>
<td>1999 – 2002</td>
</tr>
<tr>
<td>Governance</td>
<td>Governance and public administration</td>
<td>Freedom House</td>
<td>1997 – 2002</td>
</tr>
<tr>
<td>Average Freedom Index</td>
<td>Composite index of political and economic freedom</td>
<td>The Heritage Foundation</td>
<td>1995 – 2002</td>
</tr>
<tr>
<td><strong>Additional controls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>War dummy</td>
<td>1 if the country suffered a major conflict or war</td>
<td>De Melo et al. (1996)</td>
<td>1990 – 2002</td>
</tr>
<tr>
<td>FSU dummy</td>
<td>1 if country belonged to the FSU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACC dummy</td>
<td>1 if the country becomes a member of EU in 2004 or 2007</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The choice of explanatory variables builds on both the general empirical growth literature and on transition-specific studies. As in Barro (1991) and Mankiw, Romer and Weil (1992), investment in physical capital is measured by fixed capital formation as a proportion of GDP and investment in human capital – by school enrolment (see below for details). Initial level of GDP per capita, population growth and the logarithm of the inflation rate are traditionally used in empirical growth analysis (Levine and Renelt, 1992; Barro, 1991; Mankiw, Romer and Weil, 1992).

We use four of the initial condition variables constructed by de Melo, Denizer and Gelb (1997) and broadly used in later works. These are the degree of over-industrialization, (the excessive industry share over its predicted share), the number of years under socialism, the repressed inflation in 1989 and the share of CMEA trade in total trade in 1989.

The reform variables are taken from EBRD and include measures of internal liberalization, external liberalization, small and large-scale privatization and enterprise restructuring. The backdated reform indicators are used (EBRD, 2000), which enables the use of time series starting in 1991.

There is criticism of the EBRD indicators in the literature. It mainly concerns their subjectivity (they are based on the opinion of country experts at the EBRD) as well as their ordinal nature, making it hard to interpret the coefficients in a quantitative analysis (Falcetti et al., 2002; Campos and Horvath, 2005). However, this is the only available comprehensive dataset on reforms in transition countries, with data collected using the same methodology for all countries\(^6\). Moreover, the present chapter does not concentrate explicitly on the effect of reforms on growth, but merely includes them as additional control variables. Therefore, we assume that they are acceptable as reform measures for the present purpose.

We consider “first generation” and “second generation” of reforms, where the first group comprises price liberalization, trade liberalization and small-scale privatization, and the slower second-generation reforms include large-scale privatization and enterprise restructuring. The reason is that the time needed to design and empower different types of reforms varies: some reforms like price liberalization were implemented by most countries early on, “with the stroke of a pen” (Gros and Steinherr, 2004), while the restructuring and privatization of the large state-owned enterprises requires substantially more time and effort. Indeed, later years do not witness a lot of cross-country variation in the two liberalization indexes and almost all countries obtain advanced “grades”, while in the third index the variation is substantial even in 2002 (EBRD, 2003).

It is hard to find consistent data about investment in human capital. The most appropriate proxy for it is the average number of years of schooling (Temple, 1999). However, such data are not systematically available for transition countries. We use the upper secondary school enrolment from the UNICEF Transmonee database, since this specialized measure is most likely to reflect the availability in the economy of the human capital obtained through high levels of education, crucial for the success of restructuring and modernizing. Moreover, this human capital measure exhibits more variation across countries than alternative schooling measures.

The institutional variables come from two sources: the Freedom House publications\(^6\). A new reform indicator dataset has been created recently in Campos and Horvath (2005).
2.6. ESTIMATION STRATEGY

and a general index of economic and political freedom by the Heritage Foundation. Since
the indexes of the Freedom House are only available for the years after 1997 and the
Heritage foundation index after 1995, they are included only for the second period.

Finally, the variables include three additional controls – a war dummy, a dummy for
the FSU countries and one for the EU accession countries. Wherever available, the data
include observations until 2002 (World Bank, 2004).

The method of principal components is used several times in the chapter in order
to handle groups of variables, which are heavily correlated, like the four institutional
variables and the two groups of reform indicators. Only the first principal component is
used out of each correlated group. In this way, the chapter only finds the relative weight of
the institutional and reform factor groups, and does not disentangle the roles of individual
factors within these groups.

Of course, any work dealing with data from transition countries should acknowledge
the problems with data quality. The problem is most severe in the initial years of tran-
sition and in some FSU countries, where estimates from two different national sources
differ by up to 50% (Gros and Steinerr, 2004). The measurement errors and initial under-
reporting of output, due to failure to capture the output of the new private sector are
widely discussed in the literature. In addition, the task of statistical offices changed from
measuring quantities towards measuring values. The targeted indicator had to change
from net material product to GDP, which includes also the so-called non-material ser-
services (World Bank, 2002) and for some countries, this change took several years. There
are further problems, like the difficulty to capture the substantial informal sector; to value
goods produced under the old system, price distortions from high inflation etc. (World
Bank, 1996). However, since these problems are less severe for later years, the analysis
using newer data should provide more accurate results.

2.6 Estimation strategy

On the first step of model specification we split transition into two periods: early and
late transition. The first period covers the years from 1990 until 1994, and the second –
from 1995 onwards. The reason for such a division is our conjecture that different factors
explain growth in the two periods of transition. Initial conditions and efficiency-improving
reforms might play a stronger role in the beginning, while other factors might come into
action later.

However, the time point when the first group of factors gives way to the second is
not identifiable. To fix this problem, we can use the U-shaped output dynamics as a
benchmark. According to this criterion, 1995 seems a reasonable choice: by 1995, 12 of
the 25 countries in the sample, (almost all non-CIS states), have already witnessed at least
one year of positive growth (Table 2.1). In the following years, the rest of the countries in
our sample also experience growth turnarounds and positive growth in the whole region
resumes by 1999 (Table 2.1).

Alternatively, we can use advances in reform and choose a cutoff point at the time
when the quickest “first generation” reforms - price and trade liberalization, are close to
completion for most countries. Inspection of the EBRD reform indicators series reveals
that only by 1995 the majority of countries receive advanced “grades” in both areas of
2.6. ESTIMATION STRATEGY

3.7 or higher\(^7\) (EBRD transition reports).

In addition, previous work has also adopted the division approach using the years 1994/1995 as a turning point (e.g. Fisher, Sahay and Vegh, 1996; Fidrmuc, 2001). Further we will refer shortly to the two sub-periods correspondingly as ‘recession’ and “recovery” periods. Section 2.7 discusses the implications of choosing two other division years and finds that the major results of the analysis are robust to such changes.

On the second step of model specification we choose the explanatory variables for the spatial regressions implementing extreme bounds analysis in the spirit of Levine and Renelt (1992). The aim of this approach is to overcome the arbitrariness in choosing variables by elimination of insignificant ones, since the path dependence in this approach is well-known in transition data: different sequences of elimination often lead to widely differing results (e.g. Berg et al., 1998). In addition, elimination of a seemingly insignificant variable often leads to change in sign and significance of the remaining ones (Falcetti et al., 2002).

The extreme bounds procedure consists in estimating regressions with all combinations of regressors and tracing the change in size and significance of the coefficients across specifications. We perform it in a two-step form: in the first stage any combination of three to six explanatory variables is allowed on the right-hand side, and if robust variables are found (robustness is defined below), the regressions are re-estimated with those variables always included. The two-step implementation is intended to avoid misspecified regressions due to omitted variables. Since from previous empirical work we can expect the explanatory variables to be rarely significant, the criteria for robustness of the variables are relatively modest. The robustness criterion of Sala-i-Martin (1997) is accepted: in order to be labeled robust, variables are expected to have the same sign in all specifications and to be significant at least in 95% of them. In addition, we take significance at the 10% level as a criterion.

As a third step in model specification we diagnose the presence of spatial dependence in growth, employing the Moran’s I test for spatial autocorrelation (see Appendix A.3). The test shows whether the growth values are spatially clustered, as opposed to the null hypothesis that they are randomly scattered. A positive and significant z-value of this test indicates positive spatial autocorrelation, a negative and significant z-value means that there is negative spatial autocorrelation, i.e. no clustering.

On the fourth, final step of model specification we choose a spatial lag model for the first period and a spatial error model for the second, as suggested by appropriate diagnostic tests. In the spatial error model, the error term at one location is assumed to be correlated with the error term at other locations. The spatial lag model assumes correlation of the dependent variable at different locations (Anselin, 1988). In fact, the spatial error model can be regarded as a constrained form of the spatial lag model (more detail is provided in Appendix A.1). The spatial lag model is estimated by Maximum Likelihood, and the spatial error model – either through Maximum Likelihood or GMM\(^8\). All spatial specifications are implemented with the help of SpaceStat\(^9\).

\(^7\)In the scale of the EBRD reform indicators, a grade of 1 means an unreformed, planned economy and 4.3 is the highest grade relating to completed reforms in the corresponding area (EBRD).

\(^8\)For a review of the main estimating methods, Maximum Likelihood and GMM, see Appendix A.2.

\(^9\)Information and links on spatial econometric software and routines can be found on the webpage of
2.7 RESULTS

In order to quantify the interdependence between the spatial units, spatial weighting matrices are used. Each element of such a matrix describes the presence or absence and the intensity of the interdependence between two countries. In this chapter, three different weighting matrices are used: a simple first-order contiguity matrix (assuming that growth is only related in neighbouring countries), an inverse distance matrix (where the intensity of the dependence is proportional to the inverse distance between the capitals of the countries) and an inverse distance matrix with cutoff point at 1000 km. A detailed description of the matrices is contained in Appendix A.5.

2.7 Results

Following the estimation strategy described above, we have chosen the explanatory variables with the help of extreme bounds analysis. For the first period, we have the war dummy, the FSU dummy, the CMEA trade and the schooling variable. For the second period, the variables are temporally lagged growth, schooling, investment, FSU dummy and institutions. The choice criterion employed is the percent of all OLS regressions in which the variables are significant and have a constant sign. Detailed information about the intermediate and final results of the extreme bounds procedure is contained in Appendix B.

Having chosen the regressors, we test for presence of spatial dependence. To start with, the global Moran’s I test statistic of the growth per capita has a positive value and is highly significant for both sub-periods (Table 2.3), meaning that countries with higher growth tend to be clustered in space together with other higher-growth countries and vice versa, lower-growth countries are surrounded by other lower-growth countries. The individual countries that contribute most to the value of the statistic for the first period are the war-torn Armenia, Georgia and Azerbaijan, as well as Bulgaria whose presence in the list might be due to the consequences from the war in former Yugoslavia. The countries are ordered according to the value of their local Moran’s I statistic, which shows in which countries growth is most correlated with that of their neighbours. In recovery, the individual country with most significant statistic is Russia. This is very likely due to the repercussions of 1998 financial crisis in Russia throughout the region.

For the first period, we choose a spatial lag model since it performs better than both OLS and the spatial error specification in terms of $R^2$, log likelihood and AIC (Table 2.7), there is no heteroskedasticity, and the test statistic for the alternative spatial error model is insignificant. The spatial error model is considered as well since the robust LMERR test seems to provide some evidence in favour of such a specification$(10)$ (see Table 2.6). However, this model is not chosen since the test statistic on the common factor hypothesis is highly significant, suggesting that the specification including spatial lag and spatially lagged explanatory variables is more appropriate (see Appendix A.1 for a discussion of the common factor hypothesis). Indeed, an inspection of the estimated coefficients reveals that although the coefficient of the spatially lagged growth $\rho$ is not significant, the spatially lagged war dummy and in most cases the spatially lagged CMEA are highly significant.

Raymond Florax: http://web.ics.purdue.edu/~rflorax/links.htm

$(10)$ A short description of the specialized spatial dependence tests can also be found in Appendix A.3.
2.7. RESULTS

Table 2.3: Global and local Moran’s I test for spatial autocorrelation of the GDP growth (normal approximation)

<table>
<thead>
<tr>
<th>Matrix used</th>
<th>Value of Moran’s I</th>
<th>z-statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Res. period</td>
<td></td>
<td>Global Moran’s I statistic</td>
<td></td>
</tr>
<tr>
<td>Contiguity matrix</td>
<td>0.40</td>
<td>2.79</td>
<td>0.005</td>
</tr>
<tr>
<td>Inverse distance matrix</td>
<td>0.15</td>
<td>2.20</td>
<td>0.001</td>
</tr>
<tr>
<td>Inverse distance with cutoff at 1000</td>
<td>0.31</td>
<td>3.30</td>
<td>0.000</td>
</tr>
<tr>
<td>Recovery period</td>
<td></td>
<td>Local Moran’s I statistic: most significant observations</td>
<td></td>
</tr>
<tr>
<td>Contiguity matrix</td>
<td>0.43</td>
<td>2.98</td>
<td>0.003</td>
</tr>
<tr>
<td>Inverse distance matrix</td>
<td>0.11</td>
<td>2.62</td>
<td>0.008</td>
</tr>
<tr>
<td>Inverse distance with cutoff at 1000</td>
<td>0.28</td>
<td>3.04</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Finally, we turn to the estimation results. In the first period the coefficients of the war dummy, the CMEA and the FSU dummy in the spatial regression are more significant as compared to the OLS (see specifications 5.1.b to 5.4.b in Table 2.6). Although the same holds for the investment and human capital variables, they remain insignificant. Hence, in the initial phase of transition, growth is explained well by war and spatially lagged war, as well as by initial conditions, in this case the percent of CMEA trade and its spatial lag.

The importance of wars in explaining growth in cross-section is familiar (e.g. Fidrmuc, 2001; Cornia and Popov, 1998). The same is true for initial conditions. Naturally, the more a country’s economy was dependent on the economies of the former communist bloc, the more costly is the restructuring of the economy in order to make it viable under the changed conditions.

However, the importance of the spatially lagged war and CMEA trade suggests a new way to model the full impact of wars and international trade on a country. By nature, these variables reflect country interdependence. The war dummy registers international wars and conflicts, and the CMEA variable measures the intensity of international trade with other countries from the same bloc. Considering the countries immediately involved in wars seems not sufficient to capture the entire effect of the conflicts on the country’s economy. We should also allow for negative consequences from wars in the country’s neighbors, expressed by a coefficient equal in magnitude to the coefficient of the country’s own involvement in the war. Moreover, we see that the value of the OLS war coefficient
### 2.7. RESULTS

#### Table 2.4: Spatial diagnostics of the growth regression

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatial matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moran's I (error)</td>
<td>-1.03</td>
<td>0.30</td>
<td>-0.87</td>
<td>0.38</td>
<td>-0.68</td>
<td>0.49</td>
</tr>
<tr>
<td>Lagrange Multiplier (error)</td>
<td>1.96</td>
<td>0.16</td>
<td>1.53</td>
<td>0.22</td>
<td>1.26</td>
<td>0.26</td>
</tr>
<tr>
<td>Robust LM (error)</td>
<td>7.39</td>
<td>0.01</td>
<td>4.46</td>
<td>0.03</td>
<td>4.22</td>
<td>0.04</td>
</tr>
<tr>
<td>Kelejian-Robinson (error)</td>
<td>2.19</td>
<td>0.53</td>
<td>2.27</td>
<td>0.52</td>
<td>2.79</td>
<td>0.43</td>
</tr>
<tr>
<td>Lagrange Multiplier (lag)</td>
<td>0.21</td>
<td>0.65</td>
<td>0.31</td>
<td>0.58</td>
<td>0.53</td>
<td>0.46</td>
</tr>
<tr>
<td>Robust LM (lag)</td>
<td>5.61</td>
<td>0.02</td>
<td>3.24</td>
<td>0.07</td>
<td>3.50</td>
<td>0.06</td>
</tr>
<tr>
<td>Lagrange Multiplier (SARMA)</td>
<td>7.59</td>
<td>0.02</td>
<td>4.77</td>
<td>0.09</td>
<td>4.76</td>
<td>0.09</td>
</tr>
</tbody>
</table>

#### Table 2.5: OLS and spatial error model for growth determinants in recession

<table>
<thead>
<tr>
<th>Variables</th>
<th>OLS regression (heteroskedasticity-constant)</th>
<th>Spatial error regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-12.80 (1.41)</td>
<td>5.1 (1.31)</td>
</tr>
<tr>
<td>War</td>
<td>-6.94 (2.63)</td>
<td>-11.44 (3.03)</td>
</tr>
<tr>
<td>Dummy</td>
<td>-3.69 (0.82)</td>
<td>-1.96 (0.20)</td>
</tr>
<tr>
<td>CMEA</td>
<td>-0.16 (1.30)</td>
<td>-0.18 (1.65)</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.12 (1.14)</td>
<td>0.13 (1.15)</td>
</tr>
<tr>
<td>Log Inflation</td>
<td>-0.15 (1.13)</td>
<td>0.86 (0.53)</td>
</tr>
<tr>
<td>Lambda (z-statistic)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LR test statistic (prob)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Common factor hypothesis: LR (prob)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-67.39 (1.34)</td>
<td>-67.79 (1.35)</td>
</tr>
</tbody>
</table>

Notes: t-values (for OLS) and z-values (for the spatial error model) in parentheses. Coefficients significant at the 10% and 5% level are marked correspondingly with one and two asterisks. The weighting matrix used is the first-order contiguity matrix.
Table 2.6: Spatial lag models for growth determinants in recession

<table>
<thead>
<tr>
<th>Variables</th>
<th>Spatial lag regressions</th>
<th>Spatial error regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.1b (1)</td>
<td>5.1b (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.4b</td>
</tr>
<tr>
<td>Constant</td>
<td>-6.59 (-1.12)</td>
<td>-4.85 (-0.89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-13.75 (-1.51)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2.66 (-0.93)</td>
</tr>
<tr>
<td>War</td>
<td>-6.52*** (-3.45)</td>
<td>-7.45*** (-4.24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-7.41*** (-3.73)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-7.26*** (-3.78)</td>
</tr>
<tr>
<td>Spatially lagged</td>
<td>-6.91*** (-2.73)</td>
<td>-9.00*** (-3.41)</td>
</tr>
<tr>
<td>war</td>
<td></td>
<td>-8.02*** (-3.04)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-7.49*** (-3.66)</td>
</tr>
<tr>
<td>CMEA</td>
<td>-0.22*** (-3.01)</td>
<td>-0.17*** (-2.17)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.25*** (-2.33)</td>
</tr>
<tr>
<td>Sp. lagged CMEA</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Log inflation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.05 (-0.03)</td>
</tr>
<tr>
<td>Schooling Dummy</td>
<td>0.05 (0.72)</td>
<td>0.04 (0.59)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.05 (-0.09)</td>
</tr>
<tr>
<td>Spatial lag</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>coefficient $p$</td>
<td>-0.04 (-0.21)</td>
<td>-0.33 (-1.45)</td>
</tr>
<tr>
<td>(z-statistic)</td>
<td></td>
<td>-0.18 (-0.90)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.07 (-0.39)</td>
</tr>
<tr>
<td>LR test &amp; spatial</td>
<td>0.000 (0.98)</td>
<td>1.95 (0.16)</td>
</tr>
<tr>
<td>error (prob.)</td>
<td></td>
<td>0.14 (0.70)</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-63.78 (-1.48)</td>
<td>-62.38 (-1.48)</td>
</tr>
<tr>
<td></td>
<td>-64.07 (-1.48)</td>
<td>-64.02 (-1.48)</td>
</tr>
<tr>
<td>AIC</td>
<td>139.57</td>
<td>138.76</td>
</tr>
<tr>
<td></td>
<td>140.14</td>
<td>140.03</td>
</tr>
<tr>
<td>R2 (not adjusted)</td>
<td>0.70</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>0.69</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Table 2.7: OLS and spatial error model for growth determinants in recovery

<table>
<thead>
<tr>
<th>Variables</th>
<th>OLS regressions</th>
<th>Spatial error regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>4.</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>6.</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.22 (-1.50)</td>
<td>-4.91*** (-2.25)</td>
</tr>
<tr>
<td>Lagged growth</td>
<td>-0.31*** (-4.75)</td>
<td>-0.32*** (-4.57)</td>
</tr>
<tr>
<td></td>
<td>0.69 (1.26)</td>
<td>0.08 (1.67)</td>
</tr>
<tr>
<td>Investment</td>
<td>0.65*** (1.72)</td>
<td>0.03*** (1.89)</td>
</tr>
<tr>
<td></td>
<td>0.04*** (2.24)</td>
<td>0.04*** (2.64)</td>
</tr>
<tr>
<td></td>
<td>0.05*** (2.73)</td>
<td>0.05*** (2.77)</td>
</tr>
<tr>
<td></td>
<td>0.05*** (2.38)</td>
<td>0.05*** (2.22)</td>
</tr>
<tr>
<td>Institutions</td>
<td>-</td>
<td>-0.25 (-1.00)</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FSU dummy</td>
<td>1.14 (1.71)</td>
<td>1.40* (1.86)</td>
</tr>
<tr>
<td></td>
<td>1.45* (2.04)</td>
<td>-</td>
</tr>
<tr>
<td>Spatial error</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>coefficient $\lambda$ (z-statistic)</td>
<td>-</td>
<td>0.20*** (2.00)</td>
</tr>
<tr>
<td>LR test statistic</td>
<td>-</td>
<td>1.408 (0.25)</td>
</tr>
<tr>
<td>(prob) Common</td>
<td>-</td>
<td>0.08 (0.12)</td>
</tr>
<tr>
<td>factor log. Test</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spatial lag</td>
<td>-4.00 (-1.48)</td>
<td>-4.23 (1.48)</td>
</tr>
<tr>
<td>dependence</td>
<td>-43.40 (9.60)</td>
<td>-43.29 (9.45)</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>1.69 (0.60)</td>
<td>0.82 (0.40)</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>na</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.46 (0.46)</td>
<td>0.46 (0.46)</td>
</tr>
<tr>
<td>(not adj. for sp. error)</td>
<td>0.47 (0.47)</td>
<td>0.51 (0.51)</td>
</tr>
</tbody>
</table>
2.7. RESULTS

Table 2.8: Panel data estimations for both periods

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>7.1</td>
<td>7.2</td>
<td>7.3</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>7.0(0.03)</td>
<td>-6.06</td>
<td>0.11</td>
<td>-4.94***</td>
</tr>
<tr>
<td>War</td>
<td>-5.74***</td>
<td>-5.99**</td>
<td>-7.24***</td>
<td>-6.01***</td>
</tr>
<tr>
<td></td>
<td>(-1.16)</td>
<td>(-1.19)</td>
<td>(-2.69)</td>
<td>(-2.98)</td>
</tr>
<tr>
<td>FSU dummy</td>
<td>-10.92***</td>
<td>-8.30***</td>
<td>-9.79***</td>
<td>-4.62***</td>
</tr>
<tr>
<td></td>
<td>(-2.82)</td>
<td>(-2.17)</td>
<td>(-4.02)</td>
<td>(-4.02)</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.16</td>
<td>0.22</td>
<td>0.18</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(1.20)</td>
<td>(0.92)</td>
<td>(1.27)</td>
</tr>
<tr>
<td>Investment</td>
<td>-</td>
<td>-0.20</td>
<td>-0.03</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(-1.30)</td>
<td>(0.67)</td>
<td>(0.26)</td>
</tr>
<tr>
<td>Time lagged growth</td>
<td>-</td>
<td>-0.14***</td>
<td>-0.06</td>
<td>-0.11***</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(-2.76)</td>
<td>(0.81)</td>
<td>(-1.65)</td>
</tr>
<tr>
<td>Log inflation</td>
<td>-1.25 (-126)</td>
<td>-4.88***</td>
<td>-1.20***</td>
<td>-1.51***</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(-4.80)</td>
<td>(6.30)</td>
<td>(-5.84)</td>
</tr>
<tr>
<td>Institutions</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CMEA</td>
<td>-0.29***</td>
<td>-0.02</td>
<td>-0.01</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(-1.53)</td>
<td>(-3.11)</td>
<td>(0.06)</td>
<td>-</td>
</tr>
<tr>
<td>Reform 1st generation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>R2 (adjusted)</td>
<td>0.29</td>
<td>0.37</td>
<td>0.39</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>0.85</td>
<td>0.83</td>
<td>0.77</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Note: All regressions are estimated using cross-sectional random effects and White heteroskedasticity-consistent variance estimates. In all cases the Hausman test does not reject the null hypothesis of uncorrelation of the random effects. t-values are in parentheses. Coefficients significant at the 10% and 5% level are marked correspondingly with one and two asterisks.

is not split between the two new coefficients; rather, the cumulative effect of a war on a country appears twice the effect from the ordinary war dummy (Table 2.7). In this way, it appears that a country loses 6-7 percentage points of average growth if involved in a conflict and twice this figure if its neighbours are also involved. This result seems intuitive, as the effect of war in neighbouring countries may be due to refugee streams, lower foreign investment and destruction of trade routes (Abreu et al., 2005).

A similar reasoning is valid for the CMEA trade, probably because a substantial part of the within-bloc trade of a country is with its close neighbours. The magnitude of this coefficient suggests that for each additional percent of within-bloc trade dependence\footnote{Within-bloc trade dependence is measured as the proportion of the country’s total exports aimed at other countries belonging to the same bloc.}, a country would lose 0.2 percentage points in growth.

The first generation of reforms (price and trade liberalization, small-scale privatization) appears to have a very weak explanatory power. In the first period, initial conditions and wars explain cross-country growth differences substantially better than advance in reforms. Possible explanations for this puzzling finding might be that the chosen reform measure is a poor proxy for the real reform process or that the effect of liberalization pertains only in the short run. In fact, the effect of reforms on growth remains controversial in the literature even after the substantial increase in the work on the link between reforms and growth in the last years (Falcetti et al., 2002).

Finally, the significance of the FSU dummy, even controlling for the difference in initial conditions and reforms, means that the variable might capture unobserved or unmeasured characteristics like difference in further initial conditions or the institutions of FSU and
2.8 DISCUSSION

non-FSU countries during this first period.

For the second, recovery period, there is evidence for spatial error autocorrelation (the spatial error coefficient $\lambda$ is significant in all specifications, see table 2.7). Here, the common factor hypothesis test does not reject the null, suggesting the appropriateness of the reduced spatial error model, and indicating that there are no omitted spatially lagged variables. Indeed, experimenting with inclusion of spatial lags of some variables (war, education, and lagged growth) reveals that these are not significant. Again, the spatial error models perform better than the corresponding OLS regressions by a row of conventional measures (Table 2.7).

The most important result for the recovery period is that investment and schooling affect growth, and this result is robust to changing the control variables. The estimated coefficients are in the range between 0.07 and 0.08 for investment and 0.04–0.05 for secondary schooling. This means that a country can earn 0.07 percentage points of growth for every one percent increase of the investment/GDP ratio and 0.05 percentage points for every percent increase in human capital in the form of secondary school enrolment.

It is interesting to compare the magnitude of these coefficients to those estimated in some earlier works on empirical growth. For instance, table 4 in Barro (1991) reports coefficients of secondary school enrolment between 0.02 and 0.03 and of physical investment between 0.06 and 0.07. Therefore, the estimated coefficients in transition countries for the period starting in the middle of the 1990s are similar to those obtained for the market economies using a world sample.

We also confirm the finding of Falcetti et al. (2005) and EBRD (2004) that the coefficient of temporally lagged growth is significant with a negative sign. This is evidence for a certain type of convergence. However, it is not conventional convergence since the initial income does not appear significant. Rather, it might reflect a tendency for the countries (mainly CIS countries) to return to certain output potential after the dramatic collapse in the 1990s (Falcetti et al., 2005).

Finally, the unexpected positive sign and significance of the FSU dummy coefficient in the second period suggests that it might capture some omitted factor like the increase in oil prices for oil-producing countries, which has contributed to their recent rapid growth (Falcetti et al., 2005).

2.8 Discussion

It was noted earlier that a limitation of the present work is a small number of degrees of freedom in the cross-sectional setup. The present chapter chooses a cross-sectional and not panel framework in order to capture the medium-run growth processes and not short-run factors. Moreover, due to the substantial methodological difficulties and the lack of theoretical agreement on combining the spatial econometrics with panel data (Abreu et al., 2005) the cross-sectional regression is the only feasible one which allows integration of spatial econometric techniques.

As a way of checking the robustness of the main results, two simple panel data regressions were estimated separately for the first and second sub-periods by using three-year averages, and the results of this panel analysis are compared to the ordinary OLS regression. The panel estimation increases the degrees of freedom twice, but a comparison of
the cross-sectional results (specifications 5.1. to 5.3. and 6.1. to 6.3.) with the panel results (reported in table 2.9) shows that this increase does not substantially alter the main results. The only difference is that once the period of averaging is reduced to three years, inflation, which is a factor with shorter-run effect, is found to be significant as well. Therefore, we can argue that the cross-sectional model seems appropriate for our purpose.

The reason to consider three-year averages is that a panel using yearly data would fail to capture exactly the long-term growth pattern of most interest. In order to capture the long-term factors, data have to be averaged over 5 or 10-year periods (Temple, 1999; Durlauf and Quah, 1999). However, such averaging is not feasible with the short transition series. The three-year average seems a reasonable compromise in such circumstances.

Another important issue in the empirical design is that there might be arbitrariness in choosing the year 1995 as a turning point to outline periods of “early” and “late” transition, particularly when imposing the same turning point for all countries. In order to verify the appropriateness of this choice, we have experimented with the spatial regressions for the two sub-periods by using the following and the previous year (1996 and 1994) as turning points. The results remain very similar. However, if 1996 is adopted as a division year, the significance of factor inputs in the recovery period becomes even more pronounced while the results in the recession become less conclusive (for instance, the spatially lagged war loses significance). On the other hand, with 1994 as a division year the results for the first period are the same as with 1995, but the significance of the factor inputs in recovery decreases. Therefore, we can argue that the choice of 1995 as a schematic turning point seems appropriate since it allows us not to miss the features we are most interested in for every period. Apparently, other divisions lead to mixing together of years belonging to the two periods and this leads to the less conclusive results.

Finally, the significance of factor inputs increases when considering a later time period (1996-2002), which comes as a support for our conjecture that transition countries become more similar to the rest of the world with the progress of transition.

In this chapter we found that factor inputs play a role in determining growth in later transition and the magnitude of this effect is comparable to the one in the market economies. The efficiency-improving factors and the initial conditions, which determine cross-country differences in growth in the beginning, lose importance with the unfolding of the transition process. The growth pattern of the transition countries starts to resemble that of the established market economies. Hence, factor inputs should not be dismissed any more from the empirical analysis of growth determinants in the ex-communist countries.

Further, there is evidence for the presence of spatial dependence in the transition dataset, which has been neglected in earlier works. This confirms our conjecture that economic growth in individual countries is influenced by the growth performance of their neighbours.

The spatial econometric models appropriate for the periods of early and late transition are different (spatial lag in the former and spatial error in the latter). The spatial analysis revealed that the reason for this unexpected difference lies merely in the changing effect of the war and initial conditions variables. In early transition, the war dummy plays an important role and in order to capture its effect fully, we also have to consider the associated spatially lagged war variable. For this setting, we need a spatial lag model.
2.8. DISCUSSION

In contrast, for the second period, when the war variable (and the lagged war, connected to it) are not significant any more, we can switch to a spatial error model. We also see clearly that considering the spatial effects increases the significance of the explanatory variables. This might hint that our specification is better than OLS.

Certainly, in our case the reliability of the spatial analysis is limited by the small size of the sample since it is not entirely clear how the properties and power of the spatial dependence tests transfer to the small sample case (Anselin, 1999).

Future work might seek to answer the question whether the spatial interdependence among countries can be rigorously confirmed in a panel data setting. In addition, apart from growth, there are further variables of keen interest in the transition literature like foreign direct investment, where it is also relevant whether there are cross-country spillovers and dependencies and to what extent they can alter existing results.
CHAPTER 3

TECHNOLOGY TRANSFERS THROUGH FDI AND IMPORTS AND LABOUR PRODUCTIVITY IN THE CENTRAL AND EASTERN EUROPEAN COUNTRIES

3.1 Introduction

The globalization process has led to increased attention to the impact of foreign factors on economic growth and productivity. R&D spillovers between countries have become an object of particular interest in this context. It has been shown that they are an important factor driving economic growth: Keller (1999) estimates that R&D spillovers explain around 40% of total factor productivity growth for developed countries. Clearly, for developing countries without substantial domestic R&D activities, the international spillovers are likely to play an even larger role. In turn, the main channels through which such spillovers are realized are international trade and FDI by multinational corporations. However, while there is empirical evidence on the role of imports, the findings on FDI are inconclusive.

It has been argued that transition countries constitute a suitable sample for studying the effect of international knowledge spillovers. Since these countries were initially far from the technology frontier, but well equipped for absorption of foreign technology, FDI and imports are likely to represent a technology transfer to a larger extent than to other developing countries (Campos and Kinoshita, 2002). The influence is likely to be particularly strong for the new EU member states that have enjoyed intensive trade and investment inflows from the “old” EU countries since the middle of the 1990s in view of their expected entry into the European Union.

In this chapter, we evaluate and compare the effect of FDI and imports on economy-wide labour productivity in eight Central and Eastern European new EU member states and Croatia. We pay explicit attention to distinguishing between short- and the long- run effects, since we conjecture that the relationships representing transmission of knowledge are more likely to be long-run ones.

The main result of our analysis is that FDI and imports affect productivity over different time horizons. The relationship between FDI and the productivity level seems to be a long-run one. The impact of FDI stemming from technological leaders is higher than that from the rest of the countries, and FDI targeted towards the manufacturing sector has a higher effect than FDI to the other sectors of the economy. As far as capital goods imports are concerned, they are significantly and positively related to domestic productivity both in the short and in the long run. The trade partners with the highest level of R&D stocks are also shown to induce a stronger increase in productivity through capital goods imports. The long-run nature of the estimated relationships suggests that these international linkages affect the host economy through total factor productivity, and are carriers of foreign knowledge and technology.
3.2. LITERATURE REVIEW

In order to obtain robust results and shed some light on the precise way trade and FDI affect productivity, we use several alternative theoretical specifications prevalent in the literature. They differ both with respect to modelling the link between FDI and productivity and to the way spillovers are quantified. These are a Solow-type model, an endogenous growth model and a Coe and Helpman-type model, considering explicitly the R&D stocks of the trade and FDI partners. Our major results appear to be quite consistent in all these modifications. However, a major limitation of our empirical analysis is the small number of observations, therefore the findings, particularly the ones concerning long-run relationships, have to be interpreted with caution.

The rest of the chapter is organized as follows. In section 3.2 we review the relevant empirical literature; in section 3.3 to 3.5 we present and discuss the models used for our estimation. Section 3.6 presents the data, and section 3.7 lists the empirical results. Finally, section 3.8 and 3.9 elaborate on the results and draw conclusions.

3.2 Literature review

FDI and international trade have been recognized in the literature as the two main channels for international R&D spillovers. They are found to be positively correlated with income and labour productivity (e.g. Savvides and Zachariadis, 2005). However, there is no agreement about which of these two factors has a stronger effect. Some works find that FDI has stronger effect as compared to imports (e.g. Hejazi and Safarian, 1999), while others argue that the influence of imports is stronger (Zhu and Jeon, 2007).

Theoretically, the effects of FDI and of trade are of a different nature: FDI inflow is associated with a knowledge transfer in a broader sense, since besides superior technology it also conveys know-how in organization, efficiency, better governance and business practices. These latter improvements are the ones that have been most relevant for output recovery in Central and Eastern European countries during transition (e.g. Campos and Coricelli, 2002). In comparison, imported capital goods can convey new technology but contribute relatively modestly through further efficiency - improving factors. Hejazi and Safarian (1999) support the idea that FDI can have additional effects as compared to the trade flow, for instance in the non-tradables sectors, or due to broad opportunities for technology transfer between the headquarters and subsidiaries of a multinational enterprise. Before continuing with the discussion of our particular setup, it is worth reviewing briefly the two strands of the empirical literature dealing separately with FDI and imports.

Although economic theory has clear predictions about the positive impact of FDI on growth, the empirical findings are much less conclusive. In most cases a clear-cut independent effect of FDI on growth has not been identified. Rather, it is conditional on the level of income of the accepting economy (Blomstrom and Kokko 2003, Herzer et al. 2008), on the technological gap between the firms in the source and host countries (Lim 2001, De Mello 1999) and the human capital level as a proxy for the absorption

---

1The literature also considers further spillover channels not covered in this paper, e.g. exports and disembodied spillovers, the so-called “learning by watching” (Keller 2004).

2Certainly, one has to acknowledge that M&A activity is a part of FDI and it has little to do with knowledge transfers. However, one of the distinguishing characteristics of transition countries is that this aspect is relatively less important for incoming FDI in transition countries from developed economies, as compared to FDI between developed economies (Campos and Kinoshita 2002).
3.2. LITERATURE REVIEW

capacity of the home economy (Borensztein 1998, Eller et al. 2006, Benhabib and Spiegel 2005). Some studies argue that in developing countries a robust link between FDI and growth exists neither in the short nor in the long run (Herzer et al. 2008). Recent studies of FDI on the firm level have suggested one possible reason for the inconclusive macro findings: that the positive effects of FDI are in fact very limited in scope. Only vertical spillovers - those between a foreign firm and its affiliated firms in the host country - are present; horizontal spillovers - between the foreign firm and the competing domestic firms - are zero or even negative (e.g. Damijan et al. 2003). This might prevent the transfer of superior technology to the entire economy, leaving only a limited number of firms to enjoy its benefits.

A particular strand of the empirical literature has found the FDI impact to depend on the sector FDI flows into. Sector-level studies relating growth to FDI report substantial heterogeneity (e.g. Alfaro 2001, Vu and Noy 2009, Bijsterbosch and Kolasa 2008). In most cases, these studies identify a positive effect of FDI on manufacturing, but not on services. Keller (2004) also notes that FDI spillovers appear to be much stronger in high-technology sectors than in low-technology sectors. However, there are also alternative views: Eller et al. (2006) identify a positive effect of FDI into financial service on income growth. One of the goals of this chapter is to see whether some sectoral differences are also present in CEE countries, and to test the hypothesis that FDI into manufacturing is the main driver of productivity improvements in the whole economy. Therefore, we devote specific attention to sector heterogeneity by considering separately FDI to manufacturing, and those to the rest of the economy.

Transition countries might be distinguishable from other developing countries in terms of the potential effect of foreign technology on the domestic economy. Namely, they have started the period well-prepared for technology adoption (well-endowed with human capital), but far from the technological frontier. Therefore, transition countries offer the “right context” for studying the influence of FDI on growth (Campos and Kinoshita 2002), since there spillovers represent to the largest extent a technology transfer. Indeed, studies covering transition countries as host countries tend to find positive results more often than general ones.

As far as the empirical literature on imports and productivity is concerned, there appears to be more evidence on their positive effect (Coe and Helpman 1995, Grunfeld 2002). There are two issues that might provide an explanation of why some results are conclusive and others not. Firstly, it seems that the degree of relative development of the source and host countries matters: Zhang and Zou (1995) find significant impact of imports on economic growth in a panel of 50 developing countries, just as Kim et al. (2007) find convincing evidence about Korea. At the same time, Funk (2001) fails to find a long-run relationship between total factor productivity and imports in OECD countries, which are at similar development levels. Second, it has been shown that imports of capital goods rather than total imports are the carriers of R&D spillovers embodied in trade flows (e.g. Lee1995, Xu and Wang 1999). Funk (2001) also notes that his negative results may be driven by the fact that total and not only capital goods imports were considered. Based on this evidence, we also choose capital goods imports as a measure of the trade-related R&D spillover channel.

Previous works make a variety of assumptions about the way R&D transfers affect
3.3. CHOICE OF THE THEORETICAL MODEL

Correspondingly, they adopt a range of approaches to testing their hypothesis. Some authors use a form of augmented Solow model, where foreign capital (imported goods or FDI) is a substitute to domestic capital (e.g., Campos and Kinoshita 2002) and therefore affects growth and labour productivity through increasing the capital stock. Others utilize endogenous growth models (Borensztein 1998, Bijsterbosch and Kolasa 2009), where the foreign capital affects directly the total factor productivity term by improving the technological level.

Studies also differ in the way they quantify the technology spillovers. Some of them simply include measures of the imports or FDI inflows as explanatory variables, like in the two models above. There is however another strand in the literature which regards bilateral FDI or imports as carriers of the specific knowledge stock from the source country. Therefore, it seeks to identify the influence of this knowledge stock, usually proxied by the R&D stock, on other countries and constructs for this purpose elaborate spillover measures containing the R&D stocks of the source countries. This is the method developed by Coe and Helpman (1995). Studies using this approach often report imports and FDI to be significant and substantial means of technology diffusion.

In this chapter, we strive towards using a broader range of underlying models and measures in order to ensure robustness and better comparability with the existing literature.

3.3 Choice of the theoretical model

This section presents the alternative models used in the current chapter. In the beginning, we follow the way they are formulated in the literature; in section 4 we also elaborate on their implementation over the short- and long-run horizons.

3.3.1 Solow-type model

The Solow-type augmented growth model is based on the framework of Mankiw, Romer and Weil (1992). They use as a basis the Solow model with a Cobb-Douglas production function including physical and human capital and assuming exogenous technology and population growth. Using approximation around the steady state, they derive the following equation for steady-state growth:

\[
\ln \hat{y} = \theta \ln A(0) + gt + \alpha_1 \ln s_h + \alpha_2 \ln s_h + \alpha_3 \ln (n + g + \delta) - \theta \ln y_0 + \varepsilon
\]

This equation is then also estimated empirically: per capita output growth of a country is regressed on the rates of investment in physical and human capital, the population growth and the initial income level (Temple, 1999). Following MRW’s seminal work, this equation has been extended to include many further institutional and policy variables, forming the framework of the so-called informal growth regressions (Temple, 1999). Recently, this basic framework has also been extended with external factors like FDI (Campos and Kinoshita 2002, among others).

We also employ the basic framework, adding the FDI and imports variables, with the difference that instead of per capita growth, our dependent variable is labour productivity,
3.3. CHOICE OF THE THEORETICAL MODEL

measured by output per worker. This transforms the basic equation in the following way:

$$\Delta P_{it} = \gamma + \beta_t I_{it} + H_{it} + \beta^{FDI} FDI_{it} + \beta^{IM} IM_{it} + \alpha P_{it-1} + \eta_i + \lambda_t + \nu_{it}$$ (3.1)

Here $\Delta P_{it}$ denotes the change of productivity in country $i$, $P_{it-1}$ is lagged productivity, $I_{it}$ is capital investment, and $H_{it}$ is the human capital variable. $FDI_{it}$ is one of the several measures of FDI which we use, and $IM_{it}$ is a measure of the imported capital goods. Since we are working with panel data, $\eta_i$ are the country-specific and $\lambda_t$ are the time-specific fixed effects.

3.3.2 Endogenous growth model

The second model we estimate is the endogenous growth model by Borensztein et al. (1998), which has been recently broadly used (e.g. Campos and Kinoshita 2002, Kolasa and Bijsterbosch 2008). They use a general equilibrium model with a Cobb-Douglas production function including physical and human capital and agents maximizing a standard intertemporal utility function. Further, they assume that the capital stock is composed of a continuum of varieties of capital goods produced both by domestic firms and by foreign firms which have invested in the host economy. This is expressed formally as

$$N = n + n^*$$

where $N$ is the total number of domestically produced capital varieties, of which $n$ by domestic firms and $n^*$ by foreign firms. The foreign firms’ investment (FDI) is the main driver of technological progress since it introduces into the economy the technology necessary to produce the new capital varieties. Foreign direct investment increases the variety of capital goods (or their quality) and in this way drives technological change. However, the process of technology adoption is costly and its cost depends on two factors:

$$F = F \left( \frac{n^*}{N}, \frac{N}{N^*} \right)$$

The cost decreases in the share of the intermediate products produced by foreign firms in the total number of products ($\frac{n^*}{N}$), reflecting that foreign firms bring an advantage in the production of new intermediate goods (and the larger the share of foreign-produced goods, the larger this advantage is for the economy). Moreover, the cost decreases with increasing ($\frac{N}{N^*}$), the number of capital varieties produced at home compared with the number of them produced in the leading countries, since in countries where this ratio is lower, the scope for imitation is larger and therefore the cost of adopting new technology is lower (Borensztein et al., 1998).

Borensztein et al. derive the following expression for steady-state growth:

$$g = \frac{1}{\sigma} \left( A^\frac{1}{\sigma} F \left( \frac{n^*}{N}, \frac{N}{N^*} \right)^{-1} H - \rho \right)$$

Hence, growth is a function of the two ratios ($\frac{n^*}{N}$) and ($\frac{N}{N^*}$) as well as the level of human capital.
3.3. **CHOICE OF THE THEORETICAL MODEL**

The testable hypothesis of Borensztein et al. (1998) relates total factor productivity to its lagged value, FDI, the level of human capital and an interaction term between the human capital and FDI. Our basic equation is very similar, with the difference that we use labour productivity instead of total factor productivity, and control for physical investment on the right-hand side.

\[ \Delta P_{it} = \gamma + \eta_i + \lambda_t + \alpha P_{it-1} + \beta^I I_{it} + \beta^{FDI} FDI_{it} + \beta^{INT} FDI_{it} * H_{it} + \nu_{it} \quad (3.2) \]

Here, \( H \) is the measure of human capital and \( FDI * H \) is an interaction term between FDI and human capital, included in order to test whether human capital determines the magnitude of the effect of foreign technology absorption (see e.g. Benhabib and Spiegel, 2005). With this setup, the effect of a marginal unit of FDI becomes \( \beta^{FDI} + \beta^{INT} * H_{it} \). Since both coefficients \( \beta^{FDI} \) and \( \beta^{INT} \) are expected to be positive, the cumulative effect of a marginal unit of FDI is expected to be higher the higher is the human capital in the country.

Apart from FDI, we also estimate a similar equation for imports.

\[ \Delta P_{it} = \gamma + \eta_i + \lambda_t + \alpha P_{it-1} + \beta^I I_{it} + \beta^{FDI} IM_{it} + \beta^{H} H_{it} + \beta^{INT} IM_{it} * H_{it} + \nu_{it} \quad (3.3) \]

The principal difference between Borenzstein’s and the Solow-type model is that the latter assumes that the foreign capital (FDI or imports) is a substitute for national capital and therefore has a similar effect on productivity. Under this assumption FDI has no long-run effect on growth, and its effect on output and productivity levels is likely to be small (Campos and Kinoshita, 2002). In contrast, in the endogenous model foreign capital affects technology, and hence directly total factor productivity. Its effect on growth and productivity is therefore likely to be a long-term one. Since the testable equations corresponding to the Solow-type and the endogenous model are very similar, they may actually be selected by our estimation. If the Solow model gets more empirical support, we are more likely to estimate a short-term relationship; and if the endogenous growth model is better supported by the data, the long-term component would be present.

The second criterion for distinguishing the models is the role of human capital: it is logical that the better an economy is endowed with human capital, the better it absorbs new technologies. Therefore, in the endogenous model, human capital variables or interaction terms between them and foreign capital variables should be significant (Borensztein 1989, Campos and Kinoshita 2002).

### 3.3.3 Bilaterally-weighted model (Coe and Helpman type model)

Finally, we also estimate a model of the type designed by Coe and Helpman (1995) and further developed in Hejazi and Safarian (1999). They consider the technology adoption from a somewhat different perspective and take explicit account of the effect of the size of domestic and foreign R&D stocks. Similarly to Borensztein et al. (1998), they assume that R&D (domestic as well as foreign) can increase the variety of intermediate goods available to domestic production firms, or their quality. In order to construct an estimate of the foreign R&D stocks, the authors take the calculated R&D stock of the country’s trade
3.3. **CHOICE OF THE THEORETICAL MODEL**

partners, and weight them with the share of these countries’ imports in total imports. An alternative way of viewing this indicator is as an imports index, weighted by the R&D intensity of the trade partners: countries with larger R&D stocks receive a larger weight in the cumulative import flow to the host country\(^3\).

The original equation of the model is the following:

\[
\ln P_{it} = \alpha + \beta^D \ln S^D_{it} + \beta^{IM} S^{IM}_{it} + \eta_i + \nu_{it} \quad (3.4)
\]

where the \(S^D_{it}\) is the domestic R&D stock of the host country and \(S^{IM}_{it}\) is the import-weighted R&D index:

\[
S^{IM}_{it} = \sum_h m_{hit} S^d_{ht}
\]

\(S^d_{ht}\) is the domestic R&D stock of foreign country \(h\) in period \(t\),

\(m_{hit}\) is the capital imports inflow from country \(h\) to country \(i\) in period \(t\).

However, we use several modifications of the model, most of them in order to ensure consistency and comparability across all models. First, we do not consider all trade and investment partners of the CEE countries, but similarly to Hejazi and Safarian (1999) choose a group of 6 technological leaders, assuming that imports from technologically more advanced countries are likely to have a stronger effect on productivity. The six countries are chosen by the size of the accumulated R&D stocks as estimated by Coe and Helpman, and whether the countries are significant trade partners of the countries from our sample. Second, as in the previous models, we strive towards a comparison of the effect of imports and FDI, therefore we construct an FDI-weighted measure of the R&D stocks analogous to the imports-weighted one (see equation 3.5 below).

Third, for consistency we employ labour productivity and not TFP as a dependent variable; therefore, as in sections 3.1 and 3.2, we control for investment in physical capital on the right-hand side. Fourth, we stick to our choice of capital goods imports instead of total imports, and therefore the bilateral weights are calculated using capital goods imports only. Finally, since the domestic R&D of the CEE countries is very limited, and comprehensive data on it is lacking, we omit this variable from our analysis.

With the modifications, the equation to be estimated is the following:

\[
\ln P_{it} = \alpha + \beta^{FDI} \ln S^{FDI}_{it} + \beta^{IM} S^{IM}_{it} + \eta_i + \nu_{it} \quad (3.5)
\]

where

\[
S^{FDI}_{it} = \sum_h f_{hit} S^d_{ht}
\]

and \(S^{FDI}_{it}\) are the FDI-weighted R&D stocks of the 6 technological leaders. Similarly to the imports weights, \(f_{hit}\) is the FDI stock from country \(h\) to country \(i\) in period \(t\).

Based on Table 3 in Coe and Helpman, the countries with the largest R&D stocks are USA, Germany, France, UK, Netherlands, Sweden, Canada and Japan, and that there

---

\(^3\)Keller (1998) criticized the approach of Coe and Helpman. He argued that the choice of weights to foreign R&D stocks is irrelevant to identifying research spillovers, and hence Coe and Helpman’s approach does not prove that imports are indeed a spillover channel. However, Funk (2001) shows that the weights choice does actually matter.
3.4. LONG-RUN VS. SHORT-RUN RELATIONSHIPS

is a large gap between their R&D stocks and those of the countries next in the ranking. We however do not consider Canada and Japan since their shares of imports/FDI in the CEE states were found to be rather small. In order to calculate the contemporary R&D stocks of the technological leaders, we follow the perpetual inventory method used by Coe and Helpman (1995): on the basis of the yearly R&D expenditure figures, it provides an estimate of the starting values of the R&D stocks, and then also constructs their current values assuming 5% depreciation.

Although it would be insightful to estimate this model on sectoral in addition to the national level, or at least to consider separately the manufacturing sector, we are unable to do it. The lack of FDI data disaggregated simultaneously by sector and by country does not allow us to repeat the construction of the bilaterally-weighted measures only for a certain sector.

3.4 Long-run vs. short-run relationships

It is intuitive to expect that the effects of the knowledge transfers are different in the long and in the short run, or even might be observable only in the long run. Firstly, the effect of FDI on productivity is unlikely to materialize in the same period as when FDI is recorded; rather, it would take longer to translate into productivity improvements. The reason is that FDI are usually counted in the national accounts in the year in which the foreign investment is received, and there is a time lag before the foreign firm starts its operations in the host country and they lead to measurable productivity increases. Second, productivity growth is neither driven by the capital inflow within one particular year, nor does the influence of the knowledge transfer expire after a particular year. Rather, the whole accumulated stock of transferred foreign knowledge is likely to play a role for productivity improvements over an extended period. In order to capture the long- and short-run effects, we use an error correction framework including a short-run and a long-run component. The long-run component is a cointegrating relationship between variables in levels and the short-run component, capturing the adjustment towards long-run equilibrium - in differences. Correspondingly, the long-run component would seek to identify the determinants of the productivity level, whereas the error correction equation explains productivity growth.

There is one further compelling econometric reason for such a differentiation. The equations (3.1) - (3.3) are very likely to represent a mix of stationary and non-stationary variables. In particular, the stock variables are by definition non-stationary, as opposed to the flow variables. Provided that our time horizon is very short and our data does not span even one full business cycle, the presence of non-stationary variables is likely to have a strong effect and lead to spurious inference.

In the literature, there is insufficient attention devoted to the issue of stationarity of the participating variables and the appropriateness of the models for nonstationary variables. In many works, relationships between variables which are most likely non-stationary, are being estimated through OLS methods (cited in Funk 2001). However, some studies pay explicit attention to non-stationarity: Zhu and Jeon (2007), Herzer et al. (2008), Funk (2001) apply panel data techniques to estimate cointegrating relationships between the variables. Since fully-fledged cointegration analysis (e.g. using the Johansen
cointegration test) is not possible in our case due to the short time dimension of the data, we prefer implementing the Engle - Granger two-step procedure to construct error correction models as explained above.

Consider, for example, the Solow-type model from equation 3.1. If we denote with hats the long-run coefficients in order to distinguish them from the short-run ones, the long-run component of the error-correction model is formulated as follows:

$$P_{it} = \hat{\gamma} + \hat{\beta} I_{it} + \hat{\beta}^{FDI} FDIS_{it} + \hat{\beta}^{IM} IMS_{it} + \hat{\beta}^{H} H_{it} + \hat{\eta}_{i} + \hat{v}_{it} \quad (3.6)$$

where FDIS are the FDI stocks and IMS are the import stocks in the host country\(^4\). Then, the corresponding error-correction equation is estimated according to equation 3.7, using the residuals \(\hat{v}_{it}\) from the long-run component as an ECT:

$$\Delta P_{it} = \gamma + ECT_{it} + \alpha P_{it-1} + \beta I_{it} + \beta^{FDI} FDI_{it} +$$
$$+ \beta^{IM} IMS_{it} + \eta_{i} + \lambda_{i} + \nu_{it} \quad (3.7)$$

$$ECT_{it} = \hat{\nu}_{it} \quad (3.8)$$

3.5 Estimation and data

3.5.1 Econometric methodology

Apart from non-stationarity, our estimation is problematic because of possible simultaneity bias of some of our key variables, for instance FDI or capital goods imports. It is intuitive that a country with higher labour productivity can attract more FDI\(^5\). For this reason, in addition to the fixed-effects OLS specification, we also estimate the regressions using GMM methods for dynamic panel data. The use of GMM methods is additionally necessitated by the fact that some models have a lagged dependent variable present on the right-hand side, in which case we are dealing with a dynamic panel. GMM methods have been recently extensively used in the empirical macroeconomic literature (Roodman 2006, Bond et al. 2001), including applications featuring FDI or international trade (e.g. Bun and Windmeijer 2007, Levine and Carkovic 2007). However, the OLS estimates are also useful as a benchmark and basis for comparison. Moreover, they represent a convenient way of addressing unobserved cross-country heterogeneity. (Acharya and Keller 2007).

An important limitation of the current study is the small sample (a “small N, small T”) panel, since most of the methods developed for panel data are intended for individual or firm data (“small T, large N” samples). The small sample limits the number of variables we can include, and compels us to use special estimating options. These modeling considerations are discussed in detail in Appendix D. However, here we present briefly the models used and some caveats that have to be borne in mind when working with them.

The GMM methods exploit a number of moment conditions, which allow us to construct internal instruments for the potentially endogenous variables as well as for the lagged endogenous variables. The GMM methods are suitable for growth regressions since

\(^4\)The calculation of the import stocks is described in the Data section.

\(^5\)In fact, some studies (Keller 2004) report that the biases introduced by the imports and FDI variables being endogenous are not large. Therefore, we also use the fixed effect estimations for comparison purposes.
they relax many of the assumptions imposed on the data generating process by earlier methods: they allow for endogenous explanatory variables, variables which are measured with error, and presence of country fixed effects (Bond et al. 2001, Roodman 2007). We apply both the "difference GMM" and “system GMM” \(^6\). The former one uses moment conditions derived from the assumptions that the errors are serially uncorrelated and the initial conditions are predetermined, which allows the use of levels lagged \(t - 2\) and further as instruments for the equations in differences (Bond et al. 2001). However, the differenced GMM has been shown to be subject to a downward finite-sample bias, particularly when the number of periods \(T\) is small. Another weakness is that differenced series may be weak instruments for levels if the original series are highly persistent, as is often the case with series like output or productivity (Bun and Windmeijer 2007). Therefore, the recently more popular GMM method is the "system GMM", which has superior finite-sample properties (Judson and Owen 1999). It exploits one additional moment condition, which requires that the initial conditions satisfy a mean stationarity restriction for each cross-section. This permits lagged differences of the series to be used as instruments for the equations in levels. However, this method also has a drawback: the additional condition is a nontrivial one and it might easily be violated (it is discussed in more detail in Appendix D). Therefore, we prefer system GMM estimation whenever diagnostic tests do not show problems with the instruments, but resort to difference GMM whenever system GMM tests have poor values, hinting at possible violation of the additional condition.

Another issue considered is whether we should use a linear or log-linear form for our equations (there is no consensus on this point in the literature). We have opted for the former one, since estimating the models in log-linear form would be equivalent to imposing restrictions on the model, i.e. constant elasticity of productivity with respect to FDI. Moreover, our FDI inflow series contain negative values, therefore taking logarithms would not be possible, and considering other transformations would complicate the interpretation of the results.

3.6 Data

Our data encompasses 12 years (1995 – 2006), but for several countries the actual length of the time series is shorter due to missing observations. The countries considered are 11: the 10 new EU member states from Central and Eastern Europe plus Croatia, a country which, although not yet an EU member, has structural characteristics very similar to those of Bulgaria and Romania.

The data about FDI is taken from the WIIW database on the foreign investment in Central and Eastern Europe\(^7\). We use FDI stocks for the long-run relationships and flows for the short-run ones. In order to avoid scale effects and to have a consistent way of measuring the variables, we divide both FDI and imports by the total employment in order to express them as a quantity per worker. There is a caveat which has to be kept in mind when using FDI flows: they are very volatile series, which often exhibit negative

---

\(^6\)For a detailed discussion on the use of GMM methods in macroeconomic empirical problems, see Bond et al. (2001), and for their practical implementation in STATA - Roodman (2006) and Roodman (2007).

\(^7\)Detailed information about the sources and the definitions of data used is contained in the Data Appendix.
values, and these are very hard to interpret meaningfully in terms of technology adoption: negative FDI values in a certain year are not likely to be associated with reversal of the productivity improvements. In general, we have to bear in mind that FDI data is of rather poor quality, which is shown by the sometimes large discrepancies in data between the database we use and alternative data taken directly from the national central banks (which we can not use for alternative estimation due to limited availability).

Apart from data about total FDI, we also use different disaggregations of the data available in the WIIW database. Firstly, in order to differentiate between economic activities and to test the hypothesis that FDI into manufacturing is especially effective in increasing labour productivity, we consider FDI into manufacturing and services separately. Second, in order to investigate whether the source country matters for the effect magnitude, we also use bilateral FDI data.

Total and bilateral imports data stem from UN Comtrade database. For calculating the import stocks, we apply once again the perpetual inventory method of Coe and Helpman (1995), which was already used for calculating R&D stocks. The calculations are based on the yearly import data, assuming a depreciation rate of 5%.

Finally, for human capital, we use data from the Unicef TransMONEE database (2006), which is a comprehensive dataset with full coverage of transition countries for the years 1995-2005. More specifically, we use two alternative measures: higher education enrollment ratios and secondary education enrollment ratios, both as a percentage of the corresponding age group.

### 3.7 Results

First we apply unit root tests to our variables. We use the Fisher panel unit root test, which is suitable for unbalanced panels. The results are quite intuitive: for the stock and level variables (labour productivity, human capital, physical investment; R&D, FDI and import stocks) the test does not reject the presence of a unit root, whereas in the case of the flow variables (FDI flows, imports, and the change in productivity and investment) the null hypothesis was rejected, therefore the series were found to be stationary. For the weighted R&D measures, used for the Coe and Helpman-type model, the test also failed to reject the null hypothesis of a unit root.

In what follows, we describe in detail the estimation of each of our three main models separately. We start with the Solow-type model (in three versions: only with FDI, only with imports and combined), estimating the long-run and short-run components according to equations (3.6)-(3.7). The results are presented in Tables 3.1 - 3.3.

In the long run, there exist relationships both between labour productivity and total FDI stock and between productivity and the import stocks, which show stationary residuals. The FDI stock variable is lagged, hinting that in general, it takes at least a year for the technology transfers associated with FDI to be translated into a higher productivity. The coefficient of the human capital variable, although positive, was only significant in one specification.

Similar long-run relationships were established with the disaggregated FDI variables: between lagged manufacturing FDI stock and productivity, as well as (lagged) FDI stock from the 6 technological leaders and labour productivity. Interestingly, in both cases the
3.7. RESULTS

Table 3.1: Long-term relationships: Solow-type model

<table>
<thead>
<tr>
<th></th>
<th>3.1</th>
<th>3.2</th>
<th>3.3</th>
<th>3.4</th>
<th>3.5</th>
<th>3.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>7.012***</td>
<td>6.318***</td>
<td>6.952***</td>
<td>4.482***</td>
<td>5.306***</td>
<td>5.221***</td>
</tr>
<tr>
<td></td>
<td>(0.919)</td>
<td>(0.771)</td>
<td>(0.905)</td>
<td>(0.746)</td>
<td>(1.071)</td>
<td>(0.612)</td>
</tr>
<tr>
<td>Investment</td>
<td>0.820***</td>
<td>0.789***</td>
<td>0.814***</td>
<td>0.644***</td>
<td>0.922***</td>
<td>0.615***</td>
</tr>
<tr>
<td></td>
<td>(0.093)</td>
<td>(0.081)</td>
<td>(0.111)</td>
<td>(0.088)</td>
<td>(0.089)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>Inward FDI stock (-1)</td>
<td>0.077**</td>
<td>0.614***</td>
<td>0.221***</td>
<td>0.486***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.121)</td>
<td>(0.079)</td>
<td>(0.125)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inward FDI manufact. stock (-1)</td>
<td></td>
<td>0.614***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.121)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI stock from G6 (-1)</td>
<td></td>
<td>0.221***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.079)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary education</td>
<td>0.018</td>
<td>0.022</td>
<td>0.034**</td>
<td>0.026**</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.017)</td>
<td>(0.015)</td>
<td>(0.013)</td>
<td>(0.02)</td>
<td></td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td>0.672**</td>
<td>0.672**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.168)</td>
<td>(1.63)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imports from G6</td>
<td>0.428***</td>
<td></td>
<td>4.374**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.54)</td>
<td></td>
<td>(1.90)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year dummies</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>118</td>
<td>118</td>
<td>92</td>
</tr>
</tbody>
</table>

Note: 1. Redshields are stationary.
2. One, two and three asterisks denote values significant correspondingly at the 10, 5 and 1% levels.

The coefficient of the narrow FDI measure was higher than the one of total FDI stock. This finding hints at differences across sectors: an additional unit of manufacturing FDI has a larger effect on productivity than a unit to the other sectors. Also, the long-run effect of FDI from technological leaders is larger than the one coming from the rest of the countries, probably because of the larger technology and efficiency gap between the source and host countries in this case. This finding is in line with works like De Mello (1999) and Lim (2001), who demonstrate that the magnitude of the effect from FDI increases in the size of the technology gap between the source country and the receiving country.

As opposed to FDI, contemporaneous import stocks performed better than the lagged ones. Again, as was in the case of FDI, we found that capital goods imports from the 6 technological leaders have a higher effect on productivity than those from all the world.

In the second step we estimated the error correction (EC) equations. In most of these EC equations (see Tables 3.2 and 3.3), the corresponding error correction terms were significant and with a negative sign, indicating that there is indeed a convergence process towards the long-run equilibrium. Otherwise, the equations performed poorly, particularly the ones involving FDI: they had a poor fit, reflected in a low R-squared, insignificant FDI variables and insignificance of the human capital measures in all regressions. In the fixed effects estimation, none of the FDI variables was found to be significant; but a GMM regression suggested a significant positive short-run effect of FDI to manufacturing. In contrast to FDI, the specifications with imports revealed a different picture: the coefficients of this variable are positive and robustly significant regardless of the estimation technique. The combined specification featuring simultaneously the FDI and imports also confirmed the significance of imports and insignificance of FDI. In general, a short-run

---

8 Lagged productivity was insignificant in all specifications, and was therefore dropped in the GMM regressions, in order to decrease the number of potentially endogenous variables and, therefore, of the instruments.

9 Apart from the reported specifications, a large number of alternative ones were attempted. Some
relationship between FDI and productivity was not established and FDI appears to be associated with labour productivity only in the long run, whereas capital goods imports have both a long- and a short-run relationship with productivity. The latter appears to be quite robust with respect to the estimating technique.

Next, we turned to the Borensztein-type model. The estimates of the long-run components (not reported) were rather disappointing: residuals were nonstationary; the cross terms of human capital and FDI or imports stocks, although with positive signs, were insignificant regardless of which of the two human capital measures we used. Due to the absence of established long-run relationships, only simple short-run specifications were estimated instead of error-correction equations. The results, reported in Table 3.4, reveal a picture similar to the long-run results: insignificant coefficients of the FDI measures, as well as the interaction terms, and mostly negative signs of the latter. In the GMM regressions with interaction terms the diagnostic tests for instrument validity often signalled problems with the specification. In general, there is no evidence that the magnitude of the effect of FDI or imports depends on the level of human capital in our sample.

Finally, we consider the bilaterally weighted model. It was estimated only in a long-run version, due to the long-run nature of the relationship. Its results are reported in Table 3.5. Although the coefficients of the two composite variables (FDI- and import-weighted R&D stocks) are significant, the residuals are non-stationary, suggesting that a long-run relationship can not be identified. Since we already established long-term links between productivity and correspondingly the FDI and imports, the negative results with these weighted measures are probably attributable to the newly introduced R&D stocks. As a check, we considered a specification, where instead of the weighted measures we of these included time fixed effects (in OLS), human capital variables (secondary or higher education indicators), lagged instead of contemporaneous FDI, as well as FDI to services, further differentiated by sector (e.g. real estate, financial sector etc.). However, none of these alternative regressions produced any significant results.

### Table 3.2: Error-correction equations: Solow-type model, OLS

<table>
<thead>
<tr>
<th></th>
<th>1.1.</th>
<th>1.2.</th>
<th>1.3.</th>
<th>1.4.</th>
<th>1.5.</th>
<th>1.6.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>3.915*** (0.630)</td>
<td>4.044*** (0.513)</td>
<td>3.453*** (0.544)</td>
<td>3.343*** (0.473)</td>
<td>2.650*** (0.682)</td>
<td>3.569*** (0.488)</td>
</tr>
<tr>
<td><strong>Investment</strong></td>
<td>0.979*** (0.087)</td>
<td>0.855*** (0.068)</td>
<td>0.892*** (0.098)</td>
<td>0.651*** (0.088)</td>
<td>1.013*** (0.082)</td>
<td>0.562*** (0.107)</td>
</tr>
<tr>
<td><strong>Inward FDI stock (-1)</strong></td>
<td>0.218*** (0.056)</td>
<td>0.830*** (0.107)</td>
<td>0.326*** (0.075)</td>
<td>0.074*** (0.016)</td>
<td>0.466*** (0.016)</td>
<td>0.059*** (0.017)</td>
</tr>
<tr>
<td><strong>Inward FDI manufacturing stock (-1)</strong></td>
<td>0.059*** (0.015)</td>
<td>0.074*** (0.016)</td>
<td>0.804*** (0.984)</td>
<td>0.059*** (0.017)</td>
<td>0.426*** (0.010)</td>
<td>0.042*** (0.119)</td>
</tr>
</tbody>
</table>

**Note:**
1. Residuals are stationary (Panel unit root test with trend and 2 lags).
2. One, two and three asterisks denote values significant correspondingly at the 10, 5 and 1% levels.
### Table 3.3: Error correction equations: Solow - type model, GMM

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>GMM estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.7</td>
</tr>
<tr>
<td>Lagged productivity</td>
<td>-0.126***</td>
</tr>
<tr>
<td>D(Investment)</td>
<td>0.856**</td>
</tr>
<tr>
<td></td>
<td>(0.280)</td>
</tr>
<tr>
<td>FDI variables</td>
<td></td>
</tr>
<tr>
<td>FDI inflow/worker</td>
<td>0.131*</td>
</tr>
<tr>
<td></td>
<td>(0.66)</td>
</tr>
<tr>
<td>FDI to manufacturing/worker</td>
<td>0.513**</td>
</tr>
<tr>
<td></td>
<td>(0.199)</td>
</tr>
<tr>
<td>FDI from G6/worker</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td>(0.102)</td>
</tr>
<tr>
<td>Capital goods imports</td>
<td></td>
</tr>
<tr>
<td>Imports/worker</td>
<td>10.921**</td>
</tr>
<tr>
<td></td>
<td>(4.97)</td>
</tr>
<tr>
<td>Imports from G6/worker</td>
<td>-2.2893</td>
</tr>
<tr>
<td></td>
<td>(35.757)</td>
</tr>
<tr>
<td>Error correction term (-1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.359</td>
</tr>
<tr>
<td></td>
<td>0.322</td>
</tr>
<tr>
<td></td>
<td>-0.188</td>
</tr>
<tr>
<td></td>
<td>0.186</td>
</tr>
<tr>
<td></td>
<td>-0.385</td>
</tr>
<tr>
<td></td>
<td>0.321</td>
</tr>
<tr>
<td></td>
<td>-1.334***</td>
</tr>
<tr>
<td></td>
<td>0.216</td>
</tr>
<tr>
<td></td>
<td>-0.350</td>
</tr>
<tr>
<td></td>
<td>0.536</td>
</tr>
<tr>
<td>F-statistic</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>10.56</td>
</tr>
<tr>
<td></td>
<td>11.32</td>
</tr>
<tr>
<td></td>
<td>42.49</td>
</tr>
<tr>
<td></td>
<td>21.71</td>
</tr>
<tr>
<td></td>
<td>25.59</td>
</tr>
<tr>
<td>Type of GMM method</td>
<td></td>
</tr>
<tr>
<td></td>
<td>diff</td>
</tr>
<tr>
<td></td>
<td>diff</td>
</tr>
<tr>
<td></td>
<td>system</td>
</tr>
<tr>
<td></td>
<td>system</td>
</tr>
<tr>
<td></td>
<td>diff</td>
</tr>
<tr>
<td>Number of lags used as instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 to 5</td>
</tr>
<tr>
<td></td>
<td>1 to 4</td>
</tr>
<tr>
<td></td>
<td>1 to 4</td>
</tr>
<tr>
<td></td>
<td>2 to 4</td>
</tr>
<tr>
<td></td>
<td>2 to 6</td>
</tr>
<tr>
<td>Number of instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Arellano-Bond test for AR(2) (p-value)</td>
<td>0.219</td>
</tr>
<tr>
<td></td>
<td>0.233</td>
</tr>
<tr>
<td></td>
<td>0.130</td>
</tr>
<tr>
<td></td>
<td>0.692</td>
</tr>
<tr>
<td></td>
<td>0.064</td>
</tr>
<tr>
<td>Sargan overidentif. restriction test (p-value)</td>
<td>0.490</td>
</tr>
<tr>
<td></td>
<td>0.535</td>
</tr>
<tr>
<td></td>
<td>0.062</td>
</tr>
<tr>
<td></td>
<td>0.140</td>
</tr>
<tr>
<td></td>
<td>0.486</td>
</tr>
<tr>
<td>Hausen test (p-value)</td>
<td>0.312</td>
</tr>
<tr>
<td></td>
<td>0.329</td>
</tr>
<tr>
<td></td>
<td>0.450</td>
</tr>
<tr>
<td></td>
<td>0.204</td>
</tr>
<tr>
<td></td>
<td>0.637</td>
</tr>
</tbody>
</table>

Notes:
1. Standard errors in parentheses
2. Robust standard errors in all specifications
3. Light shaded cells contain instrumented (potentially endogenous) variables
4. One, two and three asterisks denote values significant correspondingly at the 10, 5 and 1 % levels.
### Table 3.4: Short-run Borensztein-type model, OLS and GMM

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>OLS (fixed country effects)</th>
<th>GMM estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Constant</td>
<td>0.123</td>
<td></td>
</tr>
<tr>
<td>(0.114)</td>
<td>(0.005)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Lagged productivity</td>
<td>-0.152*</td>
<td>-0.207*</td>
</tr>
<tr>
<td>(0.093)</td>
<td>(0.106)</td>
<td>(0.096)</td>
</tr>
<tr>
<td>Differential</td>
<td>0.577***</td>
<td>0.572***</td>
</tr>
<tr>
<td>(0.096)</td>
<td>(0.092)</td>
<td>(0.091)</td>
</tr>
<tr>
<td>FDI variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI inflow/worker</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>(0.056)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI in manufacturing/worker</td>
<td>0.712*</td>
<td></td>
</tr>
<tr>
<td>(0.386)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI from G6/worker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.277)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction (HC * Measure of FDI) [high]</td>
<td>0.001</td>
<td>-0.010</td>
</tr>
<tr>
<td>(0.001)</td>
<td>(0.008)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Capital goods imports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import/worker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.114)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction (HC * imports)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.104)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>0.42</td>
<td>10.25</td>
</tr>
<tr>
<td>(0.114)</td>
<td>(0.114)</td>
<td>(0.114)</td>
</tr>
<tr>
<td>R-sq within</td>
<td>0.52</td>
<td>0.36</td>
</tr>
<tr>
<td>(0.104)</td>
<td>(0.104)</td>
<td>(0.104)</td>
</tr>
<tr>
<td>Observations</td>
<td>95</td>
<td>94</td>
</tr>
<tr>
<td>Type of GMM method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of instruments</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Number of lags</td>
<td>1 to 3</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Sargan test on overident restr. (p-value)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Hausman test (p-value)</td>
<td>0.561</td>
<td>0.83</td>
</tr>
<tr>
<td>(0.94)</td>
<td>(0.94)</td>
<td>(0.94)</td>
</tr>
<tr>
<td>Arellano-Bond statistic for AR(1)</td>
<td>0.073</td>
<td>0.19</td>
</tr>
<tr>
<td>(0.88)</td>
<td>(0.88)</td>
<td>(0.88)</td>
</tr>
<tr>
<td>Arellano-Bond statistic for AR(2)</td>
<td>0.105</td>
<td>0.36</td>
</tr>
<tr>
<td>(0.56)</td>
<td>(0.56)</td>
<td>(0.56)</td>
</tr>
</tbody>
</table>

**Notes:**

1. Standard errors in parentheses
2. Heteroskedasticity-consistent standard errors in all specifications
3. Country fixed effects are jointly significant in all OLS specifications
4. One, two and three asterisks denote values significant correspondingly at the 10, 5 and 1% level.
5. In the GMM estimation, shaded cells contain instrumented (potentially endogenous) variables.
Table 3.5: Long-term relationships: bilaterally-weighted model

<table>
<thead>
<tr>
<th></th>
<th>4.1</th>
<th>4.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>4.709***</td>
<td>1.962***</td>
</tr>
<tr>
<td></td>
<td>(0.584)</td>
<td>(0.428)</td>
</tr>
<tr>
<td>Investment</td>
<td>1.458***</td>
<td>1.019***</td>
</tr>
<tr>
<td></td>
<td>(0.061)</td>
<td>(0.069)</td>
</tr>
<tr>
<td>FDI-weighted R&amp;D stocks of G6</td>
<td>0.011**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.065)</td>
<td></td>
</tr>
<tr>
<td>IM-weighted R&amp;D stocks of G6</td>
<td>-0.007</td>
<td>0.28***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>R&amp;D stocks of G6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>113</td>
<td>130</td>
</tr>
</tbody>
</table>

Notes: 1. Non-stationary residuals.
2. One, two and three asterisks denote values significant correspondingly at the 10, 5 and 1 % levels.

regressed productivity on a simple sum of the R&D stocks of the 6 countries, in order to see whether they are related to productivity directly, without a specific weighting scheme. As expected, such a link was not found: the residuals were again non-stationary.

3.8 Discussion and conclusions

In this chapter, we investigated FDI and capital goods imports as carriers of technological and knowledge spillovers to 11 Central and Eastern European countries, and their influence on domestic labour productivity. We found certain evidence for both FDI and imports effects, similarly to the earlier literature. However, our approach showed that these are quite different in nature. The effect of FDI is only a long-run one, i.e. the cumulative amount of FDI exercises a positive effect on the level of labour productivity, whereas a short-run relationship between these variables was not established. Moreover, as could be expected, it is a lagged effect, i.e. a recorded unit of FDI translates into domestic labour productivity with one period lag. The magnitude of the effect seems higher in the manufacturing sector than in the rest of the sectors, and also if the source country has a larger technological advantage over the host country.

In contrast, capital goods imports were found to exercise both a long-run and short-run effect, and the long-run effect involves contemporaneous import stocks, implying a faster effect as compared to FDI. Again, imports from technologically more advanced countries leads to a larger effect on domestic productivity. The above findings are relatively robust to variation in the specifications.

In general, considering both the long-run and the short-run horizons, we found more evidence of the influence of imports on productivity than that of FDI. This difference between the measured effects of FDI and imports might be due to the different nature of these effects. Imports provide new intermediate goods, which embody a certain technology and are available for immediate use; the effects of FDI however are much broader and diffuse, impacting broadly efficiency, organization and managerial practices. These are structural factors that might take much longer to change and translate into measurable aggregate improvements, but the effects of these, due to the broader scope, might well be
larger in magnitude, particularly in the first part of the period (Campos and Kinoshita, 2002).

We can also compare the Solow-type and endogenous growth models. The long-term nature of the established relationships suggests that technology spillovers might have an impact on total factor productivity, i.e. that FDI and trade are indeed channels for technology transmission which increase the technology level in the host economy. Based on this evidence, it could be argued that the data provides more support for the endogenous growth model. However, the evidence is mixed on the other important criterion for distinguishing the models: the crucial role of human capital for the economy’s absorption capacity. The human capital variable is significant in some specifications when included independently\textsuperscript{10}, suggesting a general positive effect on labour productivity, not necessarily related to the impact of FDI or imports. The interaction terms involving human capital do not play a role neither in the short nor in the long run in our case. This result may be due to our rather general human capital measure, which might be inadequate for our purpose. The studies which employed interaction terms often relied on a more business-relevant measure of human capital, like the share of workers in a certain sector with secondary or higher education (Bijsterbosch and Kolasa 2009), which was however not available for our full sample.

The lack of relation between the R&D stocks of the technological leaders and productivity levels in our sample is at odds with previous findings of the literature on other countries (e.g. Coe and Helpman 1995 on OECD countries), and has at least two possible reasons. To start with, our calculated R&D stocks can actually be poor proxies of the actual accumulated amount of technology know-how in a country. R&D expenditures only reflect domestic innovative activity and do not capture efforts towards adoption or imitation of a technology developed abroad. An intermediate good imported from a particular country, even if it is produced in the latter, may embody technology invented in a third country, i.e. it is a result of the third country’s R&D activity. In this way, our measure does not take into account that the overall technological level in the source country may be also a function of international trade.

Second, it was already mentioned that while international economic linkages might indeed have positive influence on domestic productivity, it might be driven less by the inflow of superior intermediate goods, and more by improvements in management, organization and efficiency. R&D stocks are too narrow to capture the latter factors since they are a purely technology-related characteristic. It would be insightful to consider broader measures of knowledge, which would however be hard to find in practice. One possibility could be the labour productivity in the technologically leading countries, since it is likely to incorporate the influence both of technology and of other factors, which are hard to observe or measure, but could constitute a part of the knowledge spillover associated with trade or FDI. This investigation might be an object of further research in the area.

The time period encompassed in the current study has been a period of robust growth for the Central and Eastern European economies. However, in 2008 the region has entered a period of economic downturn, accompanied by a sharp decrease in the volume of foreign investment and trade worldwide. An interesting question would be to investigate whether

\textsuperscript{10}Without the time dummies, the human capital variable was significant in all long-run specifications.
the changed economic conditions have brought about a change in the relationship between these technology transfer channels and labour productivity. Moreover, since international capital flows are a phenomenon with a clear space dimension, another area of future work is revisiting the link between foreign capital and productivity taking into consideration the dependencies among countries through spatial econometric techniques, similar to those used in Chapter 2.
CHAPTER 4

RENT-SEEKING, STATE CAPTURE AND INSTITUTIONAL REFORM IN TRANSITION COUNTRIES

4.1 Summary

We investigate the interrelation between capital accumulation and institutional reform in a general equilibrium framework. For this purpose we introduce institutions and a rent-seeking sector to a standard Ramsey-type model. We find that higher initial capital endowment and productivity may lead to a worse institutional outcome. Although the association between institutional strength and capital investment is ambiguous, weaker institutions are always related to lower income and higher inequality. We show that our insights are in line with stylized reality of a number of transition economies.

4.2 Introduction

One of the unique features of transition countries is that they had to create and develop the institutions of a market economy virtually from scratch. The time available for this tremendous task was limited and only a few countries had any experience with market-oriented reform. In order to understand the institutional configurations that emerged, it is extremely important to know who has played a role in influencing the institutions and by what incentives they have been driven.

Institutions are often assumed exogenously given, which is reasonable for the developed economies, where they have been established as a result of a long historical process and are relatively stable. However, this assumption becomes too strong in the transition context. The existence of transition countries with little or no institutional progress, corruption and poor governance brings us to the sobering conclusion that the policy makers have not been led by the public interest. In extreme cases, government policy has become subordinated to their private interests, and the impact on the overall institutional level has been substantial, a situation known as "state capture" (Hellmann and Schankermann, 2000).

The emergence of these powerful vested interests is related to another feature of transition: the fast destruction of the previous institutional system, and the existence of an initial period of institutional vacuum, when the old institutions were removed or discredited and the new ones - not yet created. This situation has given unique opportunities for well-connected individuals to transform their connections and control from the old system into a potential for lucrative operations and rent extraction (Hellman et al, 2003). This led to the concentration of large wealth in the hands of the rent-seekers (the extreme case being the Russian oligarchs) and large increases in inequality, particularly in CIS countries (Grun and Klasen, 2000).

In order to investigate these interrelationships, we design a theoretical model where
on one hand, prevailing institutions determine the level of output and the degree of rent-seeking in the economy, but on the other hand, institutions are endogenous due to a feedback from economic variables to institutional quality. This feedback is realized through investment in and realization of political influence by rent-seekers. In this way, this study is among few to model the state capture formally and outline some conditions under which it can emerge. Simultaneously, the model describes one possible mechanism of how institutional factors (more specifically, the rule of law and the degree of protection of property rights) affect economic performance (e.g. output, investment and inequality), contributing by this to explaining the "black box" of institutional influence on the economy. To achieve this goal, we embed an institutional index and its dynamics into a standard general equilibrium model with capital and labour, and use heterogeneous agents.

The effects of other social and political factors on institutions and institutional reform have already been described in previous work, for instance the degree of civic virtue and the nature of the privatization process (Hoff and Stiglitz 2005), the degree of democracy (Acemoglu and Robinson 2008), inequality (Chong and Gradstein 2007). However, all these factors are slowly moving, whereas the "wealth" variables we consider can change much quicker. Moreover, they can themselves be affected by the institutional dynamics, creating in this way a complex feedback mechanism.

Our main novel result is that an increase in variables like the capital stock or total factor productivity may both increase the influence of interest groups on policy-making and have a negative effect on institutions. It means that better economic development does not necessarily mean better institutions. We also demonstrate that the model conforms well to several transition-related stylized facts like the inverse relationship between institutional development and inequality.

The rest of the chapter is organized as follows. Section 4.3 presents an overview of the phenomena of rent-seeking and state capture, including a case study on Bulgaria, which to the best of our knowledge is the first attempt to systematize this evidence for recent years in Bulgaria. Section 4.4 indicates the place of the chapter in the broader literature, outlining the relationship of our model with previous models, and provides justification for the model’s assumptions. Section 4.5 presents stylized facts concerning institutions in transition countries, which serve as important guidance for the model formulation and results. Section 4.6 presents the model setup, Section 4.7 explains the parameterization of the model, and Section 4.8 presents the numerical solution and the comparative statics. Finally, Section 4.9 discusses the model’s findings and draws conclusions.

4.3 Rent-seeking and state capture in transition

4.3.1 General considerations

Almost all transition countries have witnessed examples of rent-seeking, or extracting of value from unproductive activities at the expense of the other economic agents. Unreformed institutions led to the emergence of rent-seeking possibilities, which provided much higher profit than productive entrepreneurship and in some cases real windfall gains (Havrylyshyn, 2001). For instance, managers of state-owned enterprises obtained subsidized government credits and invested them at the market interest rate; subsidized energy
and raw materials were re-sold at the market price. Half-way reform of the financial sector and dysfunctional financial supervision provided the new bank owners with a possibility for profitable arbitrage (Hellman, 1998). The lack of effective control over managers in state-owned enterprises allowed large-scale asset-stripping and increasing the insiders’ stake in the former state-owned enterprises, particularly under privatization schemes favouring inside ownership (Black et al., 2000, Moser and Oppenheimer, 2001). Examples from early transition are well documented and are characteristic to varying degrees of all transition countries. However, there are countries which exhibit persistent rent-seeking even almost two decades later, as the case study on Bulgaria exemplifies.

In many cases, rent-seekers have also acquired political influence and affected policy-making in order to preserve the basis for their rent-seeking activity. When their influence is so substantial that policy-making turns into an instrument for promoting private interests, we are talking of state capture (as an analogy to the regulatory capture, where firms capture the bodies which are supposed to regulate them). An extreme example of political influence by the large-rent seekers and state capture are the Russian oligarchs of 1996-2000, who combined economic power with key political positions and large influence in the media (Black et al., 2000).

### 4.3.2 The case of Bulgaria

Although state capture is usually associated with countries like Russia, Bulgaria also presents a case of very persistent state capture. Here, the rent-seekers were initially members of the former party elite, managers of state-owned enterprises, members of the former security forces, former police and state-supported athletes (Barnes, 2007). Having access to public funds and the necessary connections, they engaged in many forms of rent-seeking, an important type being the protection racket of new small businesses in the 1990s. The weakening of the state allowed the rise of mighty and influential economic conglomerates like "Multigrup", which gained their initial capital mainly through asset stripping from major state-owned enterprises, organized crime (trafficking, money laundering) and later penetrated legitimate businesses like agricultural processing, trade and tourism (Barnes, 2007).

After almost two decades of reforms and even after the accession to the EU in 2007, examples of rent-seeking in Bulgaria still abound. The recent ones include looting of national and EU funds through criminal schemes, backed at the highest political levels; distorted and non-transparent assignment of public procurement projects to politically connected firms; non-transparent and unaccounted spending of budget funds (for instance, 1 billion BGN (Bulgarian leva) from the budget surplus in December 2007 and more that 4 billion in December 2008). Frequently observed are huge discrepancies between the amount of public funds allocated for certain projects and the value of the project’s results, which unambiguously points at large diversion of funds. Also the privatization process has been perceived as highly corrupt and nontransparent, and the most popular privatization method, "worker-management buy-outs", has allowed the Government to sell enterprises to their preferred managers (Open Society Institute, 2002). However, asset stripping and looting can occur even in privatized enterprises through insider control and abuse of minority shareholders rights (as the developments in the steel factory "Kremikovtsi" in

The 2006 confession of A. Dogan is very revealing. The leader of the political party Movement for Rights and Freedom (then in the ruling coalition) A. Dogan stated that every major political party in Bulgaria, including his own, has a "belt of firms" (Sega daily, 27 July 2006; Mediapool.bg, 3 November 2008), or a group of connected companies which drain public funds with the help of the politicians, and in turn provide the party with generous financial support and election financing.

Apart from rent-seeking, there are also multiple examples of interest group influence and state capture, concerning laws and regulations. The government is too weak to overcome the influence of powerful groups with vested interests in the status quo in many public services areas (Open Society Institute, 2002). One of the weakest areas with liberal rules and practical absence of supervision has been party financing. (Open Society Institute 2002). A telling example is the abolishment of ceilings for party financing, voted with overwhelming majority in August 2006 "Parliament abolishes ceilings to party financing", Sega daily, 8 February 2006). Another case are the provisions in the Criminal Law concerning large-scale tax crimes, which had been formulated in a way making it practically impossible to implement them (Sega daily, February 2007). In 2007, one of the national parks, Strandzha-Sakar, was deprived of its national park status for obscure reasons, with the idea to allow large-scale commercial construction in this attractive region. Illegal construction has also been very widespread in other areas and has become an important issue recently 1.

The dysfunctional law implementation as a result of political influence by vested interests is exemplified by cases like the wide-spread vote-buying at elections (at the local elections in October 2007 and in the European Parliament elections in 2009 (The New York Times, 2008). Millions of leva were given by political parties in 2007 in order to buy tens of thousands of votes only in a single town (Sega, October 2007). Although the law prescribes some sanctions in such cases, they have not been applied in practice. Moreover, there are almost no sentences for the many showcase murders of influential businessmen supposedly linked to the grey economy in the last years. Also, no major political figure has been convicted for corruption and organized crime; the judiciary processes have been protracted for years and the suspect persons allowed to go free, usually for the lack of evidence, or charged symbolic fines. In early 2008 the European Commission decided to suspend payments under the PHARE, ISPA and SAPARD accession funds worth hundreds of millions of euro due to apparent fraud and organized crime (BBC News, March 2008). No investigation or prosecution of high-level corruption followed thereafter. The facts speak for themselves.

Barnes (2006) argues that Bulgaria experiences a so-called "competitive capture", where the state subsequently becomes prey to different groups of captors: they remove from power the previous incumbents, but capture the state themselves. Indeed, although Bulgaria experienced several radical changes in the ruling political parties, the capture by parties and related firm groups persisted. This type of capture, although superior to classical state capture in terms of social welfare, is still a hindrance to institutional reform.

---

1For example, there was the case of construction and energy projects around cape Kaliakra, which attracted the attention of the European Commission (Mediapool.bg, 27 November 2008, available at: http://www.mediapool.bg/show/?storyid=146419&srcpos=21
Moreover, with time it becomes harder to eradicate since captors tend to penetrate all political parties, destroying the capture-free political alternatives (Barnes, 2006).

4.4 Related literature and modeling considerations

Conventional theories of economic reform argued that the main challenge to economic reforms is the ex ante opposition to reforms by those social groups that have to endure losses for the mere promise of future gains. Hellman (1998) demonstrated that this reasoning does not apply for the transition context and developed the theory of partial reform equilibrium as the theoretical framework tailor-made for transition reforms. It stipulates that the major political challenge comes actually from the winners of partial reform by their ex post effort to obstruct the completion of institutional reform. "Partial reform" refers to a state when a country has achieved certain progress in the fast and straightforward reforms like liberalization and privatization, but lags behind in the slower and complex institutional reforms - the creation of legislation, public administration, and law enforcement. If initial winners organize politically and slow down or stop further institutional reforms, this partially reformed state can become quite persistent.

Although rent-seeking and capture of politics by interest groups in transition countries has been studied extensively (Kaminski and Kaminski 2001, Black et al. 2000, Drazen 2004), there are only few attempts to analyze it formally. Sonin (1999 and 2003) first used formal analysis by building an overlapping generations model, in which individuals invest in private protection of property rights to compensate for the deficient state protection. The ability to protect property rights privately gives them also a possibility to encroach on other agents’ income and extract rents. Therefore, it also gives an incentive to preserve the institutional status quo and oppose the establishment of the rule of law. Therefore, given a wealth bias in political decision making, (i.e. with a government maximizing the welfare of a voter positioned higher than median in the wealth distribution), the imperfect protection of property rights becomes a permanent condition.

Another model is the one by Hoff and Stiglitz (2004), which, although not specially designed for transition countries, is also highly relevant for describing the transition phenomena. The model features heterogenous-ability individuals facing a choice between working and rent-seeking. In equilibrium, even under the most favourable assumptions (absence of concentrated wealth, democratic elections, accountability and no possibility for state capture) the rule of law will not necessarily emerge, because if there is uncertainty about the future reform course, expected returns to rent-seeking might be higher than those to producing. Hoff and Stiglitz demonstrate in this way that the transfer of property does not automatically lead to development of market institutions, which is a sobering re-consideration of the paradigm of quick privatization as a sufficient condition for emergence of appropriate market institutions.

4.4.1 Political influence and lobbying

While other works (Hoff and Stiglitz 2004, Sonin 2003) assumed that political power (and hence also power to design and implement reforms) only derives from official elections, Acemoglu and Robinson (2008) consider the possibility that powerful interest groups de-facto influence policy making, alongside the official political channels. The "de facto"
power depends both on the "de jure" power deriving from elections, and on the investments of interest groups in acquiring de facto influence (e.g. Acemoglu and Robinson 2008). As demonstrated by anecdotal evidence, this is an important element of real policy formation in transition countries, which needs to be taken into account. There are cases where democratic elections do take place, but afterwards politicians (or interest groups through politicians) easily cooperate with their adversaries to influence the implementation of measures which have been officially adopted (Kaminski and Kaminski, 2001). In the extreme case, electoral competition can turn into a formality\(^2\). The "de facto" power determines which group establishes their preferred institutional setup, and if the elite are powerful enough, the economy may end up with economic institutions favouring the elite despite democratic elections, a state described as "captured democracy" (Acemoglu and Robinson, 2008) and similar to our state capture. Under elite-favouring institutions the elite obtain rents, the incomes of citizens are reduced below factor payments and a part of national income is lost through a deadweight loss. Since in this model (Acemoglu and Robinson 2008) institutions depend on the political power of the groups, they are endogenous in this sense. In our model, we adopt a similar approach, allowing for the de facto power to depend also on the institutional level apart from the groups' contributions.

One important difference between our model and Acemoglu and Robinson (2008) is that we consider also capital and capital accumulation and the way it interacts with the political process and institution formation. We achieve this by embedding the institutional variable into a standard neoclassical model with capital and labour (Ramsey type). In this way, we can pay attention to the role of capital accumulation and its interaction with institutional change. Secondly, our institutional conditions are represented by a continuous variable, whereas in other models they usually take one of two possible values. In the model of Acemoglu and Robinson, the elite and citizens are involved in a complex game which determines the institutional outcome, whereas we adopt a simplified, non-game-theoretic approach providing for a much stronger influence of the elite than the citizens. Evidence has shown that in many transition countries like Russia, citizens and the elite are not equal participants in the political process, and the influence of the former is much smaller.

Another important difference is that our rent-seekers (our equivalent to elite members in Acemoglu) take the decision on political influence collectively. Both Acemoglu and Robinson (2008) and Hoff and Stiglitz (2004) assume that every agent takes decisions autonomously and ignores any effect of his behaviour on the others' decisions. In contrast, we assume that the decision on political influence is taken through collective, organized action like in Persson and Tabellini (2000), Campos and Giovannoni (2006). It is hard to imagine that influencing country-wide laws and large rent-extraction would be possible without cooperation and coordination. Grossman and Helpman (2002) also show that the degree to which an interest group can influence policy depends on the strength of its political organization. We assume that rent-seekers share the costs of political influence - an assumption also used in Harstad and Svensson (2008). Consistently with anecdotal evidence, we assume the presence of an effective observing and exclusion mechanism, so that rent-seekers who have not contributed can not make use of the "benefits" generated

\(^2\)Kaminski and Kaminski (2001) refer to such political systems as "electocracies" as opposed to democracies.
4.4. RELATED LITERATURE AND MODELING CONSIDERATIONS

by influencing the legislature and implementation of the law.

The collective-decision assumption brings our model close to the vast literature on lobbying (e.g. Persson and Tabellini, 2000, Harstad and Svensson, 2008). However, we consider party contributions rather than campaign contributions - the party uses the contribution not in order to win in electoral competitions, but directly in political influence. Our political influence falls under the category of lobbying, although it may also include extra activities such as placing persons to the key positions under the rent-seekers' control, threatening and exercising direct pressure on high officials.

Another difference with the lobbying literature is that we do not consider multiple lobbies competing over a policy. Non-rent-seekers, deprived of political connections, have been to a much lower extent politically organized and able to lobby than the rent-seekers. This assumption can be regarded as analogous to Persson and Tabellini (2000) lobbying model where landowners exercise stronger political power in lobbying than their competitors since they are by tradition endowed with a certain productive factor (land) more than the other agents. (the policy variable is the size of a tax). Our equivalent of the "old sector" consists of the former senior managers or party nomenklatura, and the superior endowment takes the form of a positive value of the rent-seeking opportunity. Instead of a competing lobby, the counteracting force to the rent-seekers' lobbying is the reform course of a country, to which the government has committed - in order to increase the country's attractiveness for foreign investors, improve living standards or fulfill conditions for membership in a supranational organization like the European Union. This rather mechanistic reform rule has been adopted in order to ensure simplicity and tractability of the model.

4.4.2 Administrative corruption, lobbying and state capture

It is worth briefly explaining how lobbying and its result, state capture, relate to administrative corruption, that is paying of bribes to government officials for personal favours. Lobbying is aimed at policy-making institutions and not at bureaucracy; lobbyists interfere directly with the political decision-making process, without using bribes. The targets of the lobbying are the laws and rules and their enforcement, and therefore its consequences are more global and persistent than those of administrative corruption, which are often limited to a personal favour to the briber. The difference is well illustrated by Harstad and Svensson (2008), who refer to administrative corruption vs. lobbying as "bending the rules" vs. "changing the rules".

Therefore, in modeling political influence, we are closer to Harstad and Svensson (2008) (rent-seekers influence permanently the country-wide institutions, for instance by passing laws with deliberately built-in loopholes and low levels of sanctions) than to Rodriguez (2004), where the result of political influence is eliciting of personal favours with short-term effect, negotiated anew in every period. We consider the former assumption more intuitive for conditions of institutional reforms, and in section 4.3, we provide several examples of influencing laws and regulations of country-wide importance in the case of Bulgaria. By securing a lower general institutional level in the current period rent-seekers get the increment to their rent and loss for the society forever.

These two forms of corruption, bribing and lobbying, are found to be substitutes (Harstad and Svensson (2008), Campos and Giovannoni (2006)). Agents bribe when
4.4. RELATED LITERATURE AND MODELING CONSIDERATIONS

their level of capital is low, but they switch to forming a lobbying group at its higher level. In general, this means that lobbying is more prevalent in richer countries, which is in line with the empirical findings (Harstad and Svensson, 2008). This conforms with one of our findings from section 7: the higher the initial income, the larger the extent of state capture we get.

4.4.3 Agent heterogeneity

A distinctive feature of our model is the division of agents in two groups, one of which is endowed with rent-seeking possibilities and the other not. Such a division of agents was already featured in Acemoglu and Robinson (2008), where rent-seeking possibilities are only characteristic for the elite. However, this assumption is also justified by the reality in most Eastern European and FSU countries, as explained by Alexeev (1998) for Russia. He argues that the huge post-privatization inequality increase in Russia in 1990s is actually not so large if we account for the initial distribution of control over assets, and not only of material wealth. It is true that the distribution of personal property and state housing in the Soviet Union was quite egalitarian, but the control rights on officially state-owned assets were highly concentrated - in the hands of the top enterprise management, ministerial bureaucracy, and party functionaries. These control rights sometimes extended to a kind of informal property rights, and depended on the individual’s position in the industrial and party hierarchy. Similarly to official property rights in market economies, they often implied that their holders were the residual claimants of profit streams from state-owned enterprises, whereas "planned profit" transferred to the state was rather like a fixed payment. During privatization, using insider information and connections, persons with informal control rights had an opportunity to convert them into formal rights and the hidden large inequality became visible. This process was particularly facilitated in those countries where privatization had a rent-seeking nature by design (e.g. Russia, Black et al. 2000). Our view on initial distribution is very close to Alexeev’s view: we consider the personal initial capital as uniformly distributed, but the ability to rent-seek as concentrated. Through rent-seeking it can gradually be transformed into unequal capital distribution.

Within the rent-seeking group, we assume a further level of agent heterogeneity by an individual characteristic, which determined the individual ability to rent-seek. As conventional in the previous works (e.g. Hoff and Stiglitz (2004), and Sonin (2003)), this characteristic is exogenous (determined by the individual’s position in the previous system).

4.4.4 Rent-seeking as a separate economic sector

Finally, some attention should be devoted to the way we model rent-seeking. Here we borrow from the models in Murphy, Schleifer and Vishny (1993), Barelli and Pessoa (2001), Rodriguez (2004), and model rent-seeking as a production process involving capital and labour. Rent-seekers need to invest capital and effort in protecting the rents, exercising influence and controlling, but also for making the political influence look legitimate in order to avoid sanctions and civil protests. The result of the production process is not a product, but a transfer: it is subtracted from the output for the corresponding period.
and therefore taken away from the factor payments to the workers like a lump-sum tax. We assume that the rent is not totally wasted: rent-seekers allocate the extracted rent between consumption and increase of their (rent-seeking) capital for the next period. One can think of a high-level bureaucrat, looting public funds in order to use them in the next period for production in his own business.

Similarly to Murphy, Shleifer and Vishny (1993) and Hoff and Stiglitz (2004), in our case rent-seekers are agents choosing between production or rent-seeking, and the result is an economy with two specialized sectors: a rent-seeking and producing sector (Hoff and Stiglitz call the activities correspondingly "asset stripping" and "value creating"). However, Hoff and Stiglitz (2004) assume that ability to asset-strip is inversely related to the ability to create value, whereas in our model they are independent, since the individual characteristic is related not so much to personal skills as to connections, influence and position under the socialist system.

It is well-known that rent-seeking causes a loss due to the waste of productive resources. Political influence also causes a loss due to the negative externality lobbyists impose on the whole economy by worse institutions (Harstad and Svensson, 2008). In our model, we have double loss of productive capital: once from rent-seeking and then from political influence, since the investments in rent-seeking and political influence are different and decisions on them are taken separately. In the comparative statics section we attempt to quantify these two losses for different scenarios.

4.5 Stylized facts

Our model reconciles several stylized facts from the transition literature. First of all, it has been established that institutional development in the transition countries is positively correlated with economic growth, and this relationship is quite robust (Havrylyshyn 2001 and Grogan and Moers 2001, among others). Svejnar (2002) also observes that cross-country differences in income and growth are highly correlated with the advance in the so-called Type 2 reforms, which include development of institutions and law enforcement.

Apart from that, there is a number of more specific stylized facts relevant for our model, which are briefly presented in the following section.

4.5.1 State capture index and Hellman’s stylized facts

The capture economy index, introduced by Hellman, allows some quantification of the state capture phenomenon (Hellman et al., 2003). The index is based on survey data, where survey participants have to determine "the extent to which firms or citizens influence the formation of laws, rules, regulations or decrees by public institutions" (Hellmann et al., 2003) The index is constructed on the basis of survey data. Based on the index value (reproduced in our Table 4.1), transition countries can be divided into state-capture countries (with values of the index above 50) and non-state capture countries (below 50). The list of state-capture countries in 2007 comprises Azerbaijan, Bulgaria, Croatia, Geor-

---

3For constructing the economy capture index, firms were asked to which extent the following activities have had a direct impact on their business: the sale of parliamentary votes or Presidential decrees to private interests, the sale of court decisions in criminal and commercial cases, illicit contributions paid by private interests to political parties and campaigns. (Hellman et al., 2003)
4.5. STYLIZED FACTS

Georgia, Kyrgyzstan, Latvia, Moldova, Romania, Russia, and Ukraine. Although the index is not available for Serbia and Macedonia, recent evidence exists (e.g. Pesic 2007) that they also can be included among the capture countries.

Hellman (1998) uses a number of stylized facts to provide empirical support for his partial reform theory. One of the stylized facts based on this index is that state capture countries are mostly middle reformers. The group of non-state capture countries is polarized: it comprises on one hand countries which have undertaken very little or no reforms, and on the other hand, those advanced on the reform path. In unreformed states with retained centralized control and dominating state sector, the private sector is too weak and small to be able to "capture the state". At the other end of the spectrum, in the best performing countries, there is a better developed civil society, limiting corruption and large rent-seeking opportunities.

Hellman also shows that the middle reformers experience the worst recessions. Further, he reports a hump-shaped relationship between reform progress and inequality, measured by the Gini coefficient: intermediate reformers have the highest values, while both the worst and the most successful reformers have maintained a lower level of inequality. Moreover, he observes that increased inequality is driven mainly by the larger income accruing to the highest quintile in the distribution, which he interprets as an indirect evidence of the activities of rent-seekers.

4.5.2 Stylized facts with institutional measures

Hellman plots various country characteristics against measures of reform progress, and in our model we use a measure of institutional quality. Therefore, for our purpose it would be useful to re-plot Hellman’s relationships using institutional indicators. We use one of the governance indicators of the World Bank, namely "rule of law" (listed in Kaufmann et al., 2007). "Rule of Law" is closest in its meaning to the institutional variable from our model, since it is a broad indicator which refers to the quality of the legal framework and of law enforcement in many areas (including the protection of the property rights). A brief comparison of the values of "rule of law" and the capture economy index reveals that the groupings of countries according to the two indicators overlap to a large extent with the exception of Slovakia and Latvia, which have substantially better institutional values than the state capture average. This is not the case with the newest EU members Bulgaria and Romania: being state capture countries, they show consistently moderate institutional values. A dynamic comparison of the institutional values between 1996 and 2006 reveals that in spite of some within-group changes, the classification has basically remained the same. The non-state capture countries have relatively good institutional values and have achieved progress (with the exception of Poland), but the worst performers, Turkmenistan, Uzbekistan, Belarus and Albania have worsened even further. In 2006, state capture countries still show middle to low institutional development.

4When we are describing countries generally as "state capture countries", it should be borne in mind that in each country, state capture has different characteristics and has developed also under the influence of idiosyncratic historical and other factors. For instance, in Russia there is evidence that recently state capture has been replaced by "business capture", where due to state strengthening and consolidation the state is in a position to extracts rents from businesses (Yakovlev, 2006).

5In some cases, for robustness we also use another of the World bank governance indicators - "control on corruption". The main relationships do not change when plotted against this indicator.
4.5. STYLIZED FACTS

Ideally, most relevant for our theoretical model would be to compare institutional changes between the initial and the resulting values and not just ex post levels. However, we can not construct these changes since no reliable institutional measure is available for the early 1990s, and this is a period when for some countries the largest institutional changes took place.

The relationship between state capture and reform progress can also be translated into a relationship between state capture and institutional quality. Plotting Hellman's capture economy index (it was calculated for 1997) against the "rule of law" for 1996, reveals that we can distinguish three groups: a good institution-low capture group to the right, a poor institution - high capture group in the upper part (their abbreviations are marked with larger font) and the poor institution - low state capture group in the lower left (Figure 4.1).

Notes to Figure 4.1: 1. On the X axis are the values of the World bank's index "Rule of Law" for 2002. It takes values between -2 (poor institutional value) and 2 (good institutional value).
2. On the Y axis is the capture economy index of Hellman et al. (2001), taking values from 0 (complete lack of state capture) to 100 (state capture).

4.5.3 Inequality

In Figure 2, we plot inequality against institutional quality, and observe three groups: two with poor-institution countries and one of good-institution ones. There is a group of poor- institution, low inequality countries in the lower left, another with poor institution, high inequality countries in the upper left-middle, and finally the good institution - low inequality countries in the upper right. The second group comprises mostly state capture countries (those with high value of the capture economy index), and from the 5 countries
with highest inequality 4 are also state capture countries: Russia, Georgia, Latvia and Macedonia, (for the fifth country - Turkmenistan, the capture economy index is not available)\(^6\). This relationship is in line with Hellman’s observation that intermediate reformers have in general high inequality and poor institutions.

Notes to Figure 4.2: 1. On the X axis are the values of the World bank’s index "Rule of Law" for 2002. It takes values between -2 (poor institutional value) and 2 (good institutional value).

2. On the Y axis inequality is measured by the income ratio of the richest 10% to the poorest 10% in the years 1998 - 2002 (UNDP, 2007).

3. The abbreviations of state capture countries (judging by the capture economy index) are marked with larger font.

We also observe a general negative relationship between inequality and institutional quality, which is in line with the finding of Chong and Gradstein (2007). They establish empirically a negative dynamic relationship between these two variables: countries with worse institutions are also likely to have higher inequality, and causality runs in both directions. They also demonstrate that the particular institutional variable displaying the highest correlation with inequality is indeed the rule of law.

It would be very interesting to see whether the above relationships can also be confirmed using some alternative measure of state capture apart from Hellman’s index and a more recent time period (since the index was only available for 1997). However, such measures are very hard to find. The corruption measures reported by international organizations (World Bank, Freedom House, Heritage Foundation) are "bundled measures" containing both administrative corruption and state capture (see Section 4.4.2) and would not be very informative in our case, where we need a measure only of state capture. There is also an additional problem when measuring corruption: that conventional measures of

---

\(^6\)If we repeat the plotting using the alternative institutional variable "Control of Corruption", we obtain a similar relationship (not reported).
corruption might be meaningless when "the state itself is sold" and we deal with extreme corruption affecting the core responsibilities of the state, so that the criminal, business and political worlds are fused (Kaminski and Kaminski, 2001).

Sources: Kaufmann et al. (2006), Hellman (1999), World Bank (2008), UNDP (2007)

To sum up, the the stylized facts that we expect our model to conform to are the following:

1. (a) A positive correlation between current institutional quality and current income level;
   (b) A positive correlation between initial institutional conditions and final institutional quality;
   (c) In general, a negative correlation between institutional quality and the degree of state capture. However, also presence of countries which have low values for both;
   (d) In general, a negative correlation between institutional quality and inequality, but also the presence of countries which have low values in both.

4.6 The model setup

We consider an economy populated by a continuum of individuals with measure one. A share $\lambda < \frac{1}{2}$ of them have the option to extract rents or engage in productive activity, the rest do not have a rent-seeking option and only produce. Our model has only two periods, both for the sake of simplicity and because it attempts to capture transitory phenomena, which have developed under the influence of a limited number of policy decisions and changes in the underlying conditions; we do not describe a theoretical steady state achieved in an infinite number of periods. In our first period, agents choose between consumption and saving; in the second period, agents consume all their capital.

The institutional quality is described by the parameter $\theta > 0$, where a lower value of $\theta$ stands for better institutional quality. This parameter affects the relative return to rent-seeking as compared to productive investment and therefore determines the portion of others’ income that can be expropriated as a rent. In addition, in the endogenous institutions case it also determines to what extent political influence by interest groups is possible.

Initially we assume that $\theta$ follows an exogenous process, later we endogenize it.

4.6.1 The firms

We consider a standard market sector with firms producing a single good with the following production function:

$$Y = F(K, L) = AK^\alpha L^{1-\alpha}. $$

The representative firm’s maximization problem is

$$\max_{K, L} F(K, L) - rK - wL. \quad (4.1)$$
### Table 4.1: Cross-country comparison of the institutional, state capture indicators and inequality

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Rule of Law</th>
<th>CE Index</th>
<th>Inequality</th>
<th>Inequality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azerbaijan</td>
<td>-0.94</td>
<td>-0.86</td>
<td>100</td>
<td>36.5(2001)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>-0.11</td>
<td>-0.17</td>
<td>68</td>
<td>29.2(2003)</td>
</tr>
<tr>
<td>Croatia</td>
<td>-0.16</td>
<td>-0.03</td>
<td>66</td>
<td>29(2001)</td>
</tr>
<tr>
<td>Georgia</td>
<td>-1.18</td>
<td>-0.61</td>
<td>59</td>
<td>40.4(2003)</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>-0.72</td>
<td>-1.18</td>
<td>71</td>
<td>30.3(2003)</td>
</tr>
<tr>
<td>Latvia</td>
<td>0.18</td>
<td>0.52</td>
<td>73</td>
<td>37.7(2003)</td>
</tr>
<tr>
<td>Moldova</td>
<td>-0.28</td>
<td>-0.61</td>
<td>90</td>
<td>33.2(2003)</td>
</tr>
<tr>
<td>Romania</td>
<td>-0.12</td>
<td>-0.16</td>
<td>74</td>
<td>31(2003)</td>
</tr>
<tr>
<td>Russia</td>
<td>-0.85</td>
<td>-0.91</td>
<td>78</td>
<td>39.9(2002)</td>
</tr>
<tr>
<td>Slovakia</td>
<td>0.21</td>
<td>0.43</td>
<td>59</td>
<td>25.8(2006)</td>
</tr>
<tr>
<td>Serbia</td>
<td>-0.99</td>
<td>-0.59</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Ukraine</td>
<td>-0.92</td>
<td>-0.72</td>
<td>78</td>
<td>28.1(2003)</td>
</tr>
<tr>
<td>Albania</td>
<td>-1.23</td>
<td>-0.70</td>
<td>39</td>
<td>31.1(2004)</td>
</tr>
<tr>
<td>Armenia</td>
<td>-0.42</td>
<td>-0.52</td>
<td>17</td>
<td>33.8(2003)</td>
</tr>
<tr>
<td>Belarus</td>
<td>-0.73</td>
<td>-1.16</td>
<td>20</td>
<td>29.7(2002)</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>0.83</td>
<td>0.73</td>
<td>27</td>
<td>25.4(1996)</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.76</td>
<td>0.73</td>
<td>17</td>
<td>26.9(2002)</td>
</tr>
<tr>
<td>Estonia</td>
<td>0.49</td>
<td>0.91</td>
<td>24</td>
<td>35.8(2003)</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>-0.91</td>
<td>-0.79</td>
<td>29</td>
<td>33.9(2003)</td>
</tr>
<tr>
<td>Lithuania</td>
<td>0.40</td>
<td>0.45</td>
<td>27</td>
<td>36(2003)</td>
</tr>
<tr>
<td>Poland</td>
<td>0.67</td>
<td>0.25</td>
<td>29</td>
<td>34.5(2002)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.85</td>
<td>0.79</td>
<td>17</td>
<td>28.4(1998)</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>-1.74</td>
<td>-1.06</td>
<td>na</td>
<td>32.6(2003)</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>-1.16</td>
<td>-1.44</td>
<td>na</td>
<td>40.8(1998)</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>-1.03</td>
<td>-1.44</td>
<td>15</td>
<td>36.8(2003)</td>
</tr>
</tbody>
</table>
As a result of this maximization, labour and capital are paid their marginal products:

\[ r = F'(K) = \alpha A \left( \frac{K}{L} \right)^{\alpha-1}, \]  

(4.2)

\[ w = F'(L) = (1 - \alpha) A \left( \frac{K}{L} \right)^{\alpha}. \]  

(4.3)

### 4.6.2 The households

A household faces the usual intertemporal consumption - saving problem. A household with opportunities for rent-seeking in addition chooses between rent extraction and production. The size of the extracted individual rent \( \Pi_i \) is given by a function \( f^\Pi \) which depends on their investment in (financial) capital \( k^{(r)} \):

\[ \Pi_i = f^\Pi(k^{(r)}) = \theta s_i k^{(r)}. \]  

(4.4)

The rent is also a function of \( \theta \), the prevailing institutional conditions in the economy. The individual parameter \( s_i \) characterizes the size of the rent-seeking opportunities. We assume that \( s \) is uniformly distributed in the interval \([0, S]^7 \). For agents without rent-seeking opportunities \( s_i = 0 \). Although production implies the use of productive capital and rent-seeking - the use of financial capital, we assume that they are perfect substitutes and in what follows, we will use a common symbol for capital \( k \).

We also assume that all agents (workers and rent-seekers) in the economy start with the same initial capital \( k_0 \). In the second period, the whole capital stock is consumed: \( k_2 = 0 \).

Before proceeding with the model, a brief clarification concerning notation is necessary. We will denote variables like consumption and capital with two subscripts: the first subscript for the period (1 or 2) and the second subscript for the agent type - \( w \) if the agent is a worker and \( i \) if rent-seeker (in that case, we use individual indices due to the heterogeneity of rent-seekers). In those cases where there is only one subscript, it refers to the period.

#### 4.6.2.1 Workers

The representative household without rent-seeking possibility (we will call it "worker") maximizes their utility for the two periods:

\[ \max_{c_1w, c_2w, k_{1w}} u(c_1w) + \beta u(c_2w). \]  

(4.5)

subject to the following budget constraints:

\[ c_1w + k_{1w} + T_1 = (r_1 + 1)k_0 + w_1, \]  

(4.6)

\[ c_{2w} + T_2 = (r_2 + 1)k_{1w} + w_2. \]  

(4.7)

\(^7\)The uniformity assumption is made for simplicity and since we have no a priori reason to assume a specific distribution.
where $k_{1w}$ is the capital of a representative worker at the end of period 1 and $T_1$ and $T_2$ are the amounts “stolen” from income by rent seekers correspondingly in the first and second period (for example, in the form of underpayment or underprovision of public goods and services).

The corresponding FOC for log-utility is

$$k_{1w} : c_{2w} = \beta c_{1w} (r_2 + 1).$$

(4.8)

Solving this for $k_{1w}$ gives us

$$k_{1w} = \frac{\beta}{1 + \beta} ((r_1 + 1)k_0 + w_1 - T_1) - \frac{1}{1 + \beta} \frac{w_2 - T_2}{r_2 + 1}.$$

For the sake of tractability let us denote $R_j := r_j + 1$ the gross discounted interest rate in period $j$, where $j = 1, 2$ and $W_j := w_j - T_j$ net salary to get

$$(1 + \beta) k_{1w} = \beta (R_1 k_0 + W_1) - \frac{W_2}{R_2}.$$

(4.9)

Thus the optimal capital is a generalized difference between the discounted incomes in period one and in period two.

4.6.2.2 Rent-seekers

The rent-seekers maximize the same as workers utility function given by (4.5) subject to a somewhat different set of budget constraints.

**Proposition 1** In any given period, a rent-seeker uses her capital stock either entirely for producing or entirely for rent-seeking. Therefore, the budget constraints she faces are

$$c_{1i} + k_{1i} = k_0 + \theta_1 s_i k_r,$$

(4.10)

$$c_{2i} = k_{1i}^i + \theta_2 s k_r.$$

(4.11)

if she chooses rent-seeking, and identical to the worker’s budget constraints if she chooses working.

**Proof.** All proofs are left to Appendix E. ■

Since potential rent-seekers may choose either work or rent-seeking in each period, we consider separately their three relevant combinations of choices: rent-seeking in both periods, working in both periods; rent-seeking in period 1, but switching to work in period 2.
4.6. THE MODEL SETUP

4.6.2.3 Double rent-seeking

Let us denote by $\gamma_1$ and $\gamma_2$ the measures of working individuals correspondingly in period 1 and period 2. Note that these are also the positions of the indifferent rent-seekers (indifferent between working and rent-seeking) in the two periods. Then $k_{1\gamma_1}$ is the capital of the indifferent rent-seeker at the end of period 1, and $k_{1\gamma_2}$ would be the capital of the indifferent rent-seeker for period 2.

The agents who rent seek in both periods have measure $\Gamma = 1 - \max(\gamma_1, \gamma_2)$ by definition. Then the capital $k_{1i}$ of any such individual is found as a solution to (4.5) subject to the constraints (4.10)-(4.11) that can be written as

$$c_{1i} + k_{1i} = k_0 + \theta_1 s_i k_0, \quad (4.12)$$

$$c_{2i} = k_{1i} + \theta_2 s_i k_{1i}. \quad (4.13)$$

Thus, the Euler equation in this case can be written as

$$k_{1i} = \frac{\beta}{1+\beta} k_0 (1 + \theta_1 s_i). \quad (4.14)$$

4.6.2.4 Double work

The agents who work in both periods are of measure $\Gamma_w = \min(\gamma_1, \gamma_2)$. The constraints for the first (indifferent) rent-seeker take the following form:

$$c_{1\Gamma_w} + k_{1\Gamma_w} + T_1 = (r_1 + 1)k_0 + w_1, \quad (4.15)$$

$$c_2 + T_2 = (r_2 + 1)k_{1\Gamma_w} + w_2. \quad (4.16)$$

The Euler equation in this case is familiar:

$$k_{1\Gamma_w} = \frac{\beta}{1 + \beta} (R_1 k_0 + W_1) - \frac{1}{1 + \beta} \frac{W_2}{R_2}. \quad (4.17)$$

Note that the value does not differ from that of a worker ($k_{1\Gamma_w} = k_{1w}$), which is consistent, as only the behavior and not the type of an agent matters in our model.

4.6.2.5 Rent-seek first, work afterwards

For any rent-seeker $i$ who was active in the first period and started working in the second (this happens if $\gamma_1 \leq i \leq \gamma_2$), we have the following budget constraints:

$$c_{1i} + k_{1i} = k_0 + \theta_1 s_i k_0, \quad (4.17)$$

$$c_{2i} + T_2 = (r_2 + 1)k_{1i} + w_2, \quad (4.18)$$

and the Euler equation takes the form

$$k_{1i} = \frac{\beta}{1 + \beta} (1 + \theta_1 s_i) k_0 - \frac{1}{1 + \beta} \frac{W_2}{R_2}. \quad (4.19)$$
4.6. THE MODEL SETUP

4.6.3 The equilibrium

4.6.3.1 Arbitrage conditions

In order to find what part of the potential rent-seekers choose to invest their capital in rent-seeking, we should keep in mind that the rent-seeker situated at the point $\gamma_1$ in period 1 and $\gamma_2$ in period 2 is indifferent between the returns from the two activities:

\begin{align*}
\theta_1 s_{\gamma_1} k_0 &= r_1 k_0 + W_1, \\
\theta_2 s_{\gamma_2} k_{1\gamma_2} &= r_2 k_{1\gamma_2} + W_2.
\end{align*}

(4.20)

In other words, since the capital is perfectly mobile between two sectors (production and rent-seeking), we have payoff equalization.

The measure of rent-seekers in the first period is

\begin{equation}
1 - \gamma_1 = \frac{S - s_{\gamma_1}}{S} \lambda,
\end{equation}

(4.21)

since $s$ is uniformly distributed.

4.6.3.2 Capital market

In the capital market, the supply of productive capital is given by the capital of the working agents (workers and potential rent-seekers not engaged in rent-seeking). Therefore, if we denote the working capital supply by $K_0^{(s)}$ and its demand by $K_0^{(d)}$, the available capital stock is $K_0^{(s)} = \gamma_1 k_0$ in the first period and in the second $K_1^{(s)} = \begin{align*}
\gamma_1 k_{1w} + \int_{\gamma_1}^{\gamma_2} k_{1} di, & \gamma_1 < \gamma_2; \\
\gamma_2 k_{1w}, & \gamma_1 \geq \gamma_2.
\end{align*}

It should be noted that in the first case the new working agents (those who were rent-seeking in period 1) all have different capital $k_{1i}$. After substituting the optimal capital values for the worker and rent-seeker from the corresponding utility maximization problems we obtain for the case $\gamma_1 < \gamma_2$, (i.e. people between $\gamma_1$ and $\gamma_2$ are rent-seeking in the first period, but working in the second):

\begin{equation}
K_1^{(s)} = \frac{1}{1 + \beta} \left( \gamma_1 \beta (R_1 k_0 + W_1) - \gamma_2 \frac{W_2}{R_2} \right) + \int_{\gamma_1}^{\gamma_2} \frac{\beta (\theta_1 s_i + 1)}{1 + \beta} k_0 di, \gamma_1 < \gamma_2.
\end{equation}

Due to the uniform distribution

\begin{equation}
s_i = \frac{(i - 1) S}{\lambda} + S = \frac{S}{\lambda} (i - 1 + \lambda),
\end{equation}

(4.22)

where $i \in [1 - \lambda, 1]$. 
4.6. THE MODEL SETUP

Then

\[
K_1^{(s)} = \frac{1}{1 + \beta} \left( \gamma_1 \beta W_1 - \frac{\gamma_2 W_2}{R_2} \right) + \frac{\beta}{1 + \beta} \kappa_0 \left( \left( \theta_1 S \left( 1 - \frac{1}{\lambda} \right) + 1 \right) (\gamma_2 - \gamma_1) + \theta_1 \left( \frac{\gamma_2^2 - \gamma_1^2}{2 \lambda} \right) + \gamma_1 R_1 \right).
\]

In the opposite case \((\gamma_1 \geq \gamma_2)\) the capital supply is simply

\[
K_1^{(s)} = \frac{\gamma_2}{1 + \beta} \left( \beta (R_1 \kappa_0 + W_1) - \frac{W_2}{R_2} \right).
\]

The demand for capital from producers follows from the profit maximization problem of the productive firm: \(K_t^{(d)} = \left( \frac{r_{t+1}}{\alpha A} \right)^{\frac{1}{\alpha - 1}} L_{t+1}\). The capital market equilibrium can be written then as \(K_t^s = K_t^d\):

\[
\gamma_1 \kappa_0 = \left( \frac{r_1}{\alpha A} \right)^{\frac{1}{\alpha - 1}} \gamma_1.
\]

\[
\frac{\gamma_2}{1 + \beta} \left( \beta (R_1 \kappa_0 + W_1) - \frac{W_2}{R_2} \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha - 1}} \gamma_2, \quad \gamma_1 < \gamma_2;
\]

\[
\frac{\gamma_2}{1 + \beta} \left( \beta (R_1 \kappa_0 + W_1) - \frac{W_2}{R_2} \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha - 1}} \gamma_2, \quad \gamma_1 \geq \gamma_2.
\]

### 4.6.3.3 Labor market

On the labor market, the supply is fixed (in our case only workers offer labor inelastically, so that \(L_t^{(s)} = \gamma_t\)). The demand for labor is derived from the firm maximization: \(L_t^{(s)} = \left( \frac{(1 - \alpha) A}{w_t} \right)^{\frac{1}{\alpha - 1}} K_{t-1}\), where \(t = 1, 2\). The labor market equilibrium is then \(L_t^{(s)} = L_t^{(d)}\):

\[
\gamma_t = \left( \frac{(1 - \alpha) A}{w_t} \right)^{\frac{1}{\alpha - 1}} K_{t-1}.
\]

### 4.6.3.4 Prices

The prices in the first period can be found independently and straightforwardly:

\[
r_1 = \alpha A \kappa_0^{\alpha - 1}
\]

\[
w_1 = (1 - \alpha) A \kappa_0^\alpha
\]

For the second period we have the following system for the equilibrium in two markets:

\[
\frac{r_2}{\gamma_2} \left( \beta (R_1 \kappa_0 + W_1) - \frac{W_2}{R_2} \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha - 1}}, \quad \gamma_1 < \gamma_2;
\]

\[
\left( \frac{\alpha A}{r_2} \right)^{\frac{1}{\alpha - 1}} = \left( \frac{(1 - \alpha) A}{w_2} \right)^{\frac{1}{\alpha - 1}}.
\]
The physical budget constraint is the following (the total extracted rent is equal to the product sacrificed by the workers):

\[
\int_{\gamma_1}^{1} \theta_1 s_i k_0 d_i = \gamma_1 T_1, \quad (4.26)
\]

\[
\int_{\gamma_2}^{1} \theta_2 s_i k_1 d_i = \gamma_2 T_2.
\]

**Proposition 2** The competitive equilibrium in the first period is characterized by a set of prices \((w_1, r_1)\), share of rent-seekers \(\gamma_1\) and size of the transfer \(T_1\) which satisfy the following conditions:

\[
r_1 = \alpha A k_0^{\alpha - 1},
\]

\[
w_1 = (1 - \alpha) A k_0^\alpha,
\]

\[
\gamma_1 = \frac{A k_0^{\alpha - 1}}{\theta_1 S} \lambda \left(1 + \frac{A k_0^{\alpha - 1}}{\theta_1 S} \right)^2 \lambda^2 - 2 \lambda + 1,
\]

\[
T_1 = \theta_1 k_0 S \left(\frac{1 + \gamma_1}{2 \lambda} + 1 - \frac{1}{\lambda} \right) \frac{1 - \gamma_1}{\gamma_1}.
\]

Such an equilibrium exists when the following restrictions hold:

\[
\frac{1}{2} \frac{\lambda}{1 - \lambda} < \frac{A k_0^{\alpha - 1}}{\theta_1 S} < 1.
\]

**Proposition 3** The competitive equilibrium in the second period is characterized by a set of prices \((w_2, r_2)\), share of rent-seekers \(\gamma_2\) and size of the transfer \(T_2\) which satisfy the following conditions:

\[
\left(\frac{r_2}{\alpha A}\right)^{\frac{1}{\alpha - 1}} \gamma_2 = \frac{1}{1 + \beta} \left(\gamma_1 \beta W_1 - \gamma_2 \frac{W_2}{R_2}\right) + 
\]

\[+
\frac{\beta}{1 + \beta} k_0 \left(\left(\frac{S}{\lambda} \left(\frac{1 + \gamma_2 + \gamma_1}{2}\right) + 1\right) (\gamma_2 - \gamma_1) + \gamma_1 R_1\right)
\]

\[= \left(\frac{\alpha A}{r_2}\right)^{\frac{1}{\alpha - 1}} = \left(\frac{1 - \alpha}{w_2}\right)^{\frac{1}{\alpha - 1}}
\]

\[
\left(\frac{S}{\lambda} \left(\gamma_2 - 1 + \lambda\right) - r_2\right) \frac{\beta}{1 + \beta} k_0 \left(1 + \frac{S}{\lambda} \left(\gamma_2 - 1 + \lambda\right)\right) = w_2 - T_2
\]

\[
\theta_2 \frac{S}{\lambda} \frac{1}{1 + \beta} \left(-\frac{w_2 - T_2}{R_2} \left(\frac{\gamma_2 + \gamma_1}{2} + \lambda - 1\right) (\gamma_2 - \gamma_1)\right) = \gamma_2 T_2
\]
in the case $\gamma_1 < \gamma_2$, and

\[
\frac{1}{1+\beta} \left( \beta (R_1 k_0 + W_1) - \frac{W_2}{R_2} \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}} \left( \frac{\alpha A}{r_2} \right)^{\frac{1}{\alpha-1}} = \left( \frac{(1-\alpha) A}{w_2} \right)^{\frac{1}{\alpha-1}}
\]

\[
(\theta_2 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda - r_2) \frac{1}{1+\beta} \left( \beta (R_1 k_0 + W_1) - \frac{W_2}{R_2} \right) = W_2
\]

\[
\theta_2 \frac{S}{\lambda} \frac{\beta}{1+\beta} k_0 \left( \theta_1 \frac{S}{3\lambda} (\lambda^3 - (\gamma_1 + \lambda - 1)^3) + \left( \frac{1+\gamma_1}{2} + \lambda - 1 \right) (1-\gamma_1) \right) = \gamma_2 T_2
\]

in the case $\gamma_1 \geq \gamma_2$.

These highly nonlinear systems, which we solve numerically, serve as basis for the endogenizing of the institutions in the next section.

4.7 Endogenizing institutions

We proceed by making the second-period institutional value endogenous. We leave intact the assumption that in the first period the institutional quality $\theta_1$ is exogenously given, determined by initial conditions and the initial history of reform. However, now its second-period value $\theta_2$ is determined as a result of both the reform commitment of the government and the political influence of rent-seekers to counter the reform implementation.

Non-rent-seekers have a strong interest in advancing the institutional reform since a completed reform would eliminate rent extraction. They are mostly not politically connected entrepreneurs or workers, who suffer welfare losses in the course of reform expecting future gains (Hellman, 1998). The other pro-reform force is the government’s commitment to a certain reform agenda, which determines the size of the targeted reform step. It is defined as the level of institutional quality $\hat{\theta}$, $\hat{\theta} \leq \theta_1$, which is feasible and desirable to achieve by the end of period 1 in the absence of counteracting forces. For simplicity, we assume that the targeted institutional level $\hat{\theta} = \hat{\theta}(\theta_1)$ is given by $\hat{\theta} = \theta_1 - \mu$, where $\mu$ is an exogenous parameter giving the feasible reform step.

Rent-seekers aim at decreasing the actual reform step below the targeted one in order to keep a higher rent, and for this purpose they organize politically. In terms of Acemoglu and Robinson (2008), the targeted $\hat{\theta}$ is voted at official elections and represents the de jure political power of the pro-reform forces, whereas the rent-seeker’s reform setback reflects their de facto power. The final institutional level $\theta_2$ ($\theta_2 \geq \hat{\theta}$) is hence a function of the efforts of the rent-seekers. The actual reform step (as opposed to the targeted one) is denoted by $\varepsilon = \theta_2 - \hat{\theta}$. An important assumption we make is that rent-seekers cannot induce an institutional setback $\varepsilon$ larger than the targeted step $\mu$, i.e. although they slow down the institutional improvement, they can never achieve deterioration beyond initial institution quality. This assumption is made for simplicity, but it does not contradict the available data. Judging by the EBRD institutional reform indicator, all countries have ended the 1990s with better reform values than they started in the beginning of the
4.7. ENDOGENIZING INSTITUTIONS

1990s. The assumption simplifies the analysis substantially, since now we can ignore the case \( \gamma_1 > \gamma_2 \) in section 4.

The political power of the rent-seekers to set back the proposed reform depends on their total investment for influencing policy \( O \) (analogous to the contribution to political party campaigns in Persson and Tabellini, 2000). Obviously, the contribution is an increasing function of the desired outcome \( \varepsilon \). We also assume that it is less costly to mess up the institutions if they are bad in the first place, that is \( O \) is a decreasing function of \( \theta_1 \). In the case of fully developed institutions \( (\theta_1 = 0) \) influencing the reform becomes prohibitively costly. (This is a somewhat extreme assumption since even in that case there might be some lobbying). At the same time, costs become prohibitively high only when \( \theta_1 \) is very close to zero. This is an intuitive assumption since unless laws and their implementation are sound, it is impossible to insulate decision-making from the vested interests. Analogously to Persson and Tabellini, we assume that the total cost of changing institutions through political influence depends quadratically on the result:

\[
O = \frac{B\varepsilon^2}{\theta_1},
\]

where \( \theta_1 > 0 \). The expression \( \frac{B}{\theta_1} \) is a measure of the costs of political influence per "unit of institutional change". \( B \) is an exogenous country-specific parameter. It can be assumed to capture other institutions, different from the rule of law, which co-determine the easiness of achieving political influence. More specifically, it can be interpreted as the degree of centralization of political power and the type of political system: with similar levels of institutional development, state capture will be much more difficult in a country closer to dictatorship (corresponding to a larger \( B \)) than in a country with decentralized governance. Campos (2006) also demonstrates empirically that lobbying is more likely to occur in parliamentary systems than in those with centralized governance. Alternatively, it can be regarded as a measure of transparency and accountability of the political decision-making bodies: low accountability facilitates political influence by interest groups.

In order to take into account the restriction \( \varepsilon \leq \mu \), we can re-define 4.34 as

\[
O = \begin{cases} 
\frac{B\varepsilon^2}{\theta_1}, & \varepsilon \leq \mu; \\
\infty, & \varepsilon > \mu.
\end{cases}
\]

The collective decision over political influence is taken based on the aggregate budget constraint of the party members. The individual share of contribution \( o \) is determined proportionally to the benefit of every rent-seeker, whereby we assume some sense of justice among the rent-seekers, but not outside their circle. We also assume that party members can effectively be excluded from enjoying the benefits of state capture if they do not pay a contribution. In this way, free riding is excluded and all members pay their share of the investment in political influence. Additionally, since common knowledge is preserved and there is no free riding, each agent can compute her optimal contribution as a function of her type by assuming that all other party members have the same contribution functions.

The individual utility maximization problems remain exactly the same as those in Section 4.6.2 with the exception of the double rent-seekers, who now have the opportunity to increase their second-period rent through paying a contribution in the first one. Therefore, here we also have to optimize with respect to the individual contribution \( o \).
4.8. PARAMETERIZATION

\[
\text{max}_{c_{1i}, c_{2i}, k_{1i}, o_i} \ u(c_{1i}) + \beta u(c_{2i}), \quad (4.35)
\]

\[c_{1i} + k_{1i} + o_i = k_0 + \theta_1 s_i k_0, \quad (4.36)\]

\[c_{2i} = k_{1i} + \theta_2 (O) s_i k_{1i}, \quad (4.37)\]

where \(\theta_2 (O) = \hat{\theta} + \sqrt{\frac{\theta_1 O}{B}}, O = \int o(s_j) dj.\)

In the following proposition, we formulate the second-period equilibrium in the endogenous case.²

**Proposition 4** The competitive equilibrium with endogenous institutions is characterized in the second period by a set of prices \((w_2, r_2)\), share of rent-seekers \(\gamma_2\), a transfer \(T_2\) and a total political party contribution \(O\), which satisfy the conditions of proposition 3 and the following additional condition:

\[O = \frac{1}{2} \left( \beta z + X^2 - X \sqrt{X^2 + 2\beta z} \right), \quad \text{where} \]

\[X := \left( \frac{1}{\lambda} \left( \frac{1}{\lambda} (\gamma_2 - 1 + \lambda) + \hat{\theta} \right) \right) \sqrt{\frac{B}{\theta_1}}; \]

\[z := \frac{1}{1 + \beta} k_0 \left( 1 + \theta_1 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) \right). \]

**Corollary 5** Under the restriction \(\gamma_1 < \gamma_2\), the exogenous model is the limiting case of the endogenous one under the condition \(B \to \infty\), i.e. in the case of prohibitively high costs of political influence.

4.8 Parameterization

Before turning to the numerical comparative statics, we perform parameterization of the model based on the Bulgarian case. We choose to parameterize on the endogenous model, which is more general and adequate for describing the reality since we assume that in all countries we have at least some possibilities for political influence. As shown in Corollary 5, the exogenous model would correspond to a hypothetical case with prohibitively high costs of influencing institutions (for instance, in countries with authoritarian regimes).

Since our stylized model only considers two periods, and we would like to allow for a sufficiently large institutional change between the two periods, we assume that the length of each of the periods is 5 years. This means that period one, which creates the base for anchoring of the vested interests in the political leadership, would roughly correspond to the situation until 1995, and the second period till 2000. Additional justification for

²The first-period optimization remains unaffected, the only difference being that the rent-seekers' consumption is decreased by the contribution \(o\).
this division is the value of the institutional indicators: in the first half of the 1990s the transition countries are characterized by relatively close values of the institutional indicators and measures of inequality, whereas the difference has grown very wide in the second half of the 1990s (Gruen and Klasen, 2003).

We choose the following parameter values for the model. For the annual discount factor we use the standard value of $\beta = 0.95$, which means that the value over the whole 5-year period is $0.95^5 = 0.77$. For the capital’s share in output $\alpha$, we follow Tsalinski (2007) who estimates an average value of 0.4 for the years around 2003. A similar figure is obtained also by Ganev (2005) and used by Eller (2004), although he admits that the capital elasticity for southeastern European transition countries might be substantially higher.

To the best of our knowledge, the only study reporting estimates of levels for total factor productivity (TFP) in transition countries is Eller (2004) who uses $A = 1.5$ for Central Europe. Ladu (2006) estimates separate TFP values for different European regions and the lowest TFP in certain Spanish and UK regions in the range of 1.7 to 2. Keeping in mind that currently TFP values in Central and Eastern Europe are still below the corresponding values for EU, we see that Eller’s estimate is quite reasonable.

The most problematic variable is the initial capital/output ratio. Transition countries started heavily over-capitalized, some researchers even estimated a capital-output ratio several times higher than that of market economies (Izyumov and Vahaly, 2006). However, a large part of the inherited capital turned out to be unusable under market conditions and had to be scrapped. According to different estimates the depreciated part of capital was between 15 and 50 percent of the total stock (Izyumov and Vahaly). Therefore, a couple of available estimates of this ratio in early transition are very unreliable and differ by large amounts. Instead of relying on the early ratios, we are forced to use more reliable recent data. Izyumov and Vahaly’s estimate for capital/output ratio for Bulgaria in 2002 is 1.28. Tsalinski (2007) arrives at a yearly figure of 1.5 for the years 1998-2003. We use this value, and translating it into a 5-year value (dividing by the 5-year output), we obtain a ratio equal to $1.5/5 = 0.3$. Now we are also in a position to express the initial capital $k_0$ from the production function equation:

$$k_0 = \left( \frac{K}{Y} A \right)^{\frac{1}{1-\alpha}}.$$

Substituting the values of the known parameters we obtain $k_0 = 0.26$.

As for the two parameters that characterize rent-seeking ($\lambda$ and $S$), we have basically no guidelines from the data or previous works. We take $\lambda = 0.2$, on the assumption that rent-seekers are not a large share of all agents. As for the value of $S$, we assume $S = 4.2$ in order to make the return to rent-seeking be of comparable magnitude as the return from working and avoid in this way corner solutions.

Next, we calibrate the transfer $T_2$. There is evidence that the portion of the government funds drained as a rent is substantial. The American ambassador Beyrle, cited by the Focus agency, stated in 2005 that in procurement projects an estimated 20 to 25% of the project value was diverted due to corruption. He also cited estimates that the sum that Bulgaria lost due to corruption only in 2006 is equal to the combined budgets of Health, Educational and Environmental ministries (SofiaEcho, 2007). A publication by
4.9. COMPARATIVE STATICS

The Centre for the Study of Democracy reports similar and persistent rates of fund draining also in other areas, e.g., health care (Centre for the Study of Democracy, 2003). This figure can also serve as an indication for the share of rent extracted outside the public sector, since we define rent-seeking more broadly than only that done by bureaucrats. We should also keep in mind that the grey economy is estimated at around 30% of GDP in Bulgaria. Based on all this data, we assume that 20% of total output is extracted as rent, i.e., \( \frac{T_2}{Y_2} = 0.2 \).

Another indicator we use for calibration is the ratio of the incomes of the top 20 percent to the lowest 20 percent reported by the UNDP. In the beginning of the 2000s, its value for Bulgaria is 4.4. We construct the income ratio of the rent-seekers’ to workers’ income and compare it with the UNDP ratio. Then we solve the system numerically to fit the values of the remaining parameters \( \theta_1, \mu \) and \( B \). Under the above values of \( \lambda \) and \( S \), we can find values of \( \theta_1 = 1.5, \mu = 0.9 \) and \( B = 0.8 \). Table 4.2 summarizes the parameter values which we take as a benchmark for our analysis. The solution to the model with the benchmark values provides an illustration of a case whereby the institutional conditions improve and the number of rent-seekers does not increase. Nevertheless, the economy ends up with increasing rent seeking \( T_2 > T_1 \) and a large institutional backlash (the institutional improvement \( \theta_1 - \theta_2 \) is only 0.4, as compared to the desired \( \mu = 0.7 \)).

We are now equipped to trace the comparative statics of the variables of interest.

4.9 Comparative statics

Here we analyze the effects of the parameters of the model on the endogenous variables\(^9\).

First, in Table 4.3 we provide an overview of the solution of the model in the benchmark case. The calibration of the model to Bulgarian values reveals a relatively modest degree of setback as a result of the state capture: instead of achieving the targeted value of \( \theta = 0.6 \) (corresponding to the reform without political influence), the final institutional

---

\(^9\)The derivations for the income difference ID and the total output Y can be found in Appendix F.
4.9. COMPARATIVE STATICS

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_2$</td>
<td>Second-period share of workers</td>
<td>0.917</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>Second-period institutional value</td>
<td>0.759</td>
</tr>
<tr>
<td>$ID$</td>
<td>Income difference between avg. rent-seeker and worker</td>
<td>5.126</td>
</tr>
<tr>
<td>$Y$</td>
<td>Total output</td>
<td>0.898</td>
</tr>
<tr>
<td>$O$</td>
<td>Total party contribution</td>
<td>0.013</td>
</tr>
<tr>
<td>$T_2/Y$</td>
<td>Second-period transfer as a share of total output</td>
<td>0.195</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>Reform setback achieved by rent-seekers</td>
<td>0.159</td>
</tr>
<tr>
<td>$c_2^w$</td>
<td>Second-period consumption of a worker</td>
<td>0.761</td>
</tr>
<tr>
<td>$K^p$</td>
<td>Total productive investment</td>
<td>0.316</td>
</tr>
<tr>
<td>$K^r$</td>
<td>Total rent-seeking investment</td>
<td>0.028</td>
</tr>
<tr>
<td>$k^w$</td>
<td>Investment of a worker</td>
<td>1.156</td>
</tr>
</tbody>
</table>

value is $\theta_2 = 0.75$, meaning that around 18% of the planned reform step $\mu$ has been prevented from implementation.

The income loss due to investment in political influence instead of production, $O/Y$, amounts to 1.5% of total output. Cumulative rent-seeking investment is 0.03, and total productive investment is 0.36. It means that about 9% of total investment in the economy is an unproductive investment, and allows us to roughly quantify the loss of productive resources stemming from rent-seeking.

Before presenting our comparative statics results, it should be noted that we are only interested in non-corner solutions and this is the key factor underlying our choice of parameter ranges. Our observed relationships and patterns are robust in the sense that they describe fully the variable behaviour within the range of parameters providing an internal solution.

4.9.1 Initial institutional level

First we consider the impact of the initial institutional level $\theta_1$(Table 4.4). The less developed institutions are, the higher return to rent-seeking as compared to working, therefore more agents choose rent-seeking, channeling their capital to unproductive purposes. Therefore, with increasing $\theta_1$, the share of rent-seekers in both periods increases, final institutional level worsens ($\theta_2$ increases), and naturally final output $Y$ decreases due to the lower level of productive resources. It is also intuitive that the second-period income difference $ID$ increases with higher $\theta_1$: rent-seekers receive higher and workers - lower income. These findings are in line with the empirically established importance of initial conditions (in this case the initial institutional conditions) for output (Stylized fact (b)). Indeed, countries which in the beginning of transition had some initial experience with market institutions performed in general better than those that built the institutions from scratch (de Melo, 1997). The influence of current institutions on output (stylized fact (a)) can be demonstrated through plotting $Y_1$ against $\theta_1$ and output $Y_2$ against $\theta_2$ (in both cases the relation is positive). The general negative relationship between institutional quality and inequality is in line with the empirical findings of Chong and Gradstein
(2007).

Total productive investment (the part of total end-of-period 1 capital that is not consumed) displays interesting U-shaped dynamics with respect to $\theta_1$, although the range of change in this variable is relatively small (see Figure 4.3). For our parameter values, the lowest point is achieved slightly below the benchmark value ($1.4$) and further worsening institutions actually lead to higher investment levels. This shape is due to the interaction of two terms: the capital of the "two-period workers" and of those former rent-seekers who turn to working in the second period. While the capital of the second group falls with increasing $\theta_1$, the capital of the first group increases. One explanation is the following. The agents that are always working know that the higher $\theta_1$, the larger part of their income will be taken away in the next period. In order to achieve consumption smoothing prescribed by the log utility, they invest a larger part of their income and consume less. Correspondingly, first-period worker consumption decreases with $\theta_1$. Quite the opposite is true for the rent-seekers who turn into workers. The higher $\theta_1$, the more they have captured in the first period and at the same time, the more they will have taken away from them in the second period. Therefore, they consume more in period 1 and leave less for looting in period 2. Although such a behavior of workers might seem completely counter-intuitive and artificial at first glance, it follows from the properties of the utility function, which does not include leisure.

The ratio $K^p/Y_1$ which proxies total productive investment as a share of GDP (for period 1) is increasing with $\theta_1$: countries with worse institutions tend to have a higher investment/GDP ratios. However, the amount of rent-seeking capital is increasing in $\theta_1$ as well, faster than the productive one, hence its share $K_r/(K^p+K_r)$ is rising.

4.9.2 Initial capital

The results concerning the amount of initial capital per worker are less intuitive (see Table 4.5). The measure of rent-seekers depends positively on $k_0$. The larger the capital of the rent-seekers, the more attractive is rent-seeking as compared to working (due to the decreasing returns on capital in production). True, when more agents choose rent-seeking, the wage and interest rise due to the more scarce productive factors, but on the other hand, the increased transfer $T$ outweighs the effect of higher salary and interest.

<table>
<thead>
<tr>
<th>Variables / value of $\theta_1$</th>
<th>1.3</th>
<th>1.5 (benchmark)</th>
<th>1.7</th>
<th>1.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_2$</td>
<td>0.955</td>
<td>0.917</td>
<td>0.891</td>
<td>0.870</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.589</td>
<td>0.759</td>
<td>0.936</td>
<td>1.117</td>
</tr>
<tr>
<td>$ID$</td>
<td>3.332</td>
<td>5.126</td>
<td>7.693</td>
<td>11.471</td>
</tr>
<tr>
<td>$Y_2$</td>
<td>0.921</td>
<td>0.898</td>
<td>0.889</td>
<td>0.888</td>
</tr>
<tr>
<td>$O$</td>
<td>0.022</td>
<td>0.013</td>
<td>0.009</td>
<td>0.006</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>0.189</td>
<td>0.159</td>
<td>0.136</td>
<td>0.117</td>
</tr>
<tr>
<td>$T_2/Y_2$</td>
<td>0.107</td>
<td>0.195</td>
<td>0.298</td>
<td>0.414</td>
</tr>
<tr>
<td>$K^p$</td>
<td>0.317</td>
<td>0.316</td>
<td>0.322</td>
<td>0.333</td>
</tr>
<tr>
<td>$K^r$</td>
<td>0.023</td>
<td>0.040</td>
<td>0.049</td>
<td>0.054</td>
</tr>
</tbody>
</table>
The higher \( k_0 \), the higher also \( \theta_2 \) and the income difference \( ID \). Total output \( Y \) and the productive investment \( K^p \) increase with \( k_0 \), quite intuitively. However, rent-seeking capital also increases with \( k_0 \), both absolutely and relatively to \( K^p \). The second loss (resources spent for political influence \( O \)) and the reform setback \( \varepsilon \) also increases with \( k_0 \). The fact that political contribution increases with the amount of capital per worker means the "richer" countries (in terms of higher initial capital) tend to be more prone to rent-seeking and also complies with the finding of Harstad and Svensson (2008) model that richer countries tend to have more lobbying than poorer ones. They are also characterized by larger resource loss and larger inequality. In fact, this finding might be related to the literature on the resource curse and the quality of institutions, e.g. Mehlum et al. 2006 - countries that are rich in natural resources tend to have high income if institutions are good and low income if institutions are poor, due to the intensive rent-seeking. In our sample, the resource-rich countries like Russia and Azerbaijan, are also among the countries exhibiting the highest inequality.

### 4.9.3 Total factor productivity

Higher total factor productivity in the productive sector, by increasing the relative attractiveness of working, leads to a higher share of workers, lower \( T \) and lower income difference (see Table 4.6).

We can also link total factor productivity, at least in the initial phase, with the level of distortions like over-industrialization under communism, which have a negative effect on transition performance and more specifically output level and growth (de Melo, 1997). If we assume that the presence of initial distortions implies a lower long-run value of total factor productivity \( A \), then our model is also in line with the fact that countries with
4.9. COMPARATIVE STATICs

Table 4.5: Comparative statics for varying initial capital

<table>
<thead>
<tr>
<th>Variables / value of $k_0$</th>
<th>0.26 (benchmark)</th>
<th>0.4</th>
<th>0.6</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_2$</td>
<td>0.917</td>
<td>0.887</td>
<td>0.862</td>
<td>0.846</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.758</td>
<td>0.789</td>
<td>0.816</td>
<td>0.826</td>
</tr>
<tr>
<td>$I/Y_2$</td>
<td>0.898</td>
<td>0.985</td>
<td>1.088</td>
<td>1.174</td>
</tr>
<tr>
<td>$T_2/Y_2$</td>
<td>0.195</td>
<td>0.324</td>
<td>0.486</td>
<td>0.627</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>0.16</td>
<td>0.19</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>$K^p$</td>
<td>0.316</td>
<td>0.418</td>
<td>0.559</td>
<td>0.697</td>
</tr>
<tr>
<td>$I/Y_1$</td>
<td>0.406</td>
<td>0.467</td>
<td>0.543</td>
<td>0.611</td>
</tr>
<tr>
<td>$K^r$</td>
<td>0.040</td>
<td>0.066</td>
<td>0.095</td>
<td>0.119</td>
</tr>
<tr>
<td>$K^r/(K^p + K^r)$</td>
<td>0.065</td>
<td>0.098</td>
<td>0.129</td>
<td>0.150</td>
</tr>
</tbody>
</table>

Table 4.6: Comparative statics with varying values of A

<table>
<thead>
<tr>
<th>Variables / value of $A$</th>
<th>1.1</th>
<th>1.3</th>
<th>1.5 (benchmark)</th>
<th>1.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_2$</td>
<td>0.890</td>
<td>0.904</td>
<td>0.917</td>
<td>0.930</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.731</td>
<td>0.746</td>
<td>0.7589</td>
<td>0.770</td>
</tr>
<tr>
<td>$I/Y_2$</td>
<td>8.097</td>
<td>6.287</td>
<td>5.126</td>
<td>4.317</td>
</tr>
<tr>
<td>$I/Y_1$</td>
<td>0.601</td>
<td>0.745</td>
<td>0.898</td>
<td>1.061</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>0.009</td>
<td>0.011</td>
<td>0.013</td>
<td>0.015</td>
</tr>
<tr>
<td>$T_2/Y_2$</td>
<td>0.321</td>
<td>0.249</td>
<td>0.195</td>
<td>0.148</td>
</tr>
<tr>
<td>$K^p$</td>
<td>0.263</td>
<td>0.289</td>
<td>0.316</td>
<td>0.343</td>
</tr>
<tr>
<td>$I/Y_1$</td>
<td>0.478</td>
<td>0.437</td>
<td>0.406</td>
<td>0.382</td>
</tr>
<tr>
<td>$K^r$</td>
<td>0.041</td>
<td>0.041</td>
<td>0.040</td>
<td>0.037</td>
</tr>
</tbody>
</table>
relatively low levels of distortions have escaped the sharp output fall and large inequality increases. The investment as a share of GDP is decreasing in total factor productivity: when a unit of capital produces more, less units are needed to maintain a certain output level. The amount of rent-seeking investment decreases with $A$ as well, albeit rather slowly.

A non-intuitive result is that with higher $A$ the final institutional level is worse, i.e. $\theta_2$ is higher. This is the only case in comparative statics where we see $\theta_2$ and $\gamma_2$ move in the same direction. The reason is that increasing $A$ creates more workers, but the remaining rent-seekers can easily secure a larger individual transfer at no additional price (higher $A$ does not affect in any way the costs of political influence). Therefore, it is optimal for them to invest more in political influence, which brings them higher transfer in period 2. Indeed, we observe that although the total transfer $T_2$ decreases, the transfer per rent-seeker $\frac{T_2}{1+\theta_2}$ increases (not reported in the table), and the capital spent for political influence $O$ increases.

Therefore, we obtain the seemingly paradoxical result that countries with higher total factor productivity, once political influence is possible, will under equal conditions end up with worse institutions and higher spending on political influence, although they score better on the macroeconomic indicators such as output and inequality, and a larger share of agents choose working. Admittedly, this result is a product of the assumed production function for the rent seekers. However, it could actually describe well the cases of Bulgaria and Romania.

These countries have relatively good productivity levels in comparison to the transition sample average (including also CIS and the southeastern European states) and after recovering from the severe crises of 1997-98 for a number of years performed well in terms of growth and investment. However, both countries experience serious problems with institutional reform and are (particularly Bulgaria) burdened with persistent and broad corruption. Another conclusion we can draw is that an improvement in economic fundamentals (in this case productivity) without pressing on with the reforms on institutions can actually have an adverse effect on institutional quality and increase redistribution from the workers towards the rent-seekers: the additional output only increases the basis for their rents. It is straightforward to draw a parallel with recent developments in Bulgaria.

### 4.9.4 Costs of political influence

Intuitively, the measure of rent-seekers $1 - \gamma_2$ increases and $\theta_2$ decreases with lowering cost of political influence $B$. (We demonstrated analytically that under sufficiently high costs of political influence the endogenous model reduces to the exogenous one). Numerically, if we allow $B$ to vary from 0.4 to 4, the effect varies from a large setback $\varepsilon = 5.5$ (very small institutional advance) to $\theta_2$ being very close to the no-political-influence value $\hat{\theta}$. Recall that $\varepsilon$ is the difference between the real final institutional level $\theta_2$ and the targeted one $\hat{\theta}$.

In equilibrium, spending on political influence $O$ decreases with $B$, i.e. the substitution effect (retreating from political influence) dominates the income effect (increased expenditure due to increasing price $B$ for the state capturers). In fact, the two types of
4.9. COMPARATIVE STATICS

Table 4.7: Comparative statics with varying costs of political influence $B$

<table>
<thead>
<tr>
<th>Variables / value of $B$</th>
<th>0.4</th>
<th>0.8 (benchmark)</th>
<th>1.0</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_2$</td>
<td>0.904</td>
<td>0.917</td>
<td>0.921</td>
<td>0.930</td>
<td>0.934</td>
<td>0.936</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.865</td>
<td>0.759</td>
<td>0.733</td>
<td>0.674</td>
<td>0.651</td>
<td>0.641</td>
</tr>
<tr>
<td>$ID$</td>
<td>5.974</td>
<td>5.126</td>
<td>4.930</td>
<td>4.495</td>
<td>4.336</td>
<td>4.252</td>
</tr>
<tr>
<td>$Y$</td>
<td>0.892</td>
<td>0.898</td>
<td>0.900</td>
<td>0.906</td>
<td>0.909</td>
<td>0.910</td>
</tr>
<tr>
<td>$O$</td>
<td>0.019</td>
<td>0.013</td>
<td>0.012</td>
<td>0.007</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>0.256</td>
<td>0.159</td>
<td>0.133</td>
<td>0.074</td>
<td>0.052</td>
<td>0.041</td>
</tr>
<tr>
<td>$T_2/Y$</td>
<td>0.232</td>
<td>0.195</td>
<td>0.186</td>
<td>0.165</td>
<td>0.157</td>
<td>0.154</td>
</tr>
<tr>
<td>$K^p$</td>
<td>0.317</td>
<td>0.316</td>
<td>0.316</td>
<td>0.316</td>
<td>0.316</td>
<td>0.316</td>
</tr>
<tr>
<td>$K^r$</td>
<td>0.044</td>
<td>0.040</td>
<td>0.038</td>
<td>0.035</td>
<td>0.034</td>
<td>0.033</td>
</tr>
</tbody>
</table>

Figure 4.4: Productive investment $I$ as a function of the cost $B$.

resource loss (capital channeled into rent-seeking $K^r$ and capital used for political influence $O$) decrease with $B$. This in turn feeds into the increase in $Y$. The final income difference $ID$ decreases with $B$, which is consistent with the result of Rodriguez (2004) that lobbying tends to exacerbate initial inequality.

As can be seen from Figure 4.4, the dependence of productive investment $I$ as well as $I/Y$ on $B$ is nonlinear: it is decreasing sharply for very low levels of $B$ and increasing henceforth. The explanation is similar to the one in the case of $k_0$.

4.9.5 Reform step

The effect of changes in $\mu$ on most of our variables listed in Table 4.8 is as expected.

It is less straightforward that the expenditure on political influence $O$ and its result - the setback $\varepsilon$, are increasing fast with the reform step. Other things equal, the more
ambitious the reform step, the more intensively rent-seekers work to achieve a bigger setback since the cost of the political action is lower than the damage they would suffer from the full step realization. The investment-output ratio \( I/Y \) has again a U-shaped dynamics, so that it falls for very small reform steps and increases after the step passes a threshold.

### 4.9.6 Explanation of the stylized facts

The combined comparative statics results for \( \theta \), the costs \( B \) and the feasible reform step \( \mu \) also shed light on some of the stylized facts listed at the end of section 4.3: low-inequality countries comprise both very poor and advanced reformers. We saw already that the second-period income difference \( ID \) increases with \( \theta_2 \): less advanced reformers have more inequality. However, it still remains to be explained why there are also very poor reformers with low levels of inequality. This can be done if we take into account that countries in the transition sample differ in their political systems, which is reflected in differing costs of political influence \( B \) and feasible reform steps \( \mu \). In countries with authoritarian regimes the costs of political influence are high since the authoritarian power does not allow other political influences. This is reflected in a high value for \( B \), for instance \( B = 10 \). Plotting again the relation between inequality and institutions with this value of \( B \), we obtain much lower inequality levels than with our earlier levels. But it is also logical to assume that an authoritarian regime is associated with a small size of the feasible reform step \( \mu \), which explains why such countries have remained at low development levels. Indeed, countries like Belarus, Uzbekistan and Turkmenistan have not even started comprehensive economic and political reforms, and have both poor institutions and relatively low inequality. This result parallels the finding of Acemoglu and Robinson (2008) that a larger democratic advantage for the citizens may imply a stronger domination of politics by the elite. It reveals the drawbacks of a democratization process which is performed without the will or possibility for institutional reform.

By the same token it is also clear that the intermediate reformers are the countries that have the highest value of the state capture index (stylized fact (c)). We employ as proxy for state capture the size of the backlash, or the difference between planned and actual
4.10. CONCLUSIONS AND DISCUSSION

Table 4.9: Comparative statics with varying parameters lambda and S

<table>
<thead>
<tr>
<th>Variables / value of k0</th>
<th>$S = 4.2$, $\lambda = 0.2$ (benchmark)</th>
<th>$S = 6; \lambda = 0.1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_2$</td>
<td>0.917</td>
<td>0.914</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.759</td>
<td>0.741</td>
</tr>
<tr>
<td>$ID$</td>
<td>5.126</td>
<td>12.360</td>
</tr>
<tr>
<td>$Y_2$</td>
<td>0.898</td>
<td>0.911</td>
</tr>
<tr>
<td>$O$</td>
<td>0.013</td>
<td>0.011</td>
</tr>
<tr>
<td>$\epsilon$</td>
<td>0.159</td>
<td>0.141</td>
</tr>
<tr>
<td>$T_2/Y_2$</td>
<td>0.195</td>
<td>0.263</td>
</tr>
<tr>
<td>$K^p$</td>
<td>0.316</td>
<td>0.329</td>
</tr>
<tr>
<td>$K^r$</td>
<td>0.040</td>
<td>0.046</td>
</tr>
</tbody>
</table>

final institutional value. On one hand, countries that have relatively favourable initial conditions have worse conditions for political influence and the backlash is moderate. On the other hand, in authoritarian countries the feasible institutional reform step is limited, which also limits the possible backlash.

4.9.7 Rent-seeking ability S and the measure of potential rent-seekers

The parameters $\lambda$ and $S$ characterize rent-seeking, and we consider two possibilities here: (i) the number of rent-seekers is relatively large, but their rent-seeking ability is relatively small; (ii) the case where they are a small but powerful clique. The intuition behind the two scenarios is that there were more and less centralized communist countries, and in more centralized ones the circle of individuals with power over decision making and resource distribution was narrower, but the circle of influence - larger (for instance, the case where a high official was responsible for a whole industrial sector). We take our standard values of $\lambda = 0.2$ and $S = 4.2$ for the first scenario, and $\lambda = 0.1$ and $S = 6$ for the second one. Most variables, with the exception of the income difference and the size of the transfer, have very similar values in the two cases.

4.10 Conclusions and discussion

Our main research question was to investigate how economic variables like the level of capital per worker and TFP may affect institutions in a transition country undergoing institutional reform given that there is a possibility for political influence of vested interests. Our modelling approach embeds institutional reform in a general equilibrium model with capital and labour and models a two-way relationship. On one hand, the prevailing institutional level affects output and its redistribution by determining the relative returns to rent-seeking and producing. On the other hand, the institutional path itself is influenced by the income in the economy, the wealth of rent-seekers and their investment in political influence.

We have shown that under certain circumstances improvement in some economic variables may increase state capture and have a negative effect on institutions. This is the main value added from a full model with labour and capital taken as a background for
incorporating institutional reform, as compared to previous models from the literature that usually neglected capital.

The negative effects of rent-seeking are most pronounced in the case of changes in initial capital. Starting with higher capital, if political influence is feasible, the country ends up with worse institutions, higher income difference, and lower output, since higher capital increases the attractiveness of rent-seeking. We can extend this reasoning to include external financial help for a capture-prone country (for instance, the accession funds of the EU). As one of the prevalent forms of current rent-seeking is the looting of public funds from the budget, provision of such financial help to institutionally unreformed countries is equivalent to an increase in capital. Nominally, we have more productive capital per capita; however, since it is public money which can easily be looted through rent-seeking, it increases the amount extracted by rent-seekers and fuels their efforts to capture the state. This results in slowing institutional reform and the loss of the incentives of a part of the economic agents to proceed with it. Moreover, in the next period, the worse institutions also feed into worse economic characteristics due to more rent-seekers and larger looting.

Another parameter which can have certain negative influence is the total factor productivity, which is usually perceived as a positive factor increasing the growth prospects. In spite of its positive effect on output and income difference, if it is not accompanied by increasing the potential for reform, it can actually increase the degree of state capture, the setback achieved for rent-seekers and the share of capital devoted to political influence. Finally, even a more ambitious and determined reform agenda by the pro-reform forces, which is basically the only tool for moving out of the state capture trap, would usually fall short of the target, since the prospect of severe limiting of their activities mobilizes rent-seeking for more intensive resistance and the more ambitious the targeted reform, the lower are its chances to fully succeed.

In general, rent-seeking and political influence are mutually reinforcing: the possibility for state capture leads to more intensive rent-seeking and in turn, rent-seeking, by allowing rent-seekers to accumulate larger capital, enables more effective political influence. Also, once political influence and state capture are in place, they are likely to become persistent since in the first place, rent-seekers seek to destroy the tools for removal of rent-seeking. This was one of the key weaknesses in the initial reform program (the Washington consensus): not devoting sufficient attention to institution building. It was assumed that after the implementation of a reform package including liberalization and privatization, and after the economy has reached a certain level of income, the necessary institutions would develop automatically. Perhaps, the logic was that institutions are just a public good, which can be provided in better quality and quantity with a larger budget. Our results show that this is not necessarily the case and that under the feedback mechanisms institutions should be a first priority, since they determine economic performance and development over a long horizon.
CHAPTER 5

SUMMARY OF THE FINDINGS

In this chapter, we return briefly to the topics presented in the Introductory Chapter and summarize the findings of our research in each of them.

5.1 On growth determinants...

The first question we asked was what factors have determined the speed of economic growth in the transition countries? In the first phase, the factors which appear to influence growth are whether the country has participated in a war or armed conflict, what percent of its trade has been within the CMEA trading bloc under communism, whether the country has belonged to the former Soviet Union and how high its educational level is. It is well known that wars and armed conflicts have a detrimental influence on economic developments and lead to destruction of the country’s capital. As for education, other things being equal, countries with higher educational levels seem to have had somewhat milder recessions. This is also quite logical, since a better educated labour force could facilitate the process of redirection of factors towards new profitable sectors: better educated workers or technical specialists could easily become familiar with the new machines and technologies needed for the new production processes, and they tend to be in general more flexible and mobile across sectors or geographic areas. In contrast, poorly-educated agricultural workers would find it hard to find and cope with a new job if agricultural production in their area were stopped because of making losses.

In the second period, growth seems to be influenced by the amount of physical and human capital used in production, as predicted by neoclassical growth theory. Moreover, the quantitative measures of these effects are very close to those researchers have found for other country groups. Further, whether the country has belonged to the former Soviet Union or not continues to play a role. This probably captures unobservable factors like certain legacies or common traditions and informal institutions which have their roots in the communist period or even earlier. Finally, the more developed institutions the country has, the faster it grows. Under “institutions” here we understand a group of characteristics describing how corrupt the government is, if the legal framework is adequate and enforceable, how citizens perceive the work of public administration, and to what extent the country has economic and political freedom. This result has also been confirmed by many other researchers in the area, and is one of the main conclusions we can draw regarding growth in transition.

5.2 ...On international economic linkages...

What can our statistical data tell us about the effect of FDI and imports? We find that there is a positive influence both from capital goods imports and from FDI of multinational
enterprises on labour productivity, but in order to discover it, one has to look in a long-
run perspective. It means that the whole accumulated FDI stock (the stock of all the
investment that has entered the country for a period of several years) has a positive effect
on the level of productivity over that period. However, we do not find this relationship
if we relate the FDI received in one particular year to the growth in productivity in the
same or the following year. This FDI stock contains foreign knowledge and expertise
which has been accumulated for many years and reflects fully the knowledge wealth of the
source country. In turn, the effect of this new knowledge is not limited to one particular
period but continues to have an effect on productivity over a higher horizon, possibly by
triggering further improvements in other sectors.

Moreover, it matters where FDI comes from and which sector it is directed to. It
seems that the foreign investment directed to the manufacturing sector has a larger pos-
itive effect on overall productivity than that in the rest of the economy (which consists
mostly of services). Probably, this can be explained by the fact that the products of man-
ufacturing industry are often used as inputs in further industries and sectors. Therefore,
the advantages in efficiency gained through the new technology and know-how are trans-
ferred into lower prices and better quality for these intermediate products and this helps
the advantages spill over to many other industries and sectors. The source of FDI also
matters: FDI coming from technologically more advanced countries has a bigger positive
effect on labour productivity for the receiving country.

As far as the capital goods imports are concerned, we also observe a similar long-run
effect: the imported new machines and equipment over a period of several years, by trans-
mitting the technology incorporated in them, improve labour productivity. Again, this
effect does not work immediately and although we find also an instantaneous relationship
between the amount of import in a certain year and the change in labour productivity for
this year, it is weak. Similarly to the case with FDI, it matters where the new machines
come from: those imported from countries with a better technology show a higher effect
on productivity. This is a very intuitive result that has also been established earlier: the
larger the difference between the two countries in terms of technological levels, the larger
immediate improvement can be achieved immediately after importing goods containing
this superior technology.

To summarize, more intensive international trade and the inflow of foreign capital
from the advanced countries has indeed helped the economic recovery and development of
those transition countries that have become EU member states. Moreover, the long-run
nature of the effect suggests that these two international channels are indeed carriers of
foreign knowledge and technology. These EU countries have had a chance to establish
very intensive trade and economic relations with the highly developed EU countries. It
would be an interesting research question whether this effects is also present in the rest
of the transition countries, in particular those from the former Soviet Union.

5.3 ...and the role of institutions

What do we find as a result of our simple institutional model? First, we confirm that
the institutions matter for economic performance (income, inequality, investment etc.)
and we give one specific mechanism for this influence. If we are concerned about the level
of output, there are at least two channels. First, the worse institutions are, the larger the proportion of people who can rent-seek who will choose to rent-seek and not to work, therefore the capital and labour force they possess will be lost for production. Second, each individual rent-seeker can steal more from the workers, meaning that the productive capital left in the hands of the workers will also shrink, and less capital means smaller amount of production in the following period. Another intuitive result is that worse institutions lead to a higher income inequality (and this is also confirmed empirically), since in that case rent-seekers loot more and workers receive less. Also, once the institutions allow for the presence of intensive political influence, it is likely that it will persist since political influence naturally in the first place destroys the tools for its own removal.

However, there is also a less intuitive result. It was commonly believed in the beginning of transition that a more prosperous country would also improve its institutions faster. The logic was probably that institutional development is just a normal public good, which can be provided in better quantity and quality if a larger budget is available for it. It was also a concept underlying the famous Washington consensus in the beginning of transition – that the economic performance would improve by reforms like liberalization and privatization, which would pave the road for the emergence of the appropriate institutions. We show that, on the contrary, given that institutions are sufficiently bad initially, it is possible that a richer country ends up with worse institutions and lower chance for improving them than a poor one, since the rent-seekers have more to steal from, and this in turn enables them to invest more in preserving the possibilities for looting in future. Moreover, high expected future income provides them with an additional incentive for larger investment in the preservation of bad institutions. The expected large inflow from EU pre-accession and accession funds in Bulgaria may be one of the factors that contributed to blocking the institutional reform and reaching high levels of corruption and organized crime in the last several years. By a “richer country” we mean here not only a country that has a higher level of capital per worker, but also a country with more efficient production (possibly due to higher technological level), so that more can be produced with a given amount of inputs. Therefore, higher output not only does not mean better institutions, it can even imply the opposite if the starting position is bad enough.

5.3.1 What is left unexplained?

The results we have obtained show unambiguously that we are not able to explain the large cross-country differences only by considering general relationships. We also have to pay attention to idiosyncratic factors that cannot be systematized and captured easily in a stylized model. Rather, these factors can be best studied with the help of case studies on individual countries, taking into account country-specific historical circumstances.

There are also several directions in which the general analysis can be extended. For example, the political factor has received a very casual treatment in the current analysis, whereas the political systems and the political decision-making might play a role for the decisions taken. Moreover, the model could be extended towards a multi-period general equilibrium model including stochastic shocks.

Being aware of the forces that played a role during transition and their consequences
would ensure better understanding of the future developments or possible weak points in these countries. Also, some more general conclusions can be drawn regarding economic reform in general and some of its aspects that require particular attention.
A. A short review of the cross-sectional spatial econometric models

This appendix discusses some technical details used in chapter 2 and is based on Anselin (1988). There are two broad groups of spatial effects: spatial dependence and spatial heterogeneity. Spatial dependence can take the form of a spatial lag or a spatial error, while spatial heterogeneity can occur in the form of heteroskedastic error or coefficient variation.

A.1. Basic spatial dependence models

The spatial error model includes a spatially correlated error term and is characterized by the following equations:

\[ Y = X\beta + \varepsilon \]

where

\[ \varepsilon = \lambda W_2 \varepsilon + \mu \]
\[ \mu \sim N(0, \sigma^2) \]

Here \( W_2 \) is a spatial weighting matrix. In this case, the spatial effect affects the residuals, which might be correlated due to unobserved factors or random shocks which affect not only one country, but also other countries. If the spatial error autocorrelation is ignored, the OLS estimates, although not biased, will be inefficient (Anselin, 1992).

The spatial lag model corresponds to the presence of a spatially lagged dependent variable:

\[ y = \rho W_1 y + X\beta + \varepsilon \]
\[ \varepsilon \sim N(0, \sigma^2) \]

\( W_1 \) is again a spatial weighting matrix.

In fact, these two main models are related. The spatial error model is a nested model in the so-called spatial Durbin model, including a spatial lag and (possibly) spatially lagged explanatory variables (Mur and Angulo, 2005). The unconstrained form of this model is:

\[ y = \rho Wy + X\beta + WX\eta + \varepsilon \]

This reduces to a spatial error model if the following non-linear restriction on the coefficients holds:
\[ \rho \beta = -\eta \]

This restriction is tested by the test of the *Common factor hypothesis* in the spatial error setting. The null hypothesis is that the above restriction is fulfilled; then a simple spatial error model can be estimated instead of the spatial Durbin model. The alternative hypothesis is a model including a spatial lag \( \text{Wy} \) and spatially lagged variables \( \text{WX} \); if the null is rejected they cannot be omitted from the specification.

If the spatial autocorrelation in the dependent variable is ignored, the OLS estimates will be biased and correspondingly the inference from them incorrect (Anselin, 1992).

A.2. Estimation methods

In the spatial lag and spatial error models, the spatial autoregressive parameters (\( \rho \) and \( \lambda \)) have to be estimated together with the parameters of the regression \( \beta \) and \( \sigma^2 \). SpaceStat estimates both models through maximum likelihood and a nonlinear optimization procedure, which relies on the assumption of normal errors. Initially the regression parameters \( \beta \) and \( \sigma^2 \) can be expressed as functions of the autoregressive parameter \( \lambda \); after their substitution in the likelihood function the so-called concentrated likelihood is obtained, which depends only on \( \lambda \). The concentrated likelihood is then maximized through a bisection search between the two threshold values, \( 1/w_{\text{min}} \) and \( 1/w_{\text{max}} \), which are correspondingly the largest and the smallest eigenvector of the weighting matrix. The spatial lag model is estimated in a similar way – the regression parameters are expressed as functions of the autocorrelation parameter \( \rho \); then they are substituted to obtain the concentrated likelihood and it is maximized between the same two boundary values (Anselin, 1992).

Apart from the estimation with maximum likelihood, the spatial error model can also be estimated in SpaceStat with moment conditions. The estimation method is based on Kelejian and Prucha (1999) (Anselin, 1999): If \( u \) is an i.i.d. error vector, we have the following system of equations:

\[
\begin{align*}
E \left[ \frac{u'u}{N} \right] &= \sigma^2 \\
E \left[ \frac{u'W'Wu}{N} \right] &= \sigma^2 \left( \frac{1}{N} \right) \text{tr} (W'W) \\
E \left[ \frac{u'Wu}{N} \right] &= 0
\end{align*}
\]

Replacing above \( u \) with \( e - \lambda We \), where \( e \) is a vector of OLS residuals, we obtain a system of three equations in \( \lambda, \lambda^2 \) and \( \sigma^2 \) (Anselin, 1999).

A.3. Spatial dependence tests

The spatial tests used in this work are the following\(^1\):

\(^1\)For a detailed discussion and the formulas of these test statistics, see Anselin (1988).
1. Moran’s I – statistic. In matrix form the test statistic is given by

\[ I = \frac{N e'W e}{S_0} \]

where \( e \) is a vector of OLS residuals, and \( S_0 = \sum_i \sum_j w_{ij} \) is a standardization factor, equal to the sum of the weights of the non-zero cross products, and \( w_{ij} \) are the elements of a spatial weighting matrix \( W \) (Anselin, 1988).

A positive and significant z-value of that test indicates positive spatial autocorrelation; a negative and significant z-value means negative spatial autocorrelation. The test provides little information about the precise nature of the spatial effect because the alternative hypothesis is very general – it can be spatial residual autocorrelation or spatially lagged variable, heteroskedasticity or non-normality of the errors.

2. The Lagrange Multiplier error test – an asymptotic test for the presence of spatial residual autocorrelation, also called the LM-ERR test (Anselin and Florax, 1995). It is \( \chi^2(1) \)-distributed and depends crucially on the normality of the errors.

3. Kelejian and Robinson test for spatial lag or spatial error, which is specification-robust and does not depend on the normality of the errors; however, it is a large sample test with low power in small samples (Anselin, 1992).

4. Lagrange Multiplier test for spatial lag, asymptotic and dependent on the normality of the errors. Similarly to the other Lagrange Multiplier error test, it is also \( \chi^2(1) \)-distributed.

5. Test for a spatial autoregressive (SARMA) specification, or presence of both spatial lag and spatial error. It is an F-test for the joint significance of the spatial error coefficient \( \lambda \) and the spatial lag coefficient \( \rho \).

A.4. Spatial heterogeneity models

1. The second type of spatial effect is spatial heterogeneity (Anselin, 1988). It can take two forms: varying coefficients or heteroskedasticity in the error terms. These effects can be formalized correspondingly by switching regimes, random coefficient variation or suggesting a functional relationship for the heteroskedasticity in the error terms.

For the heteroskedastic error model we have

\[ \varepsilon \sim N(0, \Omega) \]

where the diagonal elements of the error covariance matrix have the form

\[ \Omega_{ii} = h_i(z\alpha) \]

In the case of varying slope parameters the variation can be systematically determined through a limited number of “spatial regimes”. The benchmark for distinguishing the
regimes can be determined on the basis of economic theory or analysis of the data itself. In the case with two spatial regimes the model is described by the equation:

\[
\begin{bmatrix}
y_i \\
y_j
\end{bmatrix} = 
\begin{bmatrix}
X_i & 0 \\
0 & X_j
\end{bmatrix}
\begin{bmatrix}
\beta_i \\
\beta_j
\end{bmatrix} + 
\begin{bmatrix}
\mu_i \\
\mu_j
\end{bmatrix}
\]

Provided there is no spatial dependence, this model can be estimated as ordinary OLS regression. However, simultaneous appearance of spatial dependence and spatial heterogeneity is possible; in this case, the model has to be estimated with maximum likelihood and the corresponding spatial effect – taken into account. Anselin (1988) demonstrates that ignoring the spatial dependence and estimating through a usual OLS procedure can invalidate OLS inference. Depending on the omitted spatial effect we would need to estimate correspondingly, a combined spatial lag – spatial regime model or spatial error – spatial regime model. (Anselin, 1992).

Since in cross-sectional samples spatial heterogeneity might be observationally equivalent to spatial dependence (Abreu et al. 2005), it is necessary to test for the latter as an alternative of the spatial dependence models. In this chapter this is done through two “switching” regimes, i.e. dividing the countries into two groups and assuming variation in all regression coefficients between them. The first division criterion chosen is whether the country belonged to FSU since the sharp difference between Central and Eastern Europe and the CIS countries in terms of economic performance is well documented in the literature (e.g. Campos and Coricelli, 2002). The second criterion is whether the country is an accession country to the EU or not. Although the estimated coefficients differ between the two regimes, the tests for the stability of coefficients show that this difference is not statistically significant. We can conclude that in our case spatial dependence is more relevant than spatial heterogeneity.

A.5. Spatial weighting matrices

The general form of a spatial weighting matrix is the following:

\[
W = \begin{bmatrix}
0 & a_{12} & \ldots & a_{1n} \\
a_{21} & 0 & \ldots & a_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
a_{n1} & \ldots & \ldots & 0
\end{bmatrix}
\]

1. In the case of a binary contiguity matrix with row-standardized weights, the element

\[
a_{ij} = \frac{d_{ij}}{\sum d_{ij}}
\]

(a) where \(d_{ij} = 1\) if countries i and j share a common border \(d_{ij} = 0\) otherwise.

where \(d_{ij}\) is the distance between the capitals of countries i and j;

<sup>2</sup>FSU dummies explain substantial part of the variance for instance in Ashlund, Boone, and Johnson (1996); Havrylyshyn (2001); Cornia and Popov (1998).
(b) For the inverse distance matrix

\[ a_{ij} = \frac{1000}{d_{ij}} \]

where \( d_{ij} \) is the distance between the capitals of the countries i and j.

(c) For the inverse distance matrix with cutoff point

\[ a_{ij} = \begin{cases} 
\frac{1000}{d_{ij}} & \text{if } d_{ij} < 1000 \\
0 & \text{if } d_{ij} \geq 1000 
\end{cases} \]

Here it is assumed that the dependence between the spatial units is present only with a distance of up to 1000 km and disappears with higher distances.

B. Extreme bounds analysis

Table 5.1 lists the results from the two steps of the extreme bounds analysis for the variables from the recession sub-period. At the first step, only the war dummy passes the robustness test of Sala-i-Martin (1997) (to show significance in 95% of the cases) Among the remaining variables, those most frequently significant are the schooling, inflation and investment variables and the FSU dummy. On the second step the war dummy is always included in the regressions (see the second part of Table 5.1), and the variables which remain significant most often are war, schooling, the FSU dummy, and CMEA. Here the reform variables are very fragile: although the 1st generation reforms coefficient has a predominantly positive coefficient, both variables perform quite poorly in terms of significance.

For the second period the average growth during the early period (lagged growth) is robustly correlated to current growth. It has a negative sign and is significant in all regressions (see table 5.2). It appears that countries, which have lost most in income during the recession, tend to grow the fastest during recovery, in particular some CIS countries. This finding is similar to the significance of lagged growth found in EBRD (2004) and Falcetti et al. (2005).

If the robust lagged growth is included as compulsory variable in the regressions (see the last two columns of Table 5.2), the only variables which remain significant at least in some regressions are the schooling and investment variables together with the FSU dummy. They render the inflation, reforms and institutional variables insignificant, which points at the superior explanatory power of factor inputs for that period.

Note: Due to the high correlations of the FSU dummy with the initial conditions and the logarithm of inflation, to avoid multicollinearity, the analysis is repeated without the dummy. The relative significance of the variables changes negligibly.

C. Data appendix

FDI flows and stocks

Data about FDI flows and stocks is taken from the 2007 edition of the WiiW database "WIIW database on Foreign Direct Investment in Central, Eastern and Southeast
### Table 5.1: Extreme bounds analysis for the recession period

<table>
<thead>
<tr>
<th>Variable</th>
<th>number of models</th>
<th>mean value</th>
<th>fraction of positive values</th>
<th>fraction of significant positive values</th>
<th>fraction of negative values</th>
<th>fraction of significant negative values</th>
<th>fraction of constant as obligatory variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2431</td>
<td>0.00</td>
<td>0.17</td>
<td>0</td>
<td>0.42</td>
<td>0</td>
<td>0.27</td>
</tr>
<tr>
<td>Initial income</td>
<td>1012</td>
<td>-0.00</td>
<td>0.25</td>
<td>0</td>
<td>0.05</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>WAR</td>
<td>1012</td>
<td>-0.08</td>
<td>0</td>
<td>0</td>
<td>0.99</td>
<td>0</td>
<td>0.98</td>
</tr>
<tr>
<td>Dummy FSU</td>
<td>1012</td>
<td>-0.04</td>
<td>0.12</td>
<td>0</td>
<td>0.30</td>
<td>0</td>
<td>0.40</td>
</tr>
<tr>
<td>Log inflation</td>
<td>1012</td>
<td>-0.69</td>
<td>0.17</td>
<td>0.02</td>
<td>0.33</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Investment</td>
<td>1012</td>
<td>0.20</td>
<td>0.98</td>
<td>0.34</td>
<td>0</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>1. gen reforms</td>
<td>1012</td>
<td>0.25</td>
<td>0.63</td>
<td>0.00</td>
<td>0.04</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>2. gen reforms</td>
<td>1012</td>
<td>-4.22</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0</td>
<td>0.01</td>
</tr>
<tr>
<td>Population growth</td>
<td>1012</td>
<td>0.27</td>
<td>0.69</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Secondary enrollment</td>
<td>1012</td>
<td>0.26</td>
<td>1</td>
<td>0.76</td>
<td>0</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>CMEA trade</td>
<td>1012</td>
<td>-0.12</td>
<td>0.09</td>
<td>0</td>
<td>0.212</td>
<td>0</td>
<td>0.41</td>
</tr>
<tr>
<td>Over-industrialization</td>
<td>1012</td>
<td>-0.07</td>
<td>0.08</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Years under communism</td>
<td>1012</td>
<td>-0.06</td>
<td>0.29</td>
<td>0</td>
<td>0.07</td>
<td>0</td>
<td>0.4</td>
</tr>
</tbody>
</table>

### Table 5.2: Extreme bounds analysis for the recovery period

<table>
<thead>
<tr>
<th>Variable</th>
<th>number of models</th>
<th>mean value</th>
<th>fraction of positive values</th>
<th>fraction of significant positive values</th>
<th>fraction of negative values</th>
<th>fraction of significant negative values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1012</td>
<td>-1.87</td>
<td>0.27</td>
<td>0.24</td>
<td>0.04</td>
<td>0.004</td>
</tr>
<tr>
<td>Lagged growth</td>
<td>1012</td>
<td>-0.29</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Log inflation</td>
<td>1012</td>
<td>-0.03</td>
<td>0.54</td>
<td>0</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>Investment</td>
<td>1012</td>
<td>0.09</td>
<td>1</td>
<td>0.06</td>
<td>0</td>
<td>0.11</td>
</tr>
<tr>
<td>Enrolment</td>
<td>1012</td>
<td>0.05</td>
<td>1</td>
<td>0.20</td>
<td>0</td>
<td>0.32</td>
</tr>
<tr>
<td>Population change</td>
<td>1012</td>
<td>0.19</td>
<td>0.25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>War dummy</td>
<td>1012</td>
<td>-1.25</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1. gen reforms</td>
<td>1012</td>
<td>0.14</td>
<td>0.77</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. gen reforms</td>
<td>1012</td>
<td>0.19</td>
<td>0.12</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dummy FSU</td>
<td>1012</td>
<td>0.96</td>
<td>1</td>
<td>0.46</td>
<td>0</td>
<td>0.10</td>
</tr>
<tr>
<td>Income in 1994</td>
<td>1012</td>
<td>0.0001</td>
<td>0.81</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Institutions</td>
<td>1012</td>
<td>-0.06</td>
<td>0.41</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Europe". The main source of the data are the national banks of the corresponding countries. The statistics in the balance of payments are collected in the standardized way described in the Balance of Payments Manual by IMF. There, capital investment abroad is regarded as foreign direct investment if the purpose is to establish and maintain permanent relations with a foreign company (the share of the foreign investor must make up at least 10% of the target firm’s equity capital).

Data about FDI flows stems from the Financial account in the balance of payment, and comprises three items: equity capital, other capital, and reinvested earnings. The yearly figures represent net values, a net difference between the increases and decreases in foreign direct investment. An increase in the foreign direct investment in the host country can result from the acquisition of equities and shares in capital, from receipt of principal of a loan or from reinvested profit. Correspondingly, a decrease can be the result of disposal of equities and shares, repayment of loans, and the non-residents share in the loss of the company.

Data about FDI stocks comes from the international investment positions, also compiled by the National banks who rely on company surveys for obtaining this type of information. These data is available usually with one year delay, but national banks may calculate the stocks by aggregating flows. It is recorded each time in the end of the year and is measured in thousands of euro. Since data on both indicators is not available for all countries, in those cases where data on FDI flows is missing, we calculate it by subtracting the corresponding stocks, and vice versa - for those years where FDI stocks are not available we obtain them using the stocks for the available years and the FDI flows from the balance of payments.

In the cases of Slovenia and Poland, since the data series from the WiiW database are too short, we complement the dataset with national bank data for recent years (2005 and 2006). For Bulgaria, since the database does not contain data on Bulgarian FDI stocks, we complemented those with data from the Bulgarian National Bank, retrieved in Bulgarian leva and correspondingly converted into euros with the fixed BNB exchange rate.

When using sectorally disaggregated FDI data, we differentiate between FDI to manufacturing and FDI to services. For Romania, since there is no separate data about FDI to manufacturing, we use FDI in total industry, including manufacturing, mining and quarrying and energy.

Bilateral FDI data used to calculate the weighted foreign R&D are also from the WiiW database.

Imports of capital goods

The imports of capital goods are from the UN comtrade database, which contains data about bilateral trade between all countries, measured in dollars. In order to convert the quantities in euros, we use the nominal effective exchange rate reported by ECB.

Labour productivity

For measuring labour productivity, we use total real GDP in euro, and divide it by the total employment. For most countries, both output and employment are contained in
Eurostat data. An exception is Croatia, for which output data is taken from the AMECO database, and since it is expressed in national currency, we use the nominal effective exchange rate of ECB. Total employment for Croatia stems from the IMF IFS database.

Investment

Investment data are given by the gross capital formation series taken from the ESA database for all countries except Croatia, where we retrieve data from AMECO. Since Croatian investment data is expressed in domestic currency, we first convert it into euro using the ECB nominal effective exchange rate.

R&D stocks

Data about the R&D stocks is extracted from the Eurostat database. The database contains total (private and public) R&D expenditure as a percent of the GDP. From this series, we first obtain the absolute amounts of R&D expenditure by multiplying it with GDP, then we construct the R&D stocks by using the perpetual inventory method explained in detail in Coe and Helpman (1995): it assumes a constant rate of depreciation equal to 5% and obtains the initial value of the R&D stock by extrapolating the yearly R&D expenditures.

D. GMM estimation

The small sample size leads to a number of problems and modifications in our system GMM estimation. First, the number of GMM-type instruments tends to grow quadratically with the number of periods $T$, and therefore if we were to use the full number of instruments, it would require a panel with large number of groups $N$. When $N$ is small, the system easily becomes overidentified, with the number of instruments larger than the number of groups. Therefore, we face a trade-off: on one hand, we need a number of instruments equal to the number of regressors in order to be able to estimate the equation. On the other hand however, too large number of instruments leads to overidentification and two negative effects: the Hansen test for overidentifying restrictions becomes unreliable and the instruments fail to isolate the endogenous part of the variables. To avoid these effects, a known rule of thumb is that the number of instruments has to be kept lower than the number of groups (Roodman 2006). In order to meet this requirement, we have to keep the number of instruments low, but then the number of regressors also has to be kept small. For this reason, and in order not to lose degrees of freedom, we do not use time dummies in the short-run regressions; moreover, tests indicate their joint insignificance.

For reducing the instrument count, we use two options in system GMM estimation incorporated by Roodman (2006) into the STATA routine xtabond2: “collapsing” of the instrument matrix and imposing a lag limit for the instruments. The “collapsed” form of the instrument matrix reduces the number of instruments by including only one instrument per time period, while still using the complete information available from all

\footnote{For a comprehensive and detailed discussion on the pitfalls of system-GMM in panel data like overidentification or violation of the additional moment conditions, see Roodman (2006) and Roodman (2007).}
time lags. The second strategy is to limit the lags used to the most recent ones. We dispose of the higher-order lags as instruments, since they are likely to be weak instruments: with increasing the lag order the quality of the instrument decreases (Acharya and Keller, 2007). The maximal lag length used in our GMM regressions was usually 2 or 3.

The decision whether to use the system or difference GMM methods took into account one caveat of the system GMM, namely that it exploits an additional moment condition introduced by Blundell and Bond (1998), which is a non-trivial one:

\[ \Delta [E y_{i,t-1} \varepsilon_{it}] = 0 \]

Roodman (2006) demonstrates that this moment condition is equivalent to the following restriction:

\[ E \left[ (y_{i1} - \frac{\mu_i}{1-\alpha}) \mu_i \right] = 0 \]

The interpretation of the last condition is that the initial deviations of the countries from the steady state are not correlated with the country fixed effects. In other words, the additional condition requires that the units have achieved steady state before the study period (Roodman, 2006). However, it is easy to see that this might be violated in our case. For instance, the country fixed effects might easily capture unobserved transition-specific factors like institutions, policy of reform and advance in restructuring. In the beginning of our sample, some countries (e.g. Bulgaria and Romania) were starting to recover from severe economic crises and were therefore supposedly far from steady state. Moreover, the crises are to a large extent attributable exactly to ill-designed policy and lack of real reform, which would be also reflected in the country’s fixed effects.

Therefore, in all cases we ran a full set of diagnostic tests for the validity of instruments. In cases where the test statistics of the system GMM were significant (e.g. significant Sargan test of overidentifying restrictions or difference-Sargan tests), we had to consider the possibility that the additional moment condition might be violated. In these cases, we estimated the regressions with the difference-GMM method, which does not use the additional moment condition, and it usually gave satisfactory values of the diagnostic tests.

E. Proofs of propositions.

Proof. (Proof of Proposition 1)

If we denote with \( k_{ii} \) the total capital available to a rent-seeker at the end of period 1, and with \( k_{0}^{(r)} \) and \( k_{1i}^{(r)} \) only the share of capital used in rent-seeking in periods 1 and 2, then the shares of capital used in producing are correspondingly \( k_0 - k_0^{(r)} \) and \( k_{1i} - k_{1i}^{(r)} \). Then the budget constraints are:

\[ c_{1i} + k_{1i} = k_0 \left( 1 - \delta \right) + \theta_1 s_i k_0^{(r)} + r_1 \left( k_0 - k_0^{(r)} \right) + w_1 \mathbb{1}_{k_0^{(r)} = 0}, \quad (E.1) \]

\[ c_{2i} = k_{1i} \left( 1 - \delta \right) + \theta_2 s_i k_{1i}^{(r)} + r_2 \left( k_{1i} - k_{1i}^{(r)} \right) + w_2 \mathbb{1}_{k_{1i}^{(r)} = 0}. \quad (E.2) \]
E. PROOFS OF PROPOSITIONS.

In the above constraints, we have substituted $\Pi_i$ the definition of the rent-seeking function from 4.4.

The decision in this case is more complicated than in the case of workers: the rent-seekers can choose $k^r_0$ and $k^r_1$ in addition to $k_1$, that results in the following FOCs:

\[
\begin{align*}
    k^r_0 : & \quad \frac{\theta_1 s - r_1}{c_1} \geq 0 \\
    k^r_1 : & \quad \beta \frac{\theta_2 s - r_2}{c_2} \geq 0 \\
    k_1 : & \quad \frac{1}{c_1} = \beta \frac{r_2 + 1 - \delta}{c_2}
\end{align*}
\]

The last condition is the Euler equation. We see that there is only one agent indifferent between working and rent-seeking, as the solution of the individual problem is at the corner, and each rent-seeker invests all her capital into one use. In a given period, any of the potential rent-seekers can either work or extract rent, depending on which of the two activities would generate more income for them. Therefore, if in a given period an agent chooses to rent-seek, we have $k^{(r)}_{1i} = k_{1i}$ and the budget constraints reduce to the ones given by..., and in case the agent works, then $k^{(r)}_{1i} = 0$ and the maximization problem is identical to that of a worker.

**Proof.** (Proof of Proposition 2) □

We can compute the consistency condition (4.26) for the first period to get

\[
\theta_1 k_0 \frac{S}{\lambda} \int_{\gamma_1}^1 (i + \lambda - 1) \, di = \gamma_1 T_1
\]

Now we can go back to the arbitrage condition (4.20) and see what it implies for $\gamma_1$:

\[
\begin{align*}
    \theta_1 k_0 \frac{\gamma_1 + \lambda - 1}{\lambda} S & = r_1 k_0 + w_1 - T_1 \\
    \gamma_1 & = \frac{r_1 k_0 + w_1 - T_1}{\theta_1 k_0 S} \lambda - \lambda + 1 \\
    \frac{\gamma_1}{\lambda} & = \frac{r_1 k_0 + w_1 - T_1}{\theta_1 k_0 S} - 1 + \frac{1}{\lambda} \\
    \frac{\gamma_1}{\lambda} & = \frac{\alpha A k_0^{\delta-1} k_0 + (1 - \alpha) A k_0^\alpha - T_1}{\theta_1 k_0 S} - 1 + \frac{1}{\lambda} \\
    \frac{\gamma_1}{\lambda} & = \frac{A k_0^\alpha - T_1}{\theta_1 k_0 S} - 1 + \frac{1}{\lambda}
\end{align*}
\]
Substituting (E.3) brings us to

\[
\begin{align*}
\frac{\gamma_1}{\lambda} &= \frac{Ak_0^\alpha - \theta_1 k_0 S \left(\frac{1+\gamma_1}{2\lambda} + 1 - \frac{1}{\lambda}\right) \frac{1-\gamma_1}{\gamma_1}}{\theta_1 k_0 S} - \left(1 - \frac{1}{\lambda}\right) \\
\frac{\gamma_1}{\lambda} &= \frac{A k_0^{\alpha-1}}{\theta_1 S} - \left(1 - \frac{1}{\lambda}\right) - \left(\frac{1+\gamma_1}{2\lambda} + 1 - \frac{1}{\lambda}\right) \frac{1-\gamma_1}{\gamma_1} \\
x &= \frac{A k_0^{\alpha-1}}{\theta_1 S} \\
\frac{\gamma_1}{\lambda} &= x - \left(1 - \frac{1}{\lambda}\right) \left(1 + \frac{1-\gamma_1}{\gamma_1}\right) - \frac{1+\gamma_1}{2\lambda} \frac{1-\gamma_1}{\gamma_1} \\
\gamma_1 &= x \lambda - (\lambda - 1) \frac{1}{\gamma_1} - \frac{1+\gamma_1}{2} \frac{1-\gamma_1}{\gamma_1} \\
\gamma_1^2 &= x \lambda \gamma_1 - (\lambda - 1) - \frac{1-\gamma_1^2}{2} \\
\frac{1}{2} \gamma_1^2 &= x \lambda \gamma_1 - \lambda + \frac{1}{2}
\end{align*}
\]

The two solutions of this quadratic equation are: \(x\lambda - \sqrt{x^2 \lambda^2 - 2\lambda + 1}\) and \(x\lambda + \sqrt{x^2 \lambda^2 - 2\lambda + 1}\)

We have a natural restriction:

\[
1 - \lambda < \gamma_1 < 1, \lambda < \frac{1}{2}
\] (E.4)

The first root is negative, so only the second root remains relevant:

\[
\gamma_1 = x\lambda + \sqrt{x^2 \lambda^2 - 2\lambda + 1}
\]

It can also be checked whether it satisfies (E.4):

\[
\begin{align*}
1 - \lambda &< x\lambda + \sqrt{x^2 \lambda^2 - 2\lambda + 1} < 1, \lambda < \frac{1}{2} \\
1 - \lambda - x\lambda &< \sqrt{x^2 \lambda^2 - 2\lambda + 1} < 1 - x\lambda \\
1 - x\lambda &> 0 \rightarrow x < \frac{1}{\lambda} \\
x^2 \lambda^2 - 2\lambda + 1 &< 1 - 2x\lambda + x^2 \lambda^2 \\
1 - 2\lambda &< 1 - 2x\lambda \\
x &< 1
\end{align*}
\]

This is an intuitive result: for an interior solution we need rent-seeking to be more attractive than working for the most able rent-seeker, otherwise everyone works. The other
Condition is

\[
1 - \lambda - x\lambda < \sqrt{x^2\lambda^2 - 2\lambda + 1} \\
1 - 2\lambda - 2x\lambda + 2x\lambda^2 + \lambda^2 < -2\lambda + 1 \\
-2x\lambda + 2x\lambda^2 + \lambda^2 < 0 \\
\lambda < 2x(1 - \lambda) \\
x > \frac{1}{2} \frac{\lambda}{1 - \lambda}
\]

This condition states that the least able rent seeker always prefers work.

Thus, for the first period all the variables are computable analytically and can be summarized in the following:

\[
\begin{align*}
    r_1 &= \alpha A k_0^{\alpha - 1} \\
    w_1 &= (1 - \alpha) A k_0^\alpha \\
    \gamma_1 &= x\lambda + \sqrt{x^2\lambda^2 - 2\lambda + 1}, \text{ where } x := \frac{A k_0^{\alpha - 1}}{\theta_1 S} \\
    T_1 &= \theta_1 k_0 S \left( \frac{1 + \gamma_1}{2\lambda} + 1 - \frac{1}{\lambda} \right) \frac{1 - \gamma_1}{\gamma_1} \\
    \frac{1}{2} \frac{\lambda}{1 - \lambda} &< \frac{A k_0^{\alpha - 1}}{\theta_1 S} < 1
\end{align*}
\]

**Proof.** (Proof of proposition 3) ■
For the second period the system is different from the first one.

\[
\theta_2 \frac{S}{\lambda} \int_{\gamma_2}^{1} (i + \lambda - 1) k_1 d{i} = \gamma_2 T_2;
\]

\[
\theta_2 \frac{S}{\lambda} \left( \int_{\gamma_1}^{\gamma_2} (i + \lambda - 1) \left( \frac{\beta}{1+\beta} (1 + \theta_1 s_i) k_0 - \frac{1}{1+\beta} \frac{W_2}{R_2} \right) d{i} + \right.
\]

\[
+ \int_{\gamma_2}^{1} (i + \lambda - 1) \frac{\beta}{1+\beta} k_0 (1 + \theta_1 s_i) d{i}
\]

\[
= \gamma_2 T_2,
\]

\[
\theta_2 \frac{S}{\lambda} \int_{\gamma_2}^{1} (i + \lambda - 1) \frac{\beta}{1+\beta} k_0 (1 + \theta_1 s_i) d{i} = \gamma_2 T_2 \quad \gamma_1 \geq \gamma_2;
\]

\[
\theta_2 \frac{S}{\lambda} \left( -\frac{W_2}{R_2} \int_{\gamma_1}^{\gamma_2} (i + \lambda - 1) d{i} + \beta k_0 \int_{\gamma_1}^{1} (i + \lambda - 1) (1 + \theta_1 s_i) d{i} \right) = \gamma_2 T_2, \quad \gamma_1 < \gamma_2;
\]

\[
\theta_2 \frac{S}{\lambda} \frac{\beta}{1+\beta} k_0 \left( \int_{\gamma_2}^{1} (i + \lambda - 1) (1 + \theta_1 s_i) d{i} = \gamma_2 T_2 \quad \gamma_1 \geq \gamma_2; \right.
\]

\[
\theta_2 \frac{S}{\lambda} \left( -\frac{W_2}{R_2} \left( \frac{\gamma_2^2 - \gamma_1^2}{2} + (\lambda - 1) (\gamma_2 - \gamma_1) \right) + \right.
\]

\[
+ \beta k_0 \int_{\gamma_1}^{1} (i + \lambda - 1) \left( \theta_1 \frac{s}{\lambda} (i + \lambda - 1) + 1 \right) d{i}
\]

\[
= \gamma_2 T_2,
\]

\[
\theta_2 \frac{S}{\lambda} \frac{\beta}{1+\beta} k_0 \left( \int_{\gamma_2}^{1} \left( \theta_1 \frac{s}{\lambda} (i + \lambda - 1)^2 + i + \lambda - 1 \right) d{i} = \gamma_2 T_2 \quad \gamma_1 \geq \gamma_2; \right.
\]

\[
\theta_2 \frac{S}{\lambda} \frac{1}{1+\beta} \left( \begin{array}{c}
\left( -\frac{W_2}{R_2} \left( \frac{\gamma_2^2 - \gamma_1^2}{2} + (\lambda - 1) (\gamma_2 - \gamma_1) \right) + \\
\beta k_0 \left( \theta_1 \frac{s}{\lambda} \left( (1 + \lambda - 1)^3 - (\gamma_1 + \lambda - 1)^3 \right) + \\
\right.
\left. + \frac{1}{2} - \gamma_2^2 + (\lambda - 1) (1 - \gamma_1) \right) \right) = \gamma_2 T_2, \quad \gamma_1 < \gamma_2;
\end{array} \right.
\]

\[
\theta_2 \frac{S}{\lambda} \frac{\beta}{1+\beta} k_0 \left( \theta_1 \frac{s}{\lambda} \left( (1 + \lambda - 1)^3 - (\gamma_1 + \lambda - 1)^3 \right) + \\
+ \frac{1}{2} - \gamma_2^2 + (\lambda - 1) (1 - \gamma_1) \right) = \gamma_2 T_2, \quad \gamma_1 \geq \gamma_2;
\]

\[
\theta_2 \frac{S}{\lambda} \left( \begin{array}{c}
\left( -\frac{W_2}{R_2} \left( \frac{\gamma_2^2 + \gamma_1^2}{2} + (\lambda - 1) (\gamma_2 - \gamma_1) \right) + \\
+ \beta k_0 \left( \theta_1 \frac{s}{\lambda} \left( \lambda^3 - (\gamma_1 + \lambda - 1)^3 \right) + \\
\right.
\left. + \frac{1}{2} - \gamma_2^2 + (\lambda - 1) (1 - \gamma_1) \right) = \gamma_2 T_2, \quad \gamma_1 < \gamma_2;
\end{array} \right.
\]

In this way we have implicitly expressed \( T_2 \) from other variables, and obtained a
constraint on the rent seeking.

It proves useful in the following to express the capital of the agent who is indifferent between rent-seeking and working in the second period as:

\[
k_{r_2} = \begin{cases} \frac{\beta}{1+\beta} k_0 \left( 1 + \theta_1 \frac{s}{\lambda} (\gamma_2 - 1 + \lambda) \right), & \gamma_1 < \gamma_2; \\ \frac{1}{1+\beta} \left( \beta \left( R_1 k_0 + W_1 \right) - \frac{W_2}{R_2} \right), & \gamma_1 \geq \gamma_2. \end{cases}
\]

Then for the second period we have the following system of 4 equations with 4 unknowns \(\gamma_2, r_2, w_2, T_2\), (the last one is expressed above).

\[
K^{(s)}_1 = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}} \gamma_2, \quad \gamma_1 < \gamma_2;
\]

\[
\frac{\gamma_2}{1+\beta} \left( \beta \left( R_1 k_0 + W_1 \right) - \frac{W_2}{R_2} \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}} \gamma_2, \quad \gamma_1 \geq \gamma_2.
\]

\[
\gamma_2 = \left( \frac{(1 - \alpha) A}{w_2} \right)^{\frac{1}{\alpha-1}} \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}} \gamma_2, \quad \gamma_1 \geq \gamma_2.
\]

\[
\left( \theta_2 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) - r_2 \right) k_{r_2} = W_2
\]

Here the first expression is the capital market equilibrium. The second is the labor market equilibrium, and the third is the arbitrage condition.

For the case when \(\gamma_1 < \gamma_2\) (we can derive the conditions under which this is true after solving the system) we get the following expression

\[
\frac{1}{1+\beta} \left( \frac{\gamma_1 \beta W_1 - \gamma_2 W_2}{w_2} \right) + \beta k_0 \left( \left( \theta_1 \frac{S}{\lambda} (\lambda - 1 + \gamma_2/2) + 1 \right) (\gamma_2 - \gamma_1) + \gamma_1 R_1 \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}} \gamma_2
\]

\[
\left( \frac{(1 - \alpha) A}{w_2} \right)^{\frac{1}{\alpha-1}} = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}} \gamma_2
\]

\[
\left( \theta_2 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) - r_2 \right) \beta \frac{1}{1+\beta} k_0 \left( 1 + \theta_1 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) \right) = w_2 - T_2
\]

\[
\theta_2 \frac{S}{\lambda} \frac{1}{1+\beta} \left( \frac{w_2 - T_2}{R_2} \right) \left( \theta_1 \frac{S}{3\lambda} (\lambda^3 - (\gamma_1 + \lambda - 1)^3) + \left( \frac{1+\gamma_1}{2} + \lambda - 1 \right) (1 - \gamma_1) \right) = \gamma_2 T_2
\]

The resulting system has to be solved numerically. \(\gamma_2 = \frac{1+\gamma_1}{2}\)

For the opposite case, \(\gamma_1 \geq \gamma_2\) the system is

\[
\frac{1}{1+\beta} \left( \beta \left( R_1 k_0 + W_1 \right) - \frac{W_2}{R_2} \right) = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}}
\]

\[
\left( \frac{(1 - \alpha) A}{w_2} \right)^{\frac{1}{\alpha-1}} = \left( \frac{r_2}{\alpha A} \right)^{\frac{1}{\alpha-1}}
\]

\[
\left( \theta_2 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) - r_2 \right) \frac{1}{1+\beta} \left( \beta \left( R_1 k_0 + W_1 \right) - \frac{W_2}{R_2} \right) = W_2
\]

\[
\theta_2 \frac{S}{\lambda} \frac{1}{1+\beta} k_0 \left( \theta_1 \frac{S}{3\lambda} (\lambda^3 - (\gamma_1 + \lambda - 1)^3) + \left( \frac{1+\gamma_1}{2} + \lambda - 1 \right) (1 - \gamma_1) \right) = \gamma_2 T_2
\]
Here the last expression explicitly determines the size of rents.

**Proof.** (Proof of proposition 4)

The Euler equation is unchanged as compared to the exogenous case:

\[ k_{1i} = \frac{\beta}{1+\beta} k_0 (1 + \theta_1 s_i) . \]

From the first-order condition with respect to the contribution we get

\[
\frac{1}{c_1} = \beta \frac{\sqrt{\frac{\theta_1}{BO} s^\gamma k_0}}{c_2}
\]

\[
k_1 + \left( \hat{\theta} + \sqrt{\frac{\theta_1 O}{B}} \right) s^\gamma k_1 = \frac{1}{2} \beta \sqrt{\frac{\theta_1}{BO}} s^\gamma k_0 \left( k_0 + \theta_1 s^\gamma k_0 - k_1 - o^i \right)
\]

\[
1 + \left( \hat{\theta} + \sqrt{\frac{\theta_1 O}{B}} \right) s^\gamma = \frac{1}{2} \beta \sqrt{\frac{\theta_1}{BO}} s^\gamma \left( k_0 + \theta_1 s^\gamma k_0 - k_1 - o^i \right)
\]

\[
1 + \left( \hat{\theta} + \sqrt{\frac{\theta_1 O}{B}} \right) s^\gamma = \frac{1}{2} \beta \sqrt{\frac{\theta_1}{BO}} s^\gamma \left( k_0 + \theta_1 s^\gamma k_0 - \frac{\beta}{1+\beta} k_0 (1 + \theta_1 s^\gamma) - o^i \right)
\]

\[
\frac{1}{s^i} + \hat{\theta} + \sqrt{\frac{\theta_1 O}{B}} = \frac{1}{2} \beta \sqrt{\frac{\theta_1}{BO}} \left( \frac{1}{1+\beta} k_0 (1 + \theta_1 s^i) - o^i \right), s^i = \frac{S}{\lambda} (i - 1 + \lambda)
\]

\[
\left( \frac{1}{s^i} + \hat{\theta} \right) \sqrt{\frac{BO}{\theta_1}} + O = \frac{1}{2} \beta \left( \frac{1}{1+\beta} k_0 (1 + \theta_1 s^i) - o^i \right)
\]

Rewritten without radicals:

\[
\left( \frac{1}{s^i} + \hat{\theta} \right)^2 \frac{BO}{\theta_1} = \left( \frac{1}{2} \beta \left( \frac{1}{1+\beta} k_0 (1 + \theta_1 s^i) - o^i \right) \right)^2 - O \beta \left( \frac{1}{1+\beta} k_0 (1 + \theta_1 s^i) - o^i \right) + O^2
\]

For the indifferent rent-seeker the equation takes the following form:

\[
\left( \frac{1}{\frac{S}{\lambda} (\gamma_2 - 1 + \lambda)} + \hat{\theta} \right)^2 \frac{BO}{\theta_1} = \left( \frac{1}{2} \beta \left( \frac{1}{1+\beta} k_0 \left( 1 + \theta_1 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) \right) \right) \right)^2 - O \beta \left( \frac{1}{1+\beta} k_0 \left( 1 + \theta_1 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) \right) \right) + O^2
\]

which is a quadratic equation:

\[
AO^2 + DO + C = 0, \text{ where:}
\]

\[
A = 1
\]

\[
D = -\beta \left( \frac{1}{1+\beta} k_0 \left( 1 + \theta_1 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) \right) \right) - \left( \frac{1}{\frac{S}{\lambda} (\gamma_2 - 1 + \lambda)} + \hat{\theta} \right)^2 \frac{B}{\theta_1}
\]

\[
C = \left( \frac{1}{2} \beta \left( \frac{1}{1+\beta} k_0 \left( 1 + \theta_1 \frac{S}{\lambda} (\gamma_2 - 1 + \lambda) \right) \right) \right)^2
\]
and the solution is
\[ O = \frac{1}{2} \left(-D \pm \sqrt{D^2 - 4C}\right) \]

In order to understand which root is relevant, we use the budget constraint:

\[ o^i < k_0 + \theta_1 s^i k_0 - c_1 - k_1 \]
\[ o^i < k_0 + \theta_1 s^i k_0 - \frac{\beta}{1 + \beta} k_0 \left(1 + \theta_1 s^i\right) \]
\[ o^i < \frac{1}{1 + \beta} k_0 \left(1 + \theta_1 s^i\right) \]

Due to monotonicity we have that the contribution of the most able rent-seeker is the highest, so we can write
\[ O < \frac{1 - \gamma_2}{1 + \beta} k_0 \left(1 + \theta_1 S\right) \]

If we assume that \( O + D < 0 \), then the relevant root is \(-D - \sqrt{D^2 - 4C}\). The corresponding conditions for this inequality are as follows:

\[
O = \frac{1}{2} \left( \beta \left( \frac{1}{1 + \beta} k_0 \left(1 + \theta_1 \frac{S}{X} (\gamma - 1 + \lambda)\right) + \left(\frac{1}{\lambda (\gamma_2 - 1 + \lambda)} + \hat{\theta}^2 \frac{B}{\theta_1}\right) \right) \right)
\]

We introduce the following notation to simplify the above expression:

\[ x := \frac{S}{X} (\gamma_2 - 1 + \lambda), y := \frac{1}{1 + \beta} k_0, z := y (1 + \theta_1 x), X := \left(\frac{1}{x} + \hat{\theta}\right) \sqrt{B} \theta_1 \]

\[ O = \frac{1}{2} \left( \beta z + \left(\frac{1}{x} + \hat{\theta}\right) \frac{B}{\theta_1} \right) - \sqrt{\left( \beta z + \left(\frac{1}{x} + \hat{\theta}\right) \frac{B}{\theta_1} \right)^2 - \left(\beta z\right)^2} \]

\[ O = \frac{1}{2} \left( \beta z + \left(\frac{1}{x} + \hat{\theta}\right) \frac{B}{\theta_1} \right) - \sqrt{\left( \left(\frac{1}{x} + \hat{\theta}\right) \frac{B}{\theta_1} \right)^2 + 2 \beta z \left(\frac{1}{x} + \hat{\theta}\right) \frac{B}{\theta_1} \right)} \]

\[ O = \frac{1}{2} \left( \beta z + \frac{X}{x} - X \sqrt{X^2 + 2\beta z} \right) \]

Therefore, we obtain the solution numerically.
Once we know the total contribution, the individual can be found as a solution to another quadratic equation:

\[
\left(\frac{1}{s^i} + \hat{\theta}\right)^2 \frac{BO}{\theta_1} = \left(\frac{1}{2(1 + \beta)} k_0 (1 + \theta_1 s^i)\right)^2 - \frac{\beta}{1 + \beta} k_0 (1 + \theta_1 s^i) o + O^2
\]

In fact, the individual contribution only matters for the redistribution. **Proof.** of proposition 5

This can be demonstrated trivially using the expression \(\theta_2 (O) = \hat{\theta} + \sqrt{\frac{\theta_1 O}{B}}\). Given \(B \to \infty\), then we have \(\theta_2 (O) = \hat{\theta} = \theta_1 - \mu\). Since now rent-seekers can have no influence on the second period institutional value, it is optimal to set \(O = 0\). (In the comparative statics section, it is also demonstrated numerically that total contribution \(O\) decreases with increasing \(B\)). With these modifications, all equations of the model become identical to the exogenous model.

**F. Derivations for variables of interest in simulations**

We derive the expressions for the following two additional economic variables which are of interest: the difference in incomes and the period 2 total output.

**Income difference**

The income difference is given by the ratio:

\[
ID = \frac{Y_r}{Y_w}
\]

Here \(Y_r\) and \(Y_w\) are respectively the income from rent-seeking of the average rent-seeker (with \(i = \frac{1+\gamma^2}{2}\)) and the income from working.

\[
ID = \frac{s^{1+\gamma^2} \theta_2 k_1^f}{(r_2 k_1 + w_2 - T_2)}
\]

Using the expression for \(s_i\) given by its distribution

\[
s_i = \frac{(i - 1) S}{\lambda} + S
\]

we obtain

\[
ID = \frac{\left(\frac{(\gamma^2 - 1)S}{2\lambda} + S\right) \theta_2 k_1^f}{(r_2 k_1 + w_2 - T_2)}
\]
Total output

Another variable we trace is the second-period total output. In the first period, total second-period output is simple:

\[ Y_1 = A(\gamma_1k_0)^\alpha \gamma_1^{1-\alpha} = A\gamma_1(k_0)^\alpha \]

where \( k_w \) is the workers' capital. In the opposite case total second-period output is

\[ Y_2 = AK^\alpha L^{1-\alpha} \]

\[ Y_2 = A \left( \gamma_1k_{1w} + \int_{\gamma_1}^{\gamma_2} \frac{k_1 di}{\gamma_1} \right)^{\alpha} \gamma_2^{1-\alpha} \]

where \( k^{add} \) is the following integral (under \( k^i \) we have substituted the capital of those that are rent-seeking in period 1 and then working)

\[ k^{add} = \int_{\gamma_1}^{\gamma_2} \left( \frac{\beta}{1+\beta} \left( 1 + \frac{\theta_1 S}{\lambda} \right) k_0 - \frac{1}{1+\beta} \frac{W_2}{R_2} \right) di \]

\[ k^{add} = \int_{\gamma_1}^{\gamma_2} \left( \frac{\beta}{1+\beta} \left( 1 + \gamma_1 \left( \frac{(i-1)S}{\lambda} + S \right) \right) k_0 - \frac{1}{1+\beta} \frac{W_2}{R_2} \right) di \]

\[ = \frac{\beta k_0}{1+\beta} \int_{\gamma_1}^{\gamma_2} \left( 1 + \frac{\theta_1 S}{\lambda} - \frac{\theta_1 S}{\lambda} + \theta_1 S \right) di - \frac{1}{1+\beta} \frac{W_2}{R_2} \]

\[ = \frac{\beta k_0}{1+\beta} \left( \frac{\theta_1 S}{\lambda} (\gamma_2 - \gamma_1) + \left( 1 - \frac{\theta_1 S}{\lambda} + \theta_1 S \right) (\gamma_2 - \gamma_1) \right) - \frac{1}{1+\beta} \frac{W_2}{R_2} \]

Now we can substitute:

\[ Y_2 = A \left( \gamma_1k_{1w} + k^{add} \right)^\alpha \gamma_2^{1-\alpha} \]

Total productive investment

Total productive investment is given by the sum of the investment of workers and those period-1 rent-seekers that switch to working in period 2.
\[ K_1^p = k_{1w} \gamma_1 + \int_{\gamma_1}^{\gamma_2} k_{1i} di \]

\[ K_1^p = \left( \frac{\beta}{1 + \beta} \left( (r_2 + 1) k_0 + w_1 - T_1 \right) - \frac{w_2 - T_2}{r_2 + 1} \right) \gamma_1 + \int_{\gamma_1}^{\gamma_2} \left( \frac{\beta}{1 + \beta} \left( 1 + \theta_1 s_i \right) k_0 - \frac{1}{1 + \beta} \frac{W_2}{R_2} \right) di \]

\[ K_1^p = \left( \frac{\beta}{1 + \beta} \left( (r_2 + 1) k_0 + w_1 - T_1 \right) - \frac{w_2 - T_2}{r_2 + 1} \right) \gamma_1 + \frac{\beta k_0 (\gamma_2 - \gamma_1)}{1 + \beta} \left( \frac{\theta_1 S}{2\lambda} (\gamma_2 + \gamma_1) + \left( 1 - \frac{\theta_1 S}{\lambda} + \theta_1 S \right) - \frac{w_2 - T_2}{(r_2 + 1) \beta k_0} \right) \]

Total rent-seeking investment

Total rent-seeking investment is given by the sum of investment of the double rent-seekers: those period 1 rent-seekers who continue rent-seeking in period 2. The integral is calculated analogously to the above case of productive investment:

\[ K_1^\gamma = \int_{\gamma_2}^{1} k_{1i} di \]

\[ K_1^\gamma = \int_{\gamma_2}^{1} \left( \frac{\beta}{1 + \beta} \left( 1 + \theta_1 s_i \right) k_0 \right) di \]

\[ K_1^\gamma = \frac{\beta k_0 (\gamma_2 - \gamma_1)}{1 + \beta} \left( \frac{\theta_1 S}{2\lambda} (\gamma_2 + \gamma_1) + \left( 1 - \frac{\theta_1 S}{\lambda} + \theta_1 S \right) \right) \]


[36] Dachkova, Doroteya and D. Bozhidarov, Vote traders will remain unpunished again, 1.10.2007, sega daily


[43] EBRD, 1994-2004, Transition Reports, various years


[76] Ladu, Maria Gabriela, 2006, Total Factor Productivity Estimates: Some Evidence From European Regions, Crenos working paper 2006/06


[79] Lim, Ewe - Ghee, 2001, Determinants of, and the Relation Between, Foreign Direct Investment and Growth, IMF working paper No. 175, 2001

[80] Ljungqvist, Lars and T. Sargent, 2000, Recursive Macroeconomic Theory, MIT press


[107] UNDP: Human Development Reports, various years, 1992 - 2004


[114] World Bank: World Development Indicators, various years


G. Samenvatting

De landen van centraal en Oost-Europa en de voormalige Sovjet-Unie, ook wel “transitielanden” genoemd, hebben transformaties ondergaan die ongeëvenaard zijn in de recente economische geschiedenis. Van die kenmerken, die de transitielanden onderscheiden van de rest van de wereld en die ze tot groep maken, heb ik met name aandacht besteed aan de bepalende factoren voor de groei, het effect van buitenlands kapitaal op de productiviteit, en de verandering van het economisch raamwerk.

Transitie wordt gekenmerkt door diepgaande veranderingen in het functioneren van de economie. Er kunnen dan ook krachten aan het werk zijn die behoorlijk verschillen van die van “normale” markteconomieën. De post-communistische landen begonnen hun transitie met verschillende verdraaiingen in het systeem, aangezien hun economische ontwikkeling niet het resultaat was van conventionele economische logica maar van centrale planning, die een heel ander soort logica gebruikte. Dit suggereert dat er een aanzienlijke ruimte was voor verbetering en verhoogde output, alléén al door herallocatie en reorganisatie, en zonder de inputs te verhogen.

Onze resultaten tonen inderdaad aan, dat de transitiesperiode tot en met 2002 eigenlijk uit twee periods bestaat: een beginfase, om de eerste inefficiënties te verwijderen en de fundamenten van een markteconomie te ontwikkelen, en een tweede fase, waarin het groeipatroon van transitielanden begint te lijken op dat van een gevestigde markteconomie. De twee factoren die van belang blijken gedurende het gehele transitieproces zijn het opleidingsniveau en de erfenis van de voormalige Sovjet-Unie. Als voorlopige maatstaf gebruiken we het jaar 1995. De meeste transitielanden hebben dan ten minste één jaar van positieve groei doorgemaakt.

De factoren die groei lijken te beïnvloeden in de eerste fase zijn of het land deelgenomen heeft aan een oorlog of gewapend conflict, welk deel van zijn handel viel onder het CMEA-handelsverbond onder het communisme, of het land behoorde tot de voormalige Sovjet-Unie en hoe hoog het opleidingsniveau is. In de tweede periode hangt de groei af van de hoeveelheid fysiek en menselijk kapitaal dat in de productie wordt gebruikt. Of het land tot de voormalige Sovjet-Unie behoorde of niet blijft een rol spelen. Ten slotte heeft het economisch raamwerk (een groep kenmerken die het niveau van corruptie beschrijft, de kwaliteit van het legale raamwerk, de reikwijdte van de politieke en economische vrijheid) een positief effect.

Daarbij besteden we aandacht aan ruimtegebonden afhankelijkheid, dat wil zeggen aan de situatie waarin de kenmerken van economieën van buurlanden stelselmatig samenhangen. In de eerste fase was dat het geval bij Armenië, Georgië en Azerbeidzjan, hoogst-
waarschijnlijk veroorzaakt door de gewapende conflicten in de Kaukasus in de 90-er jaren. In de tweede periode zijn het Rusland en veel landen van de voormalige Sovjet-Unie, allen beïnvloed door de Russische crisis van 1998.

Internationale handel en buitenlandse directe investeringen (FDI) hebben de groei en het herstel van de transitie bevorderd. Transitielanden vormen een optimale voedingsbodem voor FDI aangezien deze landen een hoog opleidingsniveau hebben, vergelijkbaar met dat van ontwikkelde landen en een technologische uitgangspositie met veel mogelijkheden tot groei. We concentreren ons op de nieuwe EU-leden vanwege een grotere toegankelijkheid van gegevens en de grote hoeveelheid FDI die zij ontvangen.

Zowel de import van kapitale goederen als de FDI door multinationals blijken een positieve invloed te hebben op de productiviteit op lange termijn. Dit verband zien we niet tussen de FDI ontvangen in één bepaald jaar en de verandering van productiviteit in hetzelfde jaar, oftewel de korte termijn. De FDI in de industrie heeft een groter positief effect op de totale productiviteit dan op de rest van de economie (die voornamelijk uit diensten bestaat). Zowel FDI, als import van kapitale goederen, uit technologisch leidende landen, hebben het grootste positieve effect op de productiviteit van het ontvangende land. De effecten op de lange termijn suggereren dat de twee internationale kanalen inderdaad dragers zijn van buitenlandse kennis en technologie.

Nu wij ons realiseren dat traditionele factoren en aanvangssituaties slechts een relatief klein deel verklaren van de verschillen tussen landen, concentreren we ons vervolgens op het economisch raamwerk. Dat raamwerk, bestaande uit een veelheid aan karakteristieke kenmerken, tradities en instituten van een land, maakt de ‘regels van het spel’ uit. Het raamwerk bepaalt hoe marktdeelnemers beslissingen nemen en ze handelen om ze te implementeren.

We beschouwen dus een uit twee periodes bestaand algemeen evenwichtsmodel met heterogene marktdeelnemers, waarvan sommigen de mogelijkheid hebben tot ‘rent-seeking’. Rent-seekers kunnen er ook voor kiezen om te werken, dat hangt af van welke van de twee activiteiten ze het meest oplevert. De heersende expliciete en impliciete regelgeving (de kwaliteit van de handhaving van de wet en de bescherming van eigendomsrechten) bepaalt welk deel van de output kan worden geplunderd. Als de kwaliteit van het economisch raamwerk hoog is, dan kan er niets onttrokken worden, dus werken alle marktdeelnemers; als de kwaliteit laag is, dan kunnen rent-seekers een substantieel deel aan het verdiende inkomen onttrekken.

Rent-seekers investeren een deel van het onttrokken inkomen in georganiseerde politieke activiteit, met als doel het in stand houden van onderontwikkelde onderdelen van het economisch raamwerk. Hun bijdrage aan politieke invloed hangt af van de hoogte van de onttrokken rente en de kosten van politieke invloed. Deze kosten hangen weer af van de kwaliteit van het raamwerk: hoe slechter de kwaliteit, des te makkelijker is het voor rent-seekers hun economische macht om te zetten in politieke. Op deze manier ontstaat er een feedbackmechanisme: het economisch raamwerk bepaalt de beslissingen van de rent-seekers en de mate van plunderen, maar het is ook een functie van deze twee factoren.

Ons model bevestigt dat een economisch raamwerk belangrijk is voor economische prestaties (nivo van inkomen, ongelijkheid, investeringen) en ook functioneert als mechanisme om dit te beïnvloeden. Een intuïtief resultaat is dat een zwakker raamwerk leidt
tot hogere ongelijkheid van inkomen, omdat in dat geval rent-seekers meer plunderen en er minder overblijft voor de werkende marktdeelnemers. Ook is het, zodra het raamwerk intensieve politieke invloed toestaat, waarschijnlijk dat die invloed blijft bestaan. Politieke invloed zorgt er namelijk als eerste voor dat de middelen voor zijn eigen verwijdering verwijderd worden.

Er is echter ook een minder intuïtief resultaat. Een economisch beter presterend land heeft niet noodzakelijkerwijs een beter economisch raamwerk. Integendeel, gezien het feit dat het raamwerk aanvankelijk zwak is, is het mogelijk dat een rijker land eindigt met een zwakker raamwerk, en minder kans op verbetering ervan, dan een arm land. Rent-seekers plunderen meer in de huidige periode en investeren meer in de mogelijkheid dat ook in de toekomst te kunnen blijven doen. In de loop van de tijd vertaalt zich dit in een lagere output en slechtere economische prestaties. Daarbij, de verwachting van een toekomstig hoog inkomen motiveert ze om nog meer te investeren in het behoud van een zwak economisch raamwerk. Hiermee kan verklaard worden dat er transitielanden bestaan die relatief goed presteren op economisch vlak, maar die een onderontwikkeld economisch raamwerk hebben, met veel corruptie en een grote ongelijkheid aan inkomens.
Administrative corruption................................................................. 50
Agent heterogeneity........................................................................... 51
Bilaterally-weighted model................................................................. 31
Capital accumulation.......................................................................... 50
Capture economy index....................................................................... 60
CMEA trade.......................................................................................... 19
Coe and Helpman type model............................................................... 36
Competitive capture............................................................................. 47
Difference-GMM method................................................................. 35, 101
Disorganization.................................................................................... 10
Endogenous growth model................................................................. 30
Endogenous institutions...................................................................... 64
Error correction model........................................................................ 34
Extreme bounds analysis ................................................................. 17, 97
FDI........................................................................................................ 30
FDI stocks and flows........................................................................... 41, 98
FDI to manufacturing or services....................................................... 32
First generation of reforms................................................................. 14, 20
Fisher panel unit root test.................................................................... 42
General equilibrium model................................................................. 50
GMM dynamic panel data methods..................................................... 39, 101
Human capital...................................................................................... 36
Human capital’s effect on growth......................................................... 11
Imports............................................................................................... 33
Institutional parameter........................................................................ 65
Institutional reform............................................................................. 50
Institutions.......................................................................................... 50
Investment in physical capital............................................................ 14
Investment in political influence....................................................... 73
Lobbying............................................................................................ 57
Moran’s I statistic .................................................................................................. 18, 95
Multinational enterprises ..................................................................................... 32
Non-stationarity ................................................................................................. 39
Oligarchs ............................................................................................................. 52
Partial reform equilibrium .................................................................................. 54
Political influence .............................................................................................. 51
R&D spillovers (technology spillovers) ............................................................... 30
R&D stocks ......................................................................................................... 31, 101
Reform setback .................................................................................................... 73
Reform step ......................................................................................................... 73
Rent-seekers ....................................................................................................... 51
Rent-seeking ....................................................................................................... 52
Rule of law .......................................................................................................... 61
Second generation of reforms ............................................................................ 14
Simultaneity bias ................................................................................................. 39
Solow-type model ............................................................................................... 34
Space Stat .......................................................................................................... 18
Spatial dependence ............................................................................................. 13, 18
Spatial error model ............................................................................................ 17, 93
Spatial lag model ............................................................................................... 17, 93
Spatial weighting matrix ................................................................................... 19, 97
State capture ...................................................................................................... 50, 57
System GMM method ....................................................................................... 40
Technological leaders ......................................................................................... 37
Total factor productivity ..................................................................................... 35
The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus University Rotterdam, University of Amsterdam and VU University Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

430. W. VERMEULEN, Essays on Housing Supply, Land Use Regulation and Regional Labour Markets.
437. R. LORD, Efficient pricing algorithms for exotic derivatives.
439. Y.-Y. TSENG, Valuation of travel time reliability in passenger transport.
440. M.C. NON, Essays on Consumer Search and Interlocking Directorates.
441. M. DE HAAN, Family Background and Children’s Schooling Outcomes.
442. T. ZAVADIL, Dynamic Econometric Analysis of Insurance Markets with Imperfect Information.
443. I.A. MAZZA, Essays on endogenous economic policy.
444. R. HAIJEMA, Solving large structured Markov Decision Problems for perishable-inventory management and traffic control.
446. R. SEGERS, Advances in Monitoring the Economy.
448. L. PAN, Poverty, Risk and Insurance: Evidence from Ethiopia and Yemen.
454. S. VUJIĆ, Econometric Studies to the Economic and Social Factors of Crime.
455. F. HEUKELOM, Kahneman and Tversky and the Making of Behavioral Economics.
460. O.E. JONKEREN, Adaptation to Climate Change in Inland Waterway Transport.
462. J. NIEMCZYK, Consequences and Detection of Invalid Exogeneity Conditions.
464. M. KRAWCZYK, Affect and risk in social interactions and individual decision-making.
468. M.I. OCHEA, Essays on Nonlinear Evolutionary Game Dynamics.
469. J.L.W. KIPPERSLUIS, Understanding Socioeconomic Differences in Health: An Economic Approach.
471. R.P. FABER, Prices and Price Setting.
473. J.W. VAN DER STRAATEN, Essays on Urban Amenities and Location Choice.
476. A. PARAKHONYAK, Essays on Consumer Search, Dynamic Competition and Regulation.
478. J. LIU, Breaking the Ice between Government and Business: From IT Enabled Control Procedure Redesign to Trusted Relationship Building.