Essays on the Empirics of Transition

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Katerina Kalcheva

Referent:	Prof. Stefan Mittnik, PhD
Korreferent:	Prof. Dr. Ulrich Woitek
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Introduction

Transition countries are markets with less advanced, but growing economies. The group ranges from large countries like Russia, with extensive resources to much smaller countries in Central and Eastern Europe. The change of their planned economic systems to market economies can be regarded, as one of the biggest socioeconomic transformations in the human history. This new macroeconomic policy was related to free movement of goods and capital across borders, strengthening the role of the private sector and structural reforms aiming at a sustainable growth. Furthermore, the inflation was stabilized and the fiscal and monetary policies were orientated towards long-term price stability. The process of transition, however, was not as fast and without frictions as initially expected due to conflicting policy objectives and macroeconomic imbalances. The recovery from the initial downturn in output and employment has been long, and took almost a quarter of a century before the initial convergence of incomes to Western European standards became a reality. Nevertheless, the current economic indicators show that transition countries are on the right track and that further improvement of living standards and high growth rates could be expected in the future.

The beginning of the 21st century was marked by the official membership of eight Central and Eastern European countries (CEE) in the European Union (EU). The next step towards full integration with the EU is the adoption of the euro, which is an obligation under acquis communautaire. It is also a challenging task, which will increase the benefits and the opportunities of the EU accession. The homogeneity of financial markets in Europe, since the introduction of the euro has encouraged investors to search for novel profit opportunities. Central and Eastern European markets, especially those that position themselves for prospective entry into the European Monetary Union (EMU), are more and more at the focus of attention.

Among the main analytical tasks undertaken by the current research is an analysis of the monetary and exchange rate policy in transition countries. Our objective is to evaluate how well prepared are Central and Eastern European countries (CEE) for participation in a common currency area, whether an early participation is optimal, as well as how sustainable the currency union will be after accepting new members.

In contrast to CEE countries, the magnitude of Russia's economic transition shows that, in spite of the common communist past, transition experience can vary considerably. For Russia, transition has been slower and depended on political and institutional reforms for building stable macroeconomic environment. In the last years, supported by favorable external conditions, Russia has shown remarkable economic growth and

focused on developing a liberal democracy and a market economy. Nonetheless, recent economic growth slowdown suggests symptoms of a "Dutch disease", a relevant problem for resource-rich economies.

It bears great importance to analyze and understand the complex process of transition in order further to develop market institutions and to advance in the European integration. As a consequence of being a new and dynamic area of research, empirical studies on transition countries often reach controversial results. The explanation for these controversies can be attributed to the poor quality of the data, the lack of country-level harmonization of statistical reporting, and finally the relatively short transition period. Therefore, the aim of this dissertation is to employ a sophisticated econometric methodology to improve on the current empirical literature on economic policy in transition countries. More specifically, we focus on the following contributions:

- We use high frequency time series data to increase the number of observations and to provide a more detailed picture on the development of the macroeconomic transition indicators.

- The structural vector autoregressive (VAR) approach of Clarida and Gali (2001) is applied to analyze how asymmetric shocks influence the optimal monetary policy in acceding countries.

- By using Markov regime switching VAR model we estimate empirically the credibility of the non euro zone central banks in comparison to that of the euro zone central banks, sharing a common currency.

- The Dutch Disease model of Russia, used in this study, provides an explanation of the impact of high resource prices on the country's weak long-term growth performance.

- We use cointegration procedure and vector error correction (VECM) model to estimate the long-run elasticities of the real exchange rate in Russia.

The Vector autoregressive model (VAR) is a starting point for empirical modelling in the current study. Since the original work of Sims (1972 and 1980), VAR was used as a primary time-series methodology to study the interaction among the monetary variables and the real economy. Theoretical models for the effect of exchange rates on output were tested to be consistent with the empirical evidence. In particular, the lag structure of the VAR model allows determining, whether real and monetary disturbances have played a role in output fluctuations during the transition. The simple VAR approach, however, has been criticized to suffer from overfitting and identification problems. To address these issues, we adopt more sophisticated structural and Bayesian VAR approaches, where the alternative specification allows imposing theoretical restrictions on the contemporaneous correlations among the variables.

While the above methods assess the effects of the exogenous shocks, they cannot identify the endogenous responses of the monetary policy to the economy i.e. the role played by the monetary policy rules. By using non-linear regime switching model, we aim at estimating the reaction function of the central banks' monetary policy in transition countries. The changes in the stabilization behavior, allow us to draw conclu-

sions about the central banks' credibility and the desirability of alternative monetary strategies.

The cointegration and vector error correction approach presented in the last chapter are suggestive about the long run equilibrium between the real exchange rate and the oil prices. The results provide evidence for the role played by a positive supply shock on the production structure of the economy.

The rest of this dissertation consists of three independent essays, studying the empirical implications of transition, and is organized as follows:

CHAPTER 1 studies the dynamic responses of three variables – real effective exchange rate, prices and output - to an identified supply, demand and monetary shocks on the economic policy of Central and Eastern European countries. We employ the structural VAR model of Clarida and Gali (1998) to a sample of transition countries in order to assess the importance of these different types of externalities. In particular, we are interested in how much of the variances of the output, real effective exchange rate and prices are explained by the three types of shocks on the way in the period before the euro adoption.

CHAPTER 2 employs Markov regime switching VAR model to determine, whether CEE countries put emphasis more on stabilizing inflation or on output during the last decade of transition. We find that the monetary policy depended on the country-specific structure. Therefore the attention in transition countries was more on the output stabilization. This is of particular relevance for their prospective participation in a monetary union, where in contrast, the main focus will be on the union-level price stability.

Consequently CHAPTER 3 focuses on the impact of the high oil prices on the real exchange rate in Russia and answers the question, whether Russia exhibits symptoms of Dutch Disease. We start with a three-sector model in which an increase in oil prices, by raising oil sector wages, results in real appreciation of the currency, a shrinking manufacturing sector, and a booming services sector, through a combination of classical "resource allocation" and "spending" effects. Then, the predictions of the model are tested by a detailed sectoral analysis, and a number of cointegrating vectors are determined according to the results from the Johansen procedure. Furthermore, we estimate vector error correction model, in which real exchange rate depends on the oil price, productivity differential, government consumption, and corruption. Finally, in the conclusion, we present estimates of the long-run exchange rate elasticity in Russia and summarize our main theoretical and empirical findings. The discussion of the results aims at providing relevant policy implications and a consistent framework to advance in the analysis of transition economies.

Part I

ERM II Participation and Euro Adoption

Chapter 1

Cost - Benefit Analysis

1.1 Introduction

All Central European countries (CECs) consider strategies to become full members of the European monetary union (EMU), hence to adopt the euro in the near future. From the countries' perspective, determining when to adopt the euro, depends on the costs and benefits of giving up their monetary independence. Thus, the timing of entry is determined by the overall macroeconomic stabilization and the vulnerability of the specific economy to external shocks. The last depends on how flexible or rigid is the exchange rate regime.

Macroeconomic stability depends on the ability of the exchange rate regime either to act as a shock absorber, or to propagate shocks. In particular, exchange rate flexibility could be a good instrument to absorb shocks or may propagate shocks, thus increasing macroeconomic instability. Therefore, the costs of joining a monetary union depend on the extent to which a more flexible exchange rate regime serves, as a tool for macroeconomic stabilization, which absorbs shocks. Shocks are often accompanied by higher interest rates and low investment level which create a potential for financial instability [1]. Alternatively, if the flexible exchange rate is a source of macroeconomic instability, than giving up a monetary independence will be beneficial from the perspective of macroeconomic stabilization. In the last case, abandoning the independent monetary policy will bring more benefits than costs.

Shocks have permanent or temporary asymmetric effects depending on their monetary transmission mechanisms. Therefore, decisive are the types, frequency and correlation of shocks between the new members and the Euro area. In its analysis of "taxonomy of shocks", the European Commission (1997) distinguishes: between exogenous and policy-induced shocks, between real and financial shocks, between temporary and permanent shocks, between country-specific and sector-specific shocks. In EC (2004) is applied a broader classification of shocks: demand and supply, symmetric

[1] Exogenous shocks are events, over which the authorities in particular country have no direct control but which can have permanent or temporary asymmetric effect depending on the economic structure.

and asymmetric, temporary and permanent, policy-induced and exogenous.

Despite the insightful literature on the subject, the question of the interdependence of the monetary regime and the exposure to exogenous shocks during the process of Enlargement has, so far, been underestimated. The purpose of this chapter is to analyze how the existence of asymmetries influences the optimal monetary policy in acceding countries. This will answer to the question, if the exchange rates in CECs were absorbing shocks or were amplifying shocks, as well as which shocks explain the variance of the real exchange rate.

This paper empirically investigates the link between a credible monetary policy and the external shock transmission in small open economies. It evaluates the importance of external shocks and seeks to identify the type of monetary regime to avoid instability in the pre EMU phase[2]. We separate the effects of supply, demand and monetary shocks and compare the consequences of the destabilization risk under various monetary and exchange rate regimes. The emphasis is placed on the role of the exchange rate, as well as on the external disturbances in relation to different monetary targeting mechanisms. The present chapter examines the main challenges that the acceding countries will have to confront and the policy measures that will ensure successful monetary integration. It answers the key question of how well prepared the economies of the new EU members are to join EMU. The chapter is organized as follows: Section 1.2 discusses the implications of the ERM II membership. Section 1.3 introduces the theoretical debate around EMU. Section 1.4 presents an analysis of the benefits of the monetary union.. Sections 1.5 , 1.6 and 1.7 discuss the link between the monetary regimes, the shock correlation and the transmission mechanisms. Section 1.8 presents the theoretical model followed by the empirical tests in section 1.9 and 1.10. Section 1.11 concludes.

[2] According to the Article 124 of the Treaty of Rome, countries with derogation for the introduction of the euro have to treat their exchange rate polices as a matter of common interest.

1.2 Exchange Rate Mechanism II

In May 2004 ten countries have entered EU and at some point in time will join EMU[3]. Some of the acceding countries adopted a rapid strategy and clearly announced their desire to enter the Exchange Rate Mechanism II (ERM II) , hence to adopt the Euro, as soon as possible[4]. ERM II is an agreement with a central rate and a standard fluctuation band of +/-15%. Participation in ERM II is one of the four Maastricht convergence criteria and is a prerequisite for the adoption of the euro[5]. It requires setting a central parity rate of the domestic currency against the euro, as well as participation in the mechanism for a minimum of two years without devaluation. After this period the European Central Bank and the European Commission prepare parallel convergence reports, which examine, if the requirements for entry have been fulfilled, and if the country has achieved high degree of convergence with the euro area.

From the current EU members, which are not yet EMU members, seven countries participate the ERM II: Denmark joined on 1 January 1999, Estonia, Lithuania and Slovenia joined in June 2004, Cyprus, Latvia and Malta joined in May 2005 and Slovakia has joined in November 2005. The Czech Republic, Hungary, Poland, Sweden and the United Kingdom (UK) do not participate in the mechanism. Only the UK is granted a permanent derogation. None of the other five member states has the possibility to opt-out and therefore will all have to join the Exchange rate mechanism in the future (see Table 1.1).

The central parity is based on a multilateral agreement. The country may choose its national currency to vary within a maximum of 15 percent or to commit to an unchanged exchange rate against the euro during ERM II, as in the case of Estonia, Lithuania and Malta. The central parity may in fact be revised, but only after mutual agreement. Once set, the intention for the central parity is to be maintained until the country joins the euro area with the irrevocably conversion rate. The rate is proposed by the European commission after consultations with the ECB and decided by the euro area member states and the national authorities. The long term benefits of joining a currency area are related to lower transaction costs and exchange rate and financial uncertainty, resulting in lower risk premium on interest rates. Available empirical evidence (Frankel and Rose,2002) favors the hypothesis, that there are large trade gains and technology transfers, resulting in a significantly positive effect on the economic growth. In addition, there are benefits from pursuing a common, prudent macroeconomic policy, which strengthens credibility by facilitating anti-inflation measures. A

[3]The ten countries are Slovenia, Slovakia, Hungary, Poland, Czech Republic, Estonia, Latvia, Lithuania Malta and Cyprus.

[4]See the respective Central Banks' announcements.

[5]Maastricht criteria for EMU Membership Inflation: no more than 1.5% above average of three lowest inflation countries. Nominal interest rate: no more than 2.0% above the average of the three countries with the lowest interest rate. Nominal exchange rate: respect normal fluctuation margins for ERM II without severe tensions for at least 2 years before the examination. Council of Ministers decides conversion rate. Fiscal criteria: the budget deficit should not be higher than 3% of GDP and public debt should not be higher 60% of GDP. The Central Bank should be independent.

comparison of business-cycle correlations across US regions and across EMU countries suggests, that a common monetary policy is itself a source of cyclical convergence (i.e the optimum currency areas are endogenous) (Buiter, 2000).

Maastricht criteria,however, have not predictive power, as the long term sustainability of the union is concerned. Leaving aside the undisputable gains of sharing a common currency, the governing council of the ECB also warns about "the risks implied by premature rigidity of the exchange rate" and recommends, that "it might be appropriate for some new Member States to only consider applying for ERM II membership after a further degree of convergence has been achieved". In addition, the Governing council states that "this is particularly advisable when an early rigidity could precipitate disorderly realignments with potentially disruptive economic consequences, including for the credibility of the mechanism as a whole"[6].

The main goal of the ERM II is to enhance the macroeconomic stability by fostering real and nominal convergence with the EU. On the one hand, the period after EU accession and before joining ERM II cannot be infinitely prolonged; countries have to consider their timetables for joining the EMU. On the other hand, once in the ERM II in the event of idiosyncratic shocks, the monetary policy tools of the central banks will be restricted, which reduces the possibilities for country-specific adjustment. The question remains, as to whether the new entrants in ERM II will be stable against speculative forces, such as the attack in 1992, which forced Finland, Italy, Norway, Sweden and the UK out of the mechanism in place at the time. Therefore, the role of ERM II is viewed as a testing phase for both the domestic currency stability and the convergence level.

The Asian crisis of 1998 and the oil price shocks of 2000 and 2004 have demonstrated that adjustment to shocks still remains a difficult issue in the euro area. Adverse macroeconomic developments continue to play an important role in EMU, because fixed exchange rate cannot be used to prevent shocks [7]. In addition, the value of the national currencies will vary according to how the euro fluctuates against other international currencies, mainly the dollar. Apart from the exchange rate, the costs could materialize in high volatile interest rates, credit spreads and local equity markets. In addition, the real appreciation of the national currency is a natural consequence of the high growth rates in CECs. This implies that compare with the slower growing EU members, the new ERM II entrants may have either real appreciation against the euro or higher inflation rates. Early EMU membership will, therefore, make it difficult to restrain inflation to the EU levels.

Hence, there is need for an empirical understanding of the dynamic behavior of the macroeconomic variables in transition in the period before joining the EMU. The key questions are, whether the structural adjustments will be speeded up or slowed down by an early participation in EMU and what is the optimal monetary strategy

[6] See "Policy position of the governing council of the ECB on the exchange rate issues relating to the acceding countries" http://www.ecb.int/press/03/pr031218en.htm

[7] Modern exchange rate theory also regards the exchange rate as a source of instability and doubts its effectiveness to deal with regional shocks (for an excellent review see Schelkle, 2001)

for the new EU members: to follow a strictly rigid regime or to hold on to flexibility in the pre EMU phase. The timing of entry depends mostly on the progress of financial restructuring and the real macroeconomic stabilization. Significant structural reforms, ability to advance convergence through sound economic policy and exchange rate regime compatible with ERM II, are all viewed as prerequisites for participation in the mechanism.

During the ERM II period, there will be only limited exchange rate flexibility in the context of full capital mobility. Hence, the probability of financial crises increases. This implies, that countries should assess the probability of asymmetric shocks vis-à-vis the EMU members before they eliminate their national monetary and exchange rate instruments. Furthermore, to what extent the macroeconomic situation is robust and the fiscal policy is capable of responding to shocks should be carefully scrutinized.

The choice of monetary strategy (and the exchange rate arrangement, as a part of the monetary regime) after EU accession is a responsibility and prerogative of the Members States concerned[8]. The probability of financial convergence, as specified by the Maastricht criteria, depends on the monetary regime the CECs have chosen in the pre-accession phase, as well as, on the fiscal instruments applied at the national level. In order to achieve an early membership, acceding countries must fine-tune their monetary policy, to target low inflation rates. Naturally, there is no superior exchange rate regime that can be applied to all acceding countries, which differ greatly in their economic structure[9]. Hence, during the transition to EMU there will be considerable latitude open for monetary policy and a country specific approach will be employed. On the one hand, a certain degree of flexibility is necessary because output does not respond efficiently to external shocks in the presence of sluggish prices and wages[10]. On the other hand, the exchange rate stability with the euro is a priority for all acceding countries, and is subordinated to the primary objective of price stability. The intra-marginal interventions, used by the countries that have chosen to participate in ERM II from the very beginning, are decided by their national central banks. However, a formal decision of narrowing the fluctuation band below the current level of +/-15% (related to the marginal interventions) is to be treated as an exceptional case and could only be considered at a very advanced stage of convergence[11]. This emphasizes the importance the ECB places of exercising a certain level of flexibility within ERM II before locking the exchange rate permanently and adopting the euro[12].

Macroeconomic transition in Eastern Europe is characterized by volatility in capital

[8] Report by the ECOFIN Council to the European Council in Nice on the exchange rate aspects of enlargement, Brussels, 8.11.2000, Council of the European Union press release no 13055/00

[9] Note that there was not in the past single path for the current EMU members either. Incompatible with ERM II are the cases of free floating or managed floats (without mutually agreed central rate), crawling pegs and pegs against anchors other than the euro.

[10] Driver and Wren-Lewis (1999) conclude that adjustment to shocks in the Euro area may be costly due to real wage rigidity and price-setting inertia.

[11] Denmark participates in ERM II with multilaterally agreed bands of +/- 2.25%, Estonia, Lithuania and Malta committed to maintained fixed exchange rate.

[12] During the transition period CEE countries will be highly vulnerable to financial instability, which could be avoided by full euroization, although it is not allowed by Treaty.

flows, high terms of trade shocks and large structural transformations. Real and/or financial shocks (reversal of capital flows allocation, increase of international interest rates, financial contagion) have significant implications on the economic policy of CEE countries. Moreover, as a uniform response to common shocks will not yield a uniform impact, enlargement itself acts like an exogenous shock leading to variations also in the EU, especially due to the regional differences within the Union. This could disturb the process of business cycle synchronization, and might impair monetary policy in the euro area after the euro adoption.

The impact of shocks can be asymmetric on both country, and regional level. By increasing volatility, external shocks can increase the probability of financial crises and postpone the euro adoption. An establishment of common institutions and policies has to smooth the existing structural asymmetries. Credible institutions, including sound fiscal discipline and financial regulations, adequate legal framework regarding bank defaults, as well as the implementation of the necessary structural changes could speed up the process of convergence.

1.3 Review of the Theoretical Literature

The theoretical literature distinguishes between two main concepts, concerning the relationship of the exchange rate and the shock exposure – exchange rate is considered either as an absorber of shocks or as a source of shocks.

Friedman (1953) and Mundell (1961) introduce the traditional view of the exchange rate, as an absorbing mechanism, which isolates the economy from external price shocks. In case of a sudden increase in international prices, only the appreciation of the domestic currency will prevent the economy from importing the foreign inflation level. Abandoning the exchange rate adjusting capacity has been regarded, as one of the main drawbacks of the common currency areas. This important question was reviewed in the optimum currency area theory (OCA) by Mundell (1961), Kenen (1969) and McKinnon (1963)[13].

According to the OCA theory,conditions for creating a currency union are favorable,when individual countries face symmetrical disturbances (concerning the type, direction and speed of adjustment), if their bilateral trade is significant and if the factors of production are mobile. Sharing of these

properties would reduce the role of the nominal exchange rate, as an adjustment tool i.e. business cycle fluctuations would be outweighed by the gains from sharing a single

[13]The theory of OCAs addresses the question whether a common currency is optimal for a group of countries. The aim is to find a set of various economic indicators determining which country should participate in a monetary union and how the currency area will function after bilateral exchange rates are fixed. The most famous criteria of the OCA are:

degree of factor mobility and similarity of production structures (see Mundell, 1961), openness of the economy (see McKinnon, 1963), degree of commodity diversification (Kenen, 1969), price and wage flexibility (Eichengreen, 1993), low inflation rates differentials (Haberler,1970; Fleming,1971) The latter criteria served as a background for the Maastricht convergence criterion on price stability

currency. In contrast to the traditional OCA approach, Buiter (2001) has argued that the exchange rate is not only a shock absorber, or part of the transmission mechanism for fundamental shocks originating outside the foreign exchange markets, but also a source of excess volatility, unnecessary shocks, instability and misalignment. Fidrmuc (2002) analyzes the optimality of the currency unions using two types of criteria. First, countries exposed to symmetric output shocks will tend to have synchronized business cycles. Second, if shocks are largely asymmetric, effective adjustment mechanisms can facilitate the slipovers of shocks to the rest of the union and thus mitigate their negative effect.

In order to distinguish between different types of shocks, Khan (1986) analyzes the behavior of the real exchange rate in a group of several developing countries. He considers a combination of exogenous shocks, such as worsening term of trade, falling growth rates in industrial countries and sharp changes in the costs and availability of external financing (e.g. rise in international real interest rates). Studies on externa disturbances include Eichengreen, Rose and Wypolsz (1995) and Kaminsky and Reinhart (1999) among others, focusing on the country specific variables. The impact of supply and demand shocks also related to the monetary policy (e.g. the slopes of IS, LM and BP curves) has been studied in dateail by Fry and Lilien (1986), Bayoumi and Eichengreen (1993), Gross (2001), Fidrmuc and Korhonen (2003).

Devereux (2002) reports the significance of three sources of shocks - interest rate (or capital flow) shocks, terms of trade shocks and domestic demand shocks in the non - traded goods sector. A study by Artis and Ehrmann (2002) analyzes, if shocks are symmetric or asymmetric in order to identify if the exchange rate acts as a shock absorber, or a source of shocks. Using structural vector autoregression (SVAR) technique, they look at how strongly the exchange rate responds to asymmetric supply and demand shocks and find weak results for the UK, Sweden and Denmark. The study finds that the exchange rate is driven by shocks in the exchange rate market, although these shocks have weak potential to distort output or prices.

Acceding countries are likely to face increased vulnerability of their financial systems before joining the EMU. Moreno and Trehan (2000) find that common external shocks explain between sixty to eighty percent of the variation in the total number of currency crises over the post-Bretton Woods period. Begg et al. (2002) warn of the danger of enlarged capital flows that can increase the probability of crises, if reversed or the probability of overheating and disinflation, if not reversed. Capital inflows lead to a lending boom, which deteriorates the quality of assets and increases the fragility of the financial system in the face of economic shocks. Such financial crises would slow the process of transformation and the counties' integration process to the European Union.

On the empirical side, Clarida and Gali, (1994) find that real shocks tend to explain majority of the variance of the real exchange rates for the industrial countries – Japan, Germany, the United Kingdom and Canada. Yet, for Canada, Enders and Lee (1997) find that nominal shocks tend to explain half of the variability of the nominal exchange rate. Studies on smaller open economies, however, find that the exchange rate (nominal and real) plays a less significant role as a shock absorber. Canzoneri at al (1996) finds

that monetary shocks explain larger part of the variability of the nominal exchange rates. Yet, empirical studies on CEECs yield conflicting and inconclusive results. Based on VAR model for Czech republic, Poland and Slovakia, Süppel (2003) finds that the real exchange rates is sensitive to supply shocks and acts as a shock absorber. Borghijs and Kuijs (2004) find that the exchange rate has responded little to output shocks. The monetary shocks however, have contributed significantly to the nominal exchange rate fluctuations.

In summary, the academic debate around the European Monetary Union enlargement has mainly focused on several issues:

The first aspect deals with the appropriate monetary strategy for acceding countries in the pre-EMU phase. The main conclusions are related to the country specific approach in dealing with the appropriate monetary policy before euro adoption.

The second aspect is related to a cost - benefit analysis for participation in the euro area. Long term gains are envisaged; however the loss of independent monetary policy increases the costs in the first years after the introduction of euro. The costs are also related to the extent of similarity of business cycles and the types of shocks, most likely to follow in the euro area and the acceding countries. The type of exchange rate regime is regarded, as an important absorption mechanism of external shocks. It plays a crucial role, when shocks are largely asymmetric. In contrast, abandoning the monetary policy adjustment tools brings about welfare gains, but leaves the economy vulnerable to external shocks. Another question is when the acceding countries will be able to fulfil the Maastricht criteria. An equally important issue is the difficulty of fulfilling both the inflation and exchange rate stability criteria, due to the higher productivity growth in addition to the real appreciation.

1.4 The Benefits of the Monetary Union

Conditions for common monetary policy within the Union require countries to share price stability, similar inflation rates and similar operation of the monetary policy transmission mechanisms. The benefits are associated with higher share of trade to GDP ratio, especially if the country joins a currency union with important trading partners. A currency union increases not only the trade openness but also delivers higher income growth, as a result of lower inflation (discipline effect), greater stability and credibility. Compare to the beginning of transition, all acceding countries have made considerable progress[14]. However, the macroeconomic situation in transition is characterized by real sector structural adjustments and unstable financial sector (see Tables 1.2 and 1.3 for the macroeconomic indicators in CEE countries).

Table 1.4 shows that there is still distance from the EU average, concerning inflation and budget deficit criteria. The growth rate of GDP is higher, than the EU average. Nonetheless, the relatively bigger agriculture and industry sectors imply large fiscal

[14]The annual Transition Report of the European Bank for Reconstruction and Development (EBRD) provides continuous monitoring

requirements. This has an influence on the monetary policy. Most often, the money growth and inflation were fuelled by the considerable need of seigniorage. Large current account deficits and the considerable amount of non-performing bank loans suggest higher probability for currency and banking crises. There is a clear trade off between the stabilization of output (relative to its natural level) and the inflation stabilization. Hence, the choice of monetary instruments gains special significance to avoid financial instability in the transition economies during the pre-EMU phase.

The economic transformation, that followed in the economies of CEE, came along with frequent changes in the exchange rate regimes (Table 1.6 and Figures 1.1 - 1.4). Among the reasons are the relatively high exposure to volatile capital flows, the risk of real shocks, the lack of consistency in the monetary policy and the inability to successfully control inflation. In the first years of transition, most countries opted for flexible exchange rate. After experiencing financial crises and instability, some countries transitioned to more rigid regimes, which served to increase macroeconomic discipline, in line with the economic theory. As countries become more developed, they move to increasingly flexible exchange rate regimes. Husain et al (2005) present evidence suggesting that for advanced economies, flexible rates offer significantly greater durability and higher growth without generating higher inflation. The results for the emerging markets (where CEE are classified), are not as robust; apart from being more crisis prone, emerging markets do not show significant relationship between economic performance and exchange rate regime.

Cost-benefit analysis emphasizes the importance of similarity between the business cycles in the euro area and the acceding countries. The empirical evidence by Economic Forecasting Network (EFN) can be summarized as follows: During the nineties the economic cycles of most acceding countries were strongly correlated with those of the euro area. However, the synchronization with the euro zone has been worsened by the economic slowdown 2000-2003. The EFN report provides evidence that the acceding countries' business cycles (except Slovenia) are less synchronized with the euro area aggregate relative to the business cycles of the current monetary union members before their introduction of the Euro. Also the correlation of the business cycles is lower compare to that of the non - EMU members – the United Kingdom, Denmark and Sweden. The fluctuations of inflation and growth rates in the acceding countries were higher on average than those in the EU. The comparison between two sub periods (1996.1 – 1999.4) and (2000.1-2002.4) shows that there is a positive increase of business cycle correlation for Czech Republic, Slovenia and Estonia, and decrease in the correlation for Hungary, Lithuania and the Slovak Republic (see Table 1.7)[15].

The short transition period, however, implies that only a single business cycle can be identified, which casts doubt on the reliability of the results. Also based on the Lucas critique, it is troublesome to analyze ex ante policies based on ex post data, because economic policies can lead to changes in the economic structure. Moreover it could be expected that the cycle synchronization with monetary union will increase in the years before entering in the EMU, given the example of countries such as Italy and

[15]See EFN Autumn Report – Annex ch. 5, www. efn.uni-bocconi.it/Annex _to_ chapter_ 5.pdf

Spain, which suggests that OCAs may well be endogenous.

The differences in the business cycle synchronization can be due to the exposure to different shocks or to the different transmission mechanisms. Some exogenous shocks, for instance an oil shock, as shown in Chapter 3, can have long-run effects depending on the exchange rate regime. Asymmetric supply shocks have arguably been the reason behind the collapse of the most fixed exchange rate systems. Unarguably, however, there exists shock asymmetry between current EMU members and the transition countries (see Fidrmuc and Korhonen, 2003; Horvath, 2002).

Table 1.8 and Table 1.9 show, that EMU candidate countries continue to encounter supply shocks, that are weakly correlated or uncorrelated with those affecting the core EMU (with the exception of Hungary). A general conclusion is that the correlation of shocks is low compare to EMU countries. Most of the coefficients for CECs are close to zero with positive or negative variation. In addition, the countries on the EMU periphery (Greece, Ireland) also show low coefficients. Indeed, this implies that countries, which couldn't meet OCA criteria ex ante can not meet it, so far, ex post and need a longer period for convergence.

It is natural to compare the correlation between the supply and demand shocks in the prospective members of the EMU with that in currency board countries, which had already fixed their exchange rates to euro for several years. The figures show, that fixing the exchange rate is of secondary importance for shock correlation in the short run. Moreover, smaller EMU members (Austria, Belgium or the Netherlands) are much further ahead in their economic convergence compared to acceding countries. In support of this argument Babetski, Boon and Maurel (2002) find that demand shocks have become more similar over time, whereas supply shocks have diverged.

Frankel and Rose (2002) point out that the OCA criterion of symmetry of shocks should not be considered as static, because it is endogenous in the degree of economic integration. This implies that costs and risks will be gradually reduced, as asymmetries will disappear over time. However, the timing for potential gains is also unsure. After joining EMU there will be fewer monetary instruments at countries' disposal to deal with asymmetric shocks. Moreover, if the labor markets cannot adjust easily to shocks (given the low responsiveness of labor mobility to regional unemployment and wages), then an early participation in EMU will need stronger adjustment efforts in short term. Hence, it could make the monetary union more fragile and turn out to be potentially costly both in economic and political terms not only for the new entrants, but also for the current members.

1.5 Monetary Regimes and Shock Exposure

From the theoretical point of view (see Friedman, 1953; Poole 1970; DeGrauwe 1996; Chang and Velasco, 1998) fixed exchange rates are more vulnerable to external shocks. In case of shocks when exchange rates cannot adjust easily, the real interest rate or output has to adjust. According to the theory, real shock leads to more variability

in the output at fixed exchange rate and financial shock are better offset at a fixed exchange rate. On the one hand, it is hard to guarantee soft pegs once capital mobility is liberalized. On the other hand choosing a more flexible regime can affect monetary credibility. The trade-off between higher flexibility (and hence less shock exposure) and the credibility gains of fixed exchange rate regime is an important question in the light of EMU enlargement.

The theoretical model of Rogoff (1995) supports the hypothesis, that there will be a trade-off during the pre-EMU phase between higher flexibility (hence less shock exposure, more real stabilization) and the credibility gains of a rigid exchange rate regime. Certainly, an incidence of asymmetric shocks, differences in the economic structure or swings in the foreign financing might bring serious deviations from the Maastricht criteria if countries rely only on credibility of fixed exchange rate.

The ability to respond to idiosyncratic disturbances without independent monetary policy is seriously compromised for the new members. On the one hand, monetary policy coordination has been strengthened in order to promote closer integration. On the other hand, so far long lasting monetary unions without strong political integration has never been observed. Another argument challenging the "optimality" of the common currency area between the CEE countries and EU countries is the long term real appreciation of the national currencies of the first vis-à-vis the euro (Balassa-Samuelson effect), caused by the different productivity growth during the catching-up period. Furthermore, price liberalization strengthens the convergence to the EU price level. An analysis of the main macroeconomic indicators shows that under currency board the real exchange rate appreciation results in an increase in the level of inflation, higher than the EU average, which cannot be offset by depreciation of the real exchange rates. This leads naturally to problems in meeting the inflation convergence criteria, as stipulated in the Maastricht treaty. Additionally, external changes may affect the foreign trade transactions in the EMU-11 and CEEC comparably. But different in scale and a presumably passive reaction of the ECB are likely to result in a de facto asymmetric character of these shocks.

Growth and Stability Pact also restricts the possibility to implement independent fiscal policy and further reduces the ability to respond to asymmetric shocks. A country hit by a large asymmetric shock has to rely on its fiscal policy to deal with the negative effects. Growth and Stability Pact imposes limits on the public deficit and debt levels. For the countries close to violating these limits it introduces a pro cyclical bias into national fiscal policy[16]. Further asymmetries will be reduced by the financial integration. The question is which monetary instruments will increase the prospects for ex-ante real convergence in each country.

The type of the monetary regime is one of the major determining factors of how external shocks are transmitted to the economy[17]. On the road to EMU, CECs are facing possible benefits and challenges in terms of optimal exchange rate policy. The

[16] For details on the fiscal risk sharing in the EMU, see Fidrmuc (2002).

[17] The definition of monetary transmission mechanism follows Taylor (1995, pp.11) "the process through which monetary policy decisions are transmitted into changes in real GDP and inflation".

greatest challenge is for those countries, that have certain flexibility in their exchange rate regimes. An appropriate arrangement guarantees stability and enhances chances for fast accession. The choice decision of optimal path and time strategy for Euro adoption lies between managed floating, fixed peg or currency board. Monetary policy targeting offers also scope for diversity – real product changes inflation vs. price level targeting.

This is particularly important for the small open economies, as most of the acceding countries are considered to be. It also gains a special significance for avoiding financial instability. The difference between the monetary transmission mechanisms of CECs also can constitute a source of asymmetric shocks. Dehejia and Rowe (2001) model fixed exchange rates vs. inflation targeting vs. price level targeting. They point out the differences in terms of unforeseen observed price shock. Under price level targeting the central bank will try to push the price level back in the period following the shock. Under inflation targeting, the price level will follow a random walk (or a random walk with drift under a positive inflation targeting). In contrast to the traditional literature, the authors do not emphasize the source of shocks, but rather focus on whether a given shock is observed or unobserved. Price level targeting best stabilizes output and the expected real exchange rate and enables the central bank to respond to observed shocks. Before entering the EMU, as required, transition countries will choose system that combines capital mobility with fixed but adjustable regimes. CEE countries will try to operate in the environment of common monetary policy, idiosyncratic shocks and independent fiscal policies. ECB do not want to impose any monetary regime. Higher level of heterogeneity is consistent with the enlarged ERM II. The observed trend implies moving to more fixed regimes, as stability with the euro is a central priority for acceding countries.

Gali and Monacelli (2003) employ a version of Calvo sticky price model to analyze the implications of shocks on two alternative monetary policy regimes: inflation targeting and an exchange rate peg. Results show, that the inflation targeting regime achieves full stabilization of output gap and inflation, but only at the cost of larger volatility of nominal and real exchange rates (nominal volatility is associated with high real exchange rate volatility). Both CPI targeting and the exchange rate peg imply large welfare losses, as the exchange rate peg amplifies both the output gap and the inflation. Higher degree of openness requires stable relative prices, and has a negative effect on the volatility of the real exchange rate. Indeed, the exchange rate channel operates very fast in small economies and the changes in the exchange rate affect directly domestic prices of imports and with a short lag the prices of domestic goods, containing imported inputs. In response to shocks, under inflation targeting, when nominal exchange rate appreciates, the overall inflation falls. However, with fixed exchange rates, the real appreciation is achieved only by domestic price inflation. The key constraint (see Devereux, 2002) is that with differences in productivity performance across countries, the fixed exchange rate cannot achieve inflation convergence (see Table 1.9).

A calibrated model by Devereux (2002) illustrates the effect of price and wage rigidities on the economic volatility. In case of non-traded goods price rigidity, an inflation targeting rule is the fully optimal rule. In case of wage rigidity, the performance of

fixed exchange rate is related to a lower volatility of output, but higher volatility of inflation in comparison to Taylor rule, or inflation targeting. The conclusion is that wage rigidities mitigate the trade off associated with output stability versus inflation stability. Moreover, having a fixed nominal exchange rate does not imply a constant real exchange rate or stable prices. CEE economies are also not sheltered from exchange rate variability from the non- EMU trading partners or variations between G3 countries (see Krugman and Obstfeld 2003). Therefore what matters is the real convergence, i.e. a similarity of economic cycles in the countries whose intention is to peg their exchange rates to each other. The real convergence is also related to the convergence of per capita incomes, market structures and the scope of the government. It is especially necessary to reduce country specific shocks and instability. An appropriately chosen monetary regime paves the way to the fulfilment of the Maastricht criteria and allows the possibility for EMU participation as early as possible.

In this sense, a currency union represents the most credible fixed exchange rate regime. Alesina and Barro (2000) argue that the membership in a currency union is an efficient way to address credibility. According to McCallum (1995) sharing a common currency can be seen as a much more serious and durable commitment than having an independent central bank. A uniform currency area has costs (as the omission of some stabilization instruments), as well as advantages - the reduction of transaction costs and the possibility to gain credibility by following stable monetary policy. It is a form of signal to international financial markets, which can foster foreign direct investments and business cycle synchronization ex post. Moreover, the credibility issue relates the de facto exchange rate regime with the prudent monetary policy. Hence, the main issue for CECs is not to choose the most credible regime but rather to choose the monetary regime that will ex ante increase the prospects for real convergence, taking into account the vulnerability to external shocks.

To what extent operating such a regime is close to reality? As stated by all acceding countries, full membership in EMU is the target regime once EU membership has been achieved. On the one hand, in the two-year period before EMU membership introducing 15% fluctuation bands can affect credibility and sustainability of current regimes. On the other hand, CEE countries are facing Mundell's "incompatible holy trinity" - which states that independent monetary policy, perfect capital mobility and fixed exchange rates are mutually exclusive. Speculations, as far as the central parities are not announced long before, can ruin stability and introduce high expectation margin. Flexible exchange rates are regarded as an instrument of dampening the real shocks in economies with rigid prices where resource reallocation effect takes place. Levy-Yeyati and Edwards (2003) find that rigid regimes are unable to cope with real shocks, which lead to lower growth in less developed economies. Therefore how to switch to a more flexible exchange rate without losing credibility in the years before EMU is the most relevant question for the new EU members.

In this sense, EMU participation requires stronger adjustment efforts, than that of EU. Buiter and Grafe (2001) regard that the achievement of the whole set of Maastricht targets is not under the control of the national monetary authority. The argument is that the interest rate and inflation targeting puts restrictions on the real interest

rate; and the nominal exchange rate targeting put restrictions on the real exchange rates. These real values are affected by the developments on the international financial markets and are only partly under the control of national monetary authorities. Hence, external economic shocks are part of the costs, which the membership in a currency union brings about for the acceding countries.

1.6 Types of Shocks and Channels of Monetary Transmission

In accordance with the Mundell-Flemming framework and the new open economy macroeconomic theory (Obstfeeld, 2001), the importance of the flexible exchange rate, as a shock absorber can decline depending on the type of shocks. Asymmetric shocks are classified as supply, demand and monetary shocks, as well as permanent and temporary shocks. Following Clarida and Gali (1994), we distinguish between three structural shocks: relative supply (AS), relative demand (IS) and relative monetary (LM) shocks. The following long term properties apply:

A positive supply (AS) shock has a permanent positive long-term effect on the relative output and ambiguous impact on the real exchange rate. In the short run prices should fall but the impact on the nominal and real exchange rate is ambiguous.

A positive demand (IS) shock has a permanent long-term effect on the real exchange rate, but not on the output. In the short run the nominal and real exchange rates appreciate (resulting from sticky prices) and the relative output increases. In the long run, however, prices also increase, relative output falls and the real exchange rate appreciates.

A positive monetary (LM) shock reduces the relative interest rate. It does not have long run effect neither on the output, nor on the real exchange rate. In the short run capital outflow leads to both real and nominal exchange rate depreciation and lower output. In the long run, the equilibrium is restored and the output returns to its pre-shock level.

In the case of real (supply or demand) shocks, the flexible exchange rate generates adjustment in international relative prices, thus absorbing the shock and preventing from output losses. For example, a negative demand shock would reduce relative demand, which under flexible exchange rate would cause depreciation, which in turn would restore the demand thus returning to the equilibrium (Mundell, 1964).

If, however the exchange rate pass-through to import prices is weak, and does not trigger an adjustment in the international relative prices, then the flexible exchange rate will be of little use, as a shock absorber. In the case of monetary and financial shocks, exchange rate fluctuations would amplify the effect of the shock and would cause undesired adjustments in the relative prices away from the equilibrium. For example, a negative monetary shock would increase the interest rate, which leads to real appreciation and higher relative prices. In the opposite case under fixed exchange

rate, such shock would cause capital inflows, which would put downward pressure on the interest rate. In a nutshell, the higher the occurrence of asymmetric monetary shocks, the less important the exchange rate flexibility is for absorbing shocks. The higher the occurrence of real shocks, however, the higher the benefits of the exchange rate flexibility.

Based on the above considerations in addition to the shock asymmetry, EU and CEEs have to take into account the most important channels of shock transmission in order to be able to conduct comprehensive monetary policy. Mishkin (1996) presents an overview of the channels of monetary transmission starting with traditional interest rate channels, going on to the asset prices channel, and then on to the so-called credit channels. The transmission can be conducted in two ways:

- From the monetary environment to some intermediate variable, such as monetary deposit rates or lending rates.
- From the intermediate variables to the aggregate macroeconomic variables, such as inflation, GDP and external balances.

The link between the changes in the monetary policy and the economic process has to be examined carefully by CECs in order to guarantee sustainable growth and to reduce the convergence costs. External disturbances mainly affect trade and FDI, but also capital and labor markets. Foreign trade is usually regarded as the most important channel of external shock transmission. Therefore, the degree of trade openness, i.e. the share of imports and exports relative to GDP, determines the impact of external disturbances on domestic economic activity. On the one hand, the more open the country, the more vulnerable it is to external shocks. On the other hand, trade openness suggests increasing business cycle correlation, and thus reducing asymmetry among union members. In an analysis of ten transition countries, Ganev at al. (2002) find that exchange and interest rate channels operate in all countries, but the exchange rate channel is generally stronger and more stable. For most countries the response of inflation of disturbances in exchange and interest rates was in line with the theory – inflation was low with rising interest rates and was boosted by exchange rate depreciation. In the majority of countries output was boosted by depreciation.

Besides real external disturbances, which are common for emerging market (for example external oil shock), transition countries may also face specific risks and shocks related to their accession in EMU. These risks can be divided in two types:

Exchange rate risks, can result in exceeding the limits of the 15 percent band required by the ERM II. The negative consequences are loss of credibility, increased probability of changes in the central parity and spending longer time than the minimum two years in ERM II. The last is problematic because of the perceived instability of ERM II before the adoption of the euro. Capital inflows, whose magnitude increases due to accession, result in real appreciation and may be viewed as a pure portfolio shock. The convergence play is stimulated by the interest and exchange rate expectations of the investors. Holders of debt instruments expect higher prices, because the lower currency risk premium. The increased prices allow them to reap their rewards in terms

of capital gains. This will require interest rate reduction in the country exposed to capital inflows. The related problem is twofold: On the one hand an interest rate reduction will enter into a conflict with the inflation target, on the other hand if the monetary authority does not intervene; the large capital inflows will lead to currency appreciation and balance of payment problems. Once in the ERM II, the central banks of CECs will be unable to use their exchange rate policy to close the uncovered interest rate parity. In the event of shocks, the interest rates used at national level can not differ significantly from the ECB rates. The capacity of fiscal policy and the labor markets should be explored in this case, which are not as flexible as the monetary policy.

Macroeconomic risks, on the other hand can increase the volatility of the macroeconomic variables (increased inflation, budget and balance of payment deficits). Increase in trade openness, capital inflows or productivity of the tradable sector as well as the shift of government spending from tradable to non-tradable goods could be thought of as a supply shock in the domestic economy. Lower interest rates and higher credibility can cause an increase in the aggregate demand, higher inflation, real appreciation of the national currency and higher balance of payment deficit. The increase of the trade openness, which is a specific feature of the transition countries, means that the exports increase faster than the imports relative to the GDP. This can be viewed as a supply shock, which causes trade imbalance and requires appreciation of the REER. The productivity growth, which is a characteristic feature of transition economies, also produces real appreciation by nominal appreciation or higher inflation. In the case of fixed exchange rate, the real appreciation is achieved by an appreciation in the non-traded sector. This could be interpreted as a productivity shock, which increases the prices of non-tradables due to the Balassa-Samuelson effect. It can be viewed as a sustainable equilibrium phenomenon, which does not require monetary policy response. However, with sharp differences in the productivity performance among countries and fixed exchange rates, inflation convergence cannot be achieved in the short-run. Therefore, the key constraint for CECs is the setting up of the post – accession inflation targets[18].

1.7 Theoretical Model

Here we set out the theoretical framework of our empirical analysis on a sample of transition countries based on the model by Clarida and Gali (1994). The structure is that of a two-country stochastic rational expectations open macro model in the spirit of Dornbush (1976) and Obstfeld (1985). The structural shocks are identified using the approach pioneered by Blanchard and Quah (1989). We study the dynamic responses to these shocks to three variables – real effective exchange rate, prices and output. In particular we are interested in how much of the variances of the output, real effective exchange rate and prices are explained by the three types of shocks. The following exogenous variables are specified in the model:(i) aggregate supply shocks;(ii) real demand shocks and (iii) nominal shocks. The model presents short run results

[18] For a detailed discussion, see Devereux (2002)

with sluggish price adjustment to supply, demand and monetary disturbances but also includes long run macroeconomic equilibrium, when prices adjust fully to all shocks. The framework of the model has been often used in literature therefore we will only briefly discuss it.

In the standard IS equation (1.1) the demand for home output relative to foreign output y^d is increasing in both the demand shock d_t to home absorption and the real exchange rate $s_t - p_t$. All variables are in logs (except the interest rate) and are expressed in relative terms – home to foreign levels. The output is decreasing in the real interest rate differential $i_t - E_t(p_{t+1} - p_t)$:

$$y^d = d_t + \eta(s_t - p_t) - \sigma(i_t - E_t(p_{t+1} - p_t)) \tag{1.1}$$

The price setting (1.2a) and the standard LM (1.2b) equations take the following form:

$$\begin{aligned} p_t &= (1-\theta)E_{t-1}p_t^e + \theta p_t^e && \text{(1.2a)} \\ m_t^s - p_t &= y_t - \lambda i_t && \text{(1.2b)} \end{aligned}$$

where m_t represents relative money supply shocks and shocks to relative demands for real money balances. The equation (1.2a) is the average between the expected in the past period market clearing price and the actually prevailing price in the current period. In the case, when $\theta = 0$, prices are fixed and known one period in advance. In contracts when is $\theta = 1$, prices are flexible and output is determined. The interest rate parity is given by equation (1.3):

$$i_t = E_t(s_{t+1} - s_t) \tag{1.3}$$

The solution of the model for the real exchange rate in the flexible price equilibrium is presented by the following three relations (1.4), (1.5) and (1.6):

$$y_t^e = y_t^s; \tag{1.4}$$

$$q_t^e = (y_t^s - d_t)/\eta + [\eta(\eta+\sigma)]^{-1}\sigma\gamma\delta_t; \tag{1.5}$$

$$p_t^e = m_t - y_t^s + \lambda(1+\lambda)^{-1}(\eta+\sigma)^{-1}\gamma\delta_t. \tag{1.6}$$

where the real exchange rate appreciates in response to demand shocks and depreciates in response to supply disturbances. Here, the relative supply of output y_t^s , the real exchange rate q_t^e and the relative national price levels p_t^e and relative money m_t are driven by three shocks – to supply z_t, demand δ_t, an money ν_t. The model specifies a random walk stochastic process for the shocks to supply and money. This means that shocks to supply and money are assumed to be only permanent. However, the relative demand shock has a permanent, as well as a transitory component. A fraction γ of any shock to the relative demand is expected to be reversed in the period $\mathsf{t}+\mathsf{1}$ (1.7).

$$\begin{aligned} y_t &= y_{t-1} + z_t \\ d &= d_{t-1} + \delta_t + \gamma\delta_{t-1} \\ m_t &= m_{t-1} + \nu_t \end{aligned} \tag{1.7}$$

The solution for the sluggish price equilibrium is given by the following equations (1.8), (1.9) and (1.10):

$$y_t = y_t^s + (\eta + \sigma)\,\nu(1-\theta)(\nu_t - z_t + \alpha\gamma\delta_t); \tag{1.8}$$

$$q_t = q_t^e + \nu(1-\theta)(\nu_t - z_t + \alpha\gamma\delta_t); \tag{1.9}$$

$$p_t = p_t^e + \nu(1-\theta)(\nu_t - z_t + \alpha\gamma\delta_t. \tag{1.10}$$

After a positive monetary or demand shock prices also increase but by less then in the flexible equilibrium (1.10). The same with an opposite sign is valid for the response to a positive supply shock. Equation (1.9) shows that the real exchange rate under sluggish prices is influenced by the monetary shocks, although this is not the case under flexible price equilibrium .

Clarida and Gali (1994) model has important long-run implications for the impact of the disturbances. It shows that only supply disturbances can have long term effect in the level of output. In addition, the real exchange rate is determined in the long run only by aggregate supply and real demand disturbances. To sum up, the model imposes three long-run restrictions: only supply shocks affect output in the long run, while real exchange rate is affected by both supply and demand shocks. Hence, nominal disturbances have no long run effect on output and real exchange rate, and the effect

of real demand disturbances on the output in the long run is also zero. In the case of sluggish prices, shocks to the money supply influence the real exchange rate, even though they do not have an influence at the flexible price level. Compared to the flexible price real exchange rate level, the sluggish price adjustment implies, that the real effective exchange rate undershoots in response to real supply and demand shocks.

1.8 Structural VAR Analysis

This section presents an empirical analysis of the impact of external shocks on five East European countries (Estonia, Hungary, Poland, Slovenia and the Czech Republic) with comparable available data and different nominal exchange rate regime[19]. The sample of countries has been chosen according to the availability and reliability of comparable economic time series data. On the basis of the presented above theoretical model, we would expect real demand and nominal disturbances to have only short run effect on the level of output and to be neutral in the long run. We also expect nominal disturbances to induce transitory depreciation of the real exchange rate. Thus, we can compare the theoretical assumptions from the model with the empirical estimations in order to see if the results of the model are reasonable.

The VAR model sets the relationship between the past lagged values of all variables and the current value of each variable. This allows the variation of each variable to be explained by the past variation of the variable itself, as well as by the variation of other variables included in the model (1.11).

$$\begin{bmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{nt} \end{bmatrix} = \begin{bmatrix} A_{11}(L) & \dots & A_{1n}(L) \\ \vdots & \ddots & \vdots \\ A_{n1}(L) & \dots & A_{nn}(L) \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{nt} \end{bmatrix} + \begin{bmatrix} C_1 \\ C_2 \\ \vdots \\ C_n \end{bmatrix} + \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \\ \vdots \\ \epsilon_{nt} \end{bmatrix} \tag{1.11}$$

ϵ_{nt} denotes the disturbances or innovations, the C_n is the constant and y_{nt} the n number of variables included in the model. The model parameters $A_{ij}(L)$ include the lag operator L is defined by (1.12)

$$L^k y_t = y_{t-k} \tag{1.12}$$

The question we answer is how different monetary regimes in the five CECs interact with external shocks and what are the sources of fluctuations in the output, prices and the real exchange rates [20]. The economic theory cannot measure qualitatively the size

[19] Due to data restrictions Latvia, Lithuania and Slovakia could not be included in the analysis.

[20] Following (Sims, 1980) we also modelled Cholesky decomposition with three dependent variables – REER, the ratio of M2 to foreign reserves and the trade openness (export+import/GDP).The results show that trade openness is the most important transmission channel for the sample transition countries.

of the transmission effects and cannot tell the speed of adjustment to the steady-state position after shocks. We try to find empirical evidence for the dynamic behavior of the variables, the effects of which are delayed or persist over time. The response to shocks is distributed through several periods.

There are some difficulties, however, to apply this method to the CECs, where the sample size is relatively small. This influences on the dimensionality of the estimated autoregressive model. Countries were chosen in order to represent a broad classification of nominal regimes as currency board (ultimately fixed), intermediate and floating[21].

Under managed floating we understand a direct central bank targeting of the interest rate on the domestic markets and the real exchange rate targeting on the forex market. So far, such a regime was followed only by Hungary (unfortunately not strictly) and by Slovenia during the researched period. We empirically estimate the effect of the external shocks applying structural VAR (SVAR) approach on a cross sectional data set with reported observations over time for the same countries. SVAR is a type of VAR where economic theory is used to impose restrictions on the contemporaneous correlations into orthogonal components. This is a reduced type model where identification restrictions moved by theoretical hypotheses are needed to derive meaningful policy conclusions. The choice of econometric methodology is based on the powerful performance of SVAR in smaller systems. It has been an important tool in the recent research following Doan, Litterman, Sims (1984), Blanchard and Quah (1989) and Amisano and Giannini (1997). The benefit of employing SVAR is its ability to describe the dynamics of the data that are not changing even in cases of interventions - the variance-covariance matrix of the disturbances contains all contemporaneous correlations among the variables. In this case the lagged values for at least one year should be included on the right-hand side of the regression. SVAR investigates how shocks affect the dynamic behavior of the variables. It has also been widely used for its predictive abilities in forecasting.

The structural form is given by (1.13):

$$A(I_K - A_1L - A_2L^2.. - A_pL^p)y_t{=}Be_t \tag{1.13}$$

$$\overline{A} = (I_K - A_1L - A_2L^2.. - A_pL^p)$$

$$y_t = \bar{A}^{-1}Be_t$$

$\bar{A}^{-1}B$ is the matrix of the long-run responses to the orthogonalized shocks. SVAR methodology models the dynamic behavior of economic variables by considering several

[21] De jure classification of the IMF is as follows: Fixed - currency board, conventional peg, narrow band, Intermediate – tightly managed, broad band, Float - managed float and free float.

endogenous variables together each explained by its own lagged values, as well as the lagged values of other variables. Sims (1986) considers six variables – GNP, Investment, Price index, Money supply, Unemployment and Treasury rate. He ran VAR imposing the above ordering in the cause and effect. Green (2000) views VAR model as a reduced form of the dynamic structural model. There are two different strategies: the traditional Blanchard and Quah (1989) methodology, as well as the more recent one, based on sign restrictions (see Peersman 2002). The difference is that the latter does not impose neither contemporaneous restrictions on the matrix nor shocks with long run effects. As shown by Faust and Leeper (1997) in the absence of a theoretical model such restrictions can be highly misleading. The structural errors are assumed to be uncorrelated, such that the covariance matrix $\sum = BBb4$ of the resulting innovations is diagonal.

We proceed to estimate SVAR in first differences of the logs. In this three variable case, the matrix C is a three by three matrix and if $Yt = (\Delta y, q, \Delta p)$, where y, q and p are the relative output, the REER and the relative prices with $\varepsilon = (z_t, \delta_t, v_t)$ where the three shocks would be supply, demand and nominal shocks, then the restrictions are $C_{12} = C_{13} = C_{23} = 0$ (1.14)

$$\begin{bmatrix} \Delta y \\ \Delta q \\ \Delta p \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} c_{11} & 0 & 0 \\ c_{21} & c_{22} & 0 \\ c_{31} & c_{32} & c_{33} \end{bmatrix} \begin{bmatrix} z_t \\ \delta_t \\ v_t \end{bmatrix} \tag{1.14}$$

Here, we estimate a three dimensional structural VAR model (see Hamilton, 1994, Green, 2003) with three dependent variables – Industrial production, Consumer Price Index, real effective exchange rate (REER) (see Table 1.11) [22].

Germany is taken as a benchmark. Variables are in relative terms, since we are analyzing the sources of exchange rate fluctuations. Therefore, we take the logarithms of the data, as well as the difference between the respective log variables and the Germany log variables. This is also the way to capture asymmetries between the benchmark country and the transition countries.

All series are expressed at constant prices and monthly sampled over the period 1994Jan – 2003Dec (see Figures 2.1 and 2.4). Before proceeding, we have adjusted time series seasonally and took out the missing values. The data were taken from International Financial Statistics and Institute for International Economic Studies (WIIW). An important issue is to determine the appropriate lag length to avoid model misspecification and/or waste in the degrees of freedom. In order to determine how many lags to use, several selection criteria were applied as the Akaike Information Criterion (AIC) and the Schwarz-Bayesian Information Criterion (SIC/BIC/SBIC). The SVAR model is specified with 4 lags according to the results using Likelihood Ratio (LR) test. Some of the series were found to be non- stationary for the five countries. According to Phillips-Perron and Augmented Dickey-Fuller (ADF) tests the data series were found to be integrated in order one, i.e. I (1) at 5% significance level (see Table 1.12).

[22] It is constructed from the relative price variable and the real exchange rate variable

We also perform Granger causality Wald test in order to see if the lagged values of our independent variable have explanatory power in a regression of the dependent variable on the lagged values of the dependent and independent variables. We find that only in the case of Poland the lagged values of the dependant variables have no explanatory power (see Table 1.13).

1.8.1 Results

The simulation properties of the structural VAR model were assessed by conducting an impulse response analysis with respect to innovations in the relative output, real exchange rate and the relative prices. According to the theory, the impulse response of the output level on the supply shocks should be positive, and that of the price level should be negative. Nominal and demand shocks should increase the level of output and inflation. In addition nominal shocks should lead to depreciation of the real exchange rate. In all countries there is a positive response in the relative output as a result of supply shocks. In Poland however the response of the relative prices is not properly identified. The relative output in Czech Republic, Hungary and Estonia decreases in response to a positive nominal shock and the effect wears after time, as expected (Table 1.14).

There is an initial increase in Poland and Slovenia. A positive demand shock leads to decrease in the relative output in Czech Republic and Hungary. There is an initial increase in Poland and Slovenia, followed by a decrease. In Estonia a positive demand shock is not properly identified for the relative output. A positive demand shock leads to an initial appreciation of the real exchange rate in all transition countries and to a slight permanent appreciation only in the Czech Republic. As a consequence of a positive nominal shock, the real exchange rate depreciates in the short run in Poland, Slovenia and Estonia but as expected returns to its initial level in the long run. There is, however, initial appreciation in Hungary and the Czech Republic. On the other hand, a positive nominal shock leads to an increase in the relative prices, and the effect dies out in the long run. The nominal shock is not properly identified for relative output of the Czech Republic, Slovenia and Estonia as the output decreases. However, the effect disappears in the long run as expected. There is also "unreasonable" reaction of the relative inflation due to nominal shock in Hungary and Slovenia – the inflation decreases. An increase in the output in transition countries relative to Germany is accompanied with a decline in the relative price level on Hungary, Slovenia and Estonia. This response is consistent with the predictions of the Clarida - Gali model – a supply shock drives output and prices in opposite direction. In the Czech Republic prices are very weakly affected, and in Poland relative prices even increase. The real exchange rate appreciates slightly in response to a supply shock in the Czech Republic and Hungary without following long-run deprecation predicted by the model. We observe long-run depreciation in Poland and Slovenia, which is consistent with the theoretical model. The impulse response analysis demonstrates that the demand disturbances have the strongest impact on the real exchange rate in transition countries. In contrast

to the Czech Republic and Poland, nominal shocks appear to have a strong effect on the REER in Hungary leading to a depreciation.

In our impulse response analysis we especially concentrate on Estonia, which followed currency board regime until 1992. It is expected that the shock symmetry is higher as Estonia follows fully fixed exchange rate regime. Demand shocks lead to long-run appreciation of the real exchange rate, compared to nominal shocks, which are stabilized after 16 months.

Figure 1.4 plots the response to a positive real, demand, and monetary disturbance. In the Czech Republic, Hungary and Estonia there is an increase in the output level due to a demand shock. In all transition countries there is an initial real exchange rate appreciation followed by a depreciation as predicted by the model.

Supply shocks explain most of the variability in relative output at all horizons, while nominal shocks contribute to the variability up to five months. Almost all the variation is in the real exchange rate is explained by demand shocks. Nominal shocks do not account for any variation in the real exchange rate. As demand shocks could possibly lead to higher appreciation, it is important for transition countries to target the real exchange rate in order to maintain the competitiveness in their exports.

The Argentinean, Russian and Asian crises dummies were found to be significant at 10 % level for the price endogenous variable and the Argentinean dummy at 5% for the output variable in Hungary. The Argentinean crisis dummy is significant at 5% level for the real exchange rate equation in Poland. The Russian crisis dummy is significant at 5% level for the output equation in Estonia. This result is consistent with previous findings.

The Czech Republic, Hungary and Poland have moved from a pegged to a more flexible exchange rate regime during the transition process, and have adopted inflation-targeting monetary policies. We control for the shift in the exchange rate regime and test to what extent the exchange rate regime matters for the long-run response to shocks. As suggested by the empirical results inflation targeting comparatively performs better than pegged monetary regimes, and reduces the shock asymmetry in higher extent in the short term. This shows that the two corner solutions are preferable only in the presence of very restrictive conditions and not in the presence of shocks. Inflation targeting in some of the bigger transition countries like the Czech Republic and Poland will help to meet the Maastricht criteria and to alleviate the main risks in the pre EMU phase. In addition, the central banks of transition countries learn how to operate in an inflation targeting regime, which will help them to play more active and positive role at the ECB once they adopt the euro.

1.9 Bayesian VAR Analysis

Many of the previous studies on CEE transition countries have suffered of restricted data sample, which did not allow presenting conclusive evidence. The main

drawback of VAR is its inefficient parameterization. Additionally, the lagged values $y_{t-1....}\ y_{t-n}$, which appear as independent variables, tend to be highly correlated, which, in turn, leads to biased parameter estimates. In order to have more efficient and reliable estimates, and because of the relatively shortness of the transition period we use Bayesian VAR (see Litterman 1979, Doan, Litterman and Sims, 1984). These types of models also improve out-of sample performance. They combine historical data with a-priori statistical and economic data. We would like to examine how Bayesian VAR can be used to improve the estimates of the SVAR equations by incorporating this prior information. Moreover Bayesian VAR is closely related to SVAR because it introduces prior beliefs by excluding theoretical restrictions by not assigning weights on any of the parameter values (e.g zero restrictions on certain coefficients) and constructing a structural model. Additionally it reduces the probability of overfitting (so called "curse of dimensionality") due to the good performance with smaller number of variables, short data sample and shorter lag length. The essentials of a Bayesian set-up require specifying a probability model with a prior knowledge about the parameters, which are unknown. In a Bayesian setting, data is combined with prior beliefs in order to produce a posterior probability density function (*pdf*) for the parameters. The pdf incorporates the uncertainty over the exact value of the parameters in the model as a probability distribution of the parameter vector. If there is difference, the uncertainty introduced by the pdf can be altered by the information in the data. The risk of overfitting is reduced because such change can be due only to "signal" but not by a "noise" contained in the data (Ciccarelli and Rebucci, 2003). Introducing prior information in the VAR model will help to recover more precisely the shock transmission mechanism in transition countries. The model is conditioned on the observed data. The value of parameters is considered as random and unobservable. The "prior" information is formalized as a density $p(\alpha_i, \Sigma)$, where α_i, Σ are the unknown parameters, introduced explicitly into the model. Consider

$$y_t = \alpha x_t + \epsilon_t \quad t = 1, ...T \tag{1.15}$$

where $x_t = (I_n \bigotimes W_{t-1})$ is $n \times nk, W_{t-1} = (y^{b4}_{t-1,....} y^{b4}_{t-p}, z_t)^{b4}$ is $k \times 1$, and $\alpha = vec(A_{1,} A_{2...} A_p)$ is $nk \times 1$.Sample information is represented by a density, which can be seen as a likelihood of α once the data y is observed. We know the the probability density function (*pdf*),conditional on the information in the form of a likelihood function

$$L(y \mid \alpha, \Sigma) \propto |\Sigma|^{-T/2} \exp\left\{0.5 \sum (y_t - \alpha x_t)^{b4} \Sigma^{-1} (y_t - \alpha x_t)\right\} \tag{1.16}$$

The real and prior information are combined by the means of the Bayes' theorem to obtain the joint posterior distribution (1.17) [23].

[23] Bayes' theorem states that the probability that event A occurs, given that event B has occurred, is equal to the probability that both A and B occur, divided by the probability of the occurrence of B.

$$P(\alpha, \Sigma \mid y) = \frac{p(\alpha, \Sigma) L(y \mid \alpha, \Sigma)}{p(y)} \propto p(\alpha, \Sigma) L(y \mid \alpha, \Sigma) \tag{1.17}$$

where $L(y) = \int p(\alpha, \Sigma) L(y \mid \alpha, \Sigma) d\alpha$ is the predictive density, $P(\alpha, \Sigma \mid y)$ is the posterior density. The posterior *pdf* is used to obtain the point estimate. A basic assumption is to specify a parametric form for the unknown parameters. The value of the model is found in the parameter distribution in the probabilistic terms (see Figures 1.11.1 and 1.11.5).

The BVAR literature deals with a prior distribution called Minnesota (Litterman) prior, which has unit prior mean for the first lag coefficient of each equation, whereas all other parameters are given zero prior mean. The a priori beliefs are based on statistical inference. The prior means and variances take the following form (1.18):

$$\beta_i N\ (1,\ \sigma^2_{\beta_{ij}}) \text{ and } \beta_i N\ (0,\ \sigma^2_{\beta_{ij}}) \tag{1.18}$$

where $\beta_i$denotes the lagged dependent variable in each VAR equation and β_j represents any other coefficient. The lagged dependent variables are believed to have high explanatory power. All other coefficients are viewed as less important. Because of the large number of parameters, the standard deviations are generated by a small set of hyper parameters - κ, τ and a weighting matrix $\psi_{(i,j)}$.The idea is that not only the data, but also the parameters have a distribution by assumption. The second moments of the prior distribution are specified according to a formula for κ, τ, ψ, which are assumed to be uncorrelated a priori (1.19).

$$\sigma_{i,j} = \kappa \psi_{(i,j)} k^{-\tau} \left[\frac{(\sigma_{uj})}{(\sigma_{ui})} \right] \tag{1.19}$$

where κ is the standard deviation of the prior on the first lag of the dependant variable. The $k^{-\tau}$ term is the lag decay function, where τ reflects the shrinkage of the standard deviation with increasing lag length. The idea is that the more distant the lags are, the less important is the variable for the model. The standard Minnesota prior has values $\kappa = 0.1, \tau = 1.0$ with the following weighting matrix (1.20):

$$\begin{bmatrix} \alpha_{11} & \alpha_{12} & \ldots & \alpha_{1k} \\ \alpha_{21} & \alpha_{22} & & \alpha_{2k} \\ \ldots & & & \\ \alpha_{k1} & \alpha_{k2} & \ldots. & \alpha_{kk} \end{bmatrix} \tag{1.20}$$

with weights on the diagonal $\alpha_{11} \ldots \alpha_{kk}$ equal to one and the rest equal to 0.5. This approach reduces the dimensionality by imposing a probability distribution on

the model's coefficients, which reduces dimensionality and uncertainty. The impulse response functions are similar to SVAR responses to supply, demand and nominal shocks and support the robustness of the results (see Figure 1.5).

Bayesian VAR deserves further investigation. We would like to know, whether we should apply different prior variance (uncertainty) for important and unimportant variables as well as to variables with different lag length. This requires computation of the Bayesian VAR with means other than the Minnesota prior mean, which we use in this paper as a starting point for further investigations.

Further research questions in this field will be to consider a prior based on the theoretical model by Clarida and Gali (1994) and to estimate structural BVAR. In addition we can compare the forecasting performance of the three types of models, which can yield an answer if theoretically based prior works as good as statistically based using Theil-U statistics . We would like also to calculate the correlation between different exchange rate regimes, as well as to estimate the model with different lags for different countries. In addition we would like to measure the persistence and the size of the three types of shocks for transition countries.

1.10 Conclusion

Our analysis indicates that CECs continue to be exposed to asymmetric shocks. Moving to a relatively fixed regime in the pre-EMU phase is likely to increase the asymmetries, as the theory suggests. After joining EMU CECs will be further restricted in using an independent monetary policy as an adjustment mechanism to shocks. Moreover, the official proposal for decision making in EMU restricts the possibility of small countries to promote specific monetary policy measures. The Stability and Growth Pact additionally confines their counter cyclical policy through fiscal policy. The evidence suggests that mobility is very low and will be restricted for several years after joining EU, which reduces the available adjustment mechanisms. Finally, there is no fiscal risk sharing among EMU countries. This suggests that entering in EMU, as soon as possible after joining EU is not the optimal exchange rate strategy for some of the acceding countries. Thus, a Big Bang is not an option. Moreover there is no "one size fits all" monetary policy. Fast entry in EMU is recommended only for countries with inflation bias where fixed peg is better in order to gain from importing low inflation and credibility. However in order to gain real stabilization in countries without inflation problems, the exchange rate channel and external shocks adjustment shouldn't be underestimated. The case-by-case approach is especially important, because acceding countries differ in the nominal and real convergence already achieved. We estimate structural long-run VAR in line with the economic theory. We find empirical support for the hypothesis that the higher the extent of convergence among candidates before the entry, the lower are the costs of their participation in EMU as the volatility caused by the shocks can be regarded as a major cost. These costs will be outweighed by the long-term positive benefits of sharing a common currency.

For transition countries joining the euro area is an intermediate step towards the main goal, namely sustainable improvement of living standards within functioning market economies. EMU is a result of long historical process. It combines both supernatural and institutional framework. CEE acceding countries have the chance to integrate and to share the underlying principles of these institutions. They will benefit from the monetary credibility and trade openness of the union. However, they are also expected to contribute to the euro area macroeconomic stability. Therefore costs for the transition countries as well as for the current members should be minimized (ex ante) before entry into EMU, which coincides with the official position of the governing council of ECB.

Part II

Monetary Credibility of the Euro zone Candidates

Chapter 2

An Application of a Regime-Switching Autoregressive Model

2.1 Introduction

Monetary policy credibility has been studied extensively in the last decides. This research agenda was motivated by the monetary integration of the European Union. In addition, the costs and benefits of alternative institutional arrangements for credible monetary policy were reassessed in view of several financial crises in the emerging markets [1]. New analytical instruments have been applied to contribute to institutional development and to extend the limits of our understanding of how institutional structure affects policy outcomes[2].

Despite the abundance of theoretical models, only few studies have explored empirically the determination of output and inflation policy of countries on the run up to the monetary union [3]. The goal of this chapter is to provide a theoretical and empirical link between the institutional arrangements (rules or monetary policy mechanisms) and the credibility of the central banks in the period prior to the monetary union. To test the consistency of monetary policy empirically and to find if there is switching in the monetary policy regime, we employ a Markov switching VAR model. Using monthly

[1] The term "institutions" here is understood as formal and informal monetary policy mechanisms, rules or legal contracts with certain properties which central banks follow in order to ensure price stability and sustainable output growth

[2] Traditional analysis in macroeconomics studies how private agents respond to the choice of different policy rules and policy instruments. The new approach treats policy as endogenous, by specifying the policy maker's objectives and constraints by borrowing methods from the game theory. The incentives of the policy maker affect economic policy choice and help in considering which type of policies are credible and politically feasible (for details see Persson-Tabellini, 1994).

[3] None of these studies have attempted to explain the trade-off between inflation variability and output variability in Eastern Europe in comparison to the core EMU countries.

time series data from 1994 to 2004 we analyze the probability of changes in credibility as a function of inflation, output gap and the interest rate differential. In particular, we are interested if the CEE central banks have assigned changing weights to inflation and to output. The chapter analyzes regime switching and hence differences in approaches between the central banks concerning the trade-off between stabilization of output variability and inflation variability. To our knowledge, reaction functions with coefficients has not be estimated for CEE countries yet. Therefore, our aim is to estimate the consistency of the monetray policy in CEE countries and to compare it with the results for the countries, belonging previously to the European Monetary System (EMS). If central banks' preferences and approaches differ, a stronger pressure on ECB could be expected in the future, once the acceding countries join EMU.

In the real world, policy instruments are chosen sequentially, whereby the time-path of the monetary policy is determined on the basis of different political and economic preferences. Different members within the union, as well as the new entrants may have different preferences about the conduct of the monetary policy. Where do the asymmetries come from? First asymmetries in the preferences reflect the specific economic situations in different countries and might be due to higher inflation, unemployment or asymmetric shocks (Kenen and Meade, 2003)[4]. Second, asymmetry can be linear, and thus place more weight on output than inflation variability (empirically tested in the chapter), or can be non-linear due to a bias of over caution in policy i.e stabilization of the exchange rate over the target in greater extent than stabilization of inflation below the target. Third, depending on the economic cycle, in expansionary phases the central bank will react more to inflation than in recessions.

A widely accepted view is that central banks in the 1970s put higher weight on stabilizing output, while inflation was led to increase. On the contrary, countries that had experienced hyperinflation in the past, had created monetary institutions (e.g. Deutsche Bundesbank) that target low inflation and react less to output variability. This policy gradually led to the foundation of the European Monetary Union.

The chapter studies different stages of credibility, through which monetary institutions go through, as the policy is perceived to be credible in some periods and not in others. We analyze the appropriate institutional arrangements, which commit central banks to welfare increasing behavior. A set of credible arrangements is shown to reduce the costs related to future collective decisions in a monetary union. By emphasizing the role of the central banks and the role of the economic structure, the chapter provides policy recommendations on the design of the monetary institutions in transition countries. It is organized as follows: In section 2.2 we discuss the relevant literature on the monetary policy credibility. Section 2.3 empirically analyzes credibility of monetary policy using Markov regime switching VAR model. Section 2.4 outlines the key results of the model with respect to the preferences and the optimal institutional choice.

[4]Once transition economies join the monetary union, the symmetric shocks will be dealt with using a union-wide monetary policy. Yet, this might be inefficient to respond to idiosyncratic shocks, or even to the aggregate shocks because of their relatively different impact. In addition, the ongoing structural reforms also require using the monetary and fiscal policy as stabilization tools. Therefore, the more the economy embarks on structural reforms; the more it is resilient to asymmetric shocks.

Section 2.5 concludes.

2.2 Existing Theoretical Literature

2.2.1 Models of Credibility

Economic theory has, so far, not agreed upon a single definition of credibility. Drazen and Masson (1993) define it as the expectation that the announced policy (both desired and within policymakers ability) will be carried out in the future[5]. Faust and Svensson (2001) measure credibility as "the negative of the absolute value of the deviation of the inflation expectations from zero". In the present context, credibility is defined as the capacity of the policymakers to announce a policy, which is trusted by the private agents, who base their current behavior on rational expectations[6]. The credibility problem arises from the sequential nature of the policy-making as the policy maker has incentives to deviate from the announced policy rule[7]. That is because monetary arrangements cannot be made binding, and the optimal conditions can change depending on the state of the world[8]. During the post war period, monetary authorities in many countries searched for an optimal balance between inflation and unemployment. Some succeeded in achieving lower inflation, but very often at the expense of higher short-term unemployment. Economic literature attributes these costs to the lack of credibility. In addition, instead of pre committing to certain monetary targets, monetary authorities gradually started using the interest rate as a policy instrument in a discretionary manner. This made the link between the monetary growth and the inflation unpredictable and resulted in higher inflation rates (for details see Goodhart ,1993). The idea to separate legal institutions and create an autonomous central bank, whose main objective is to achieve price stability, has been seen theoretically as a solution to the credibility problem. The procedure is to assign to the central bank a certain loss function for minimization designed to bring the equilibrium under discretion closer to the optimal equilibrium under commitment [9].

The importance of credibility was first put forward by Kydland and Prescott (1977)

[5]The authors distinguish between the toughness of a policy and the credibility of a policy maker. They assume that the policy maker type changes through time due to "external circumstances". Though policies may make devaluation more likely if there is persistent effect on output and employment. Blinder (1999) defines credibility as "deeds are expected to match the words".

[6]This study measures credibility as the negative of the absolute value of the deviation of the inflation expectations from zero, see Cuckierman and Meltzer (1986) who call it "average credibility of announcements".

[7]The credibility problem has been profoundly studied in the monetary theory literature. Nevertheless, its basic arguments are crucial for the institutional arrangements and the current study cannot move on without mentioning them.

[8]Policy rules can always be abandoned or suspended, and the central banker fired.

[9]The folk theorem states that there is a multiple equilibrium in a repeated game with perfect information. Different institutional arrangements contribute to choosing unique equilibrium which improves upon the discretionary solution.

in a seminal political economy model[10]. Their key result is that monetary policy should be based on rules rather than discretion, because discretion may result in the so called "inflation bias" (when the unconditional mean of inflation exceeds the target inflation). Barro and Gordon (1983) extended the framework to a non-Markov trigger strategy equilibrium to explain the stagnation experienced by many countries in 1970s. They modeled the optimal central banking, which involves a trade-off between credibility and flexibility and introduced the dynamic-inconsistency problem as an explanation of the positive inflation rates. Barro-Gordon model emphasizes the need for credible commitment, which will minimize the incentive for surprise inflation. Rogoff's (1999) extended model analyzes the preferences of the central banker, which may differ from those of the government. The objective function has quadratic form with linear constraints:

$$L_t = \frac{1}{2}\left[(1+\epsilon)\left(\pi_t - \pi^*\right)^2 + \chi(y_t - y^{*2}\right] \tag{2.1}$$

and the optimal preferences are given by

$$\pi = \pi^* + \frac{\chi}{1+\epsilon} y^* - \frac{\chi}{1+\epsilon+\chi}\mu_t \tag{2.2}$$

where $o < \epsilon < \infty$. A larger weight (relative to society's loss function) is assigned to inflation stabilization, because it is always optimal for the society to appoint a conservative central banker. Rogoff's equilibrium is to appoint a central banker, who has stronger low inflation preferences. Later Walsh (1995) challenged this result by modeling a simple optimal contract between the central bank (as an agent) and the government (as a principle) where the novelty is that the agent delegates power to a central banker with the same preferences. The last is being punished if the inflation exceeds the target (or awarded in the opposite case). He changed the central banker's loss function to (2.3):

$$V = \frac{1}{2}\left[(1+\epsilon)\left(\pi_t - \pi^*\right)^2 + \chi(y_t - y^*)^2\right] + \chi y^* \pi_t \tag{2.3}$$

where $\chi y^* \pi_t$ is a is a transfer which eliminates the inflationary bias and also enters the central banker's utility function. The optimal policy rule is given by (2.4)

$$\pi_t = \pi^* - \frac{\chi}{1+\chi}\mu_t \tag{2.4}$$

The model achieves first best solution: optimal output stabilization and no inflation bias. Svensson (1997) proposed another optimal solution by assigning an explicit inflation target to the central banker

[10] Nobel laureates for 2004

$$\pi^b = \pi^* - \chi y^* \tag{2.5}$$

which offsets the inflationary bias. The central bank's loss function is given by (2.6) :

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^b)^2 + \chi(y_t - y^*)^2\right] \tag{2.6}$$

Svensson finds, that it is possible to eliminate the inflation bias, without losing flexibility and stabilization. His proposal for first-best institutional arrangement is a central bank with both an inflation target and an output target equal to the potential output rate, rather than exceeding it.

A final argument in the discussion is that establishing a targeting rule by higher inflation country, can be viewed as an attempt to import credibility. In the view of this, pegging to euro is used to transfer credibility from union to non-union countries. Target zone exchange rate systems or currency pegs can be seen as enforcing credibility on behalf of the union central bank. The quadratic specification of the loss function implies that an equal weight is placed on the positive and negative deviations of inflation and output from the target. However, in contrast to the clear analytical tractability of such model, this may not be the case in practice. Such a specification is questionable, since it would imply that the central bank will be willing to accept any increase in output variance for a marginal decrease in inflation. There are losses of different order between positive and negative deviations of the state variable. As a consequence policy makers respond more aggressively to either inflation or output deviations [11].

A new strand of the literature (Nobay and Peel, 1998 and Ruge-Murcia, 2001) studies central bank preferences by Linex loss function in a Bayesian context assuming that the preferences are asymmetric. A deflationary bias emerges due to a stronger response to negative output (or positive inflation) deviations from the target. This suggests a non-quadratic form for the loss function, with the quadratic form being a special case (2.7):

$$L = \frac{e^{\alpha(\pi-\pi^*)} - \alpha\,(\pi - \pi^*) - 1}{\alpha^2} + \phi\frac{e^{b(y-y^*)} - b(y - y^*) - 1}{b^2} \tag{2.7}$$

They deliver the non-conventional results that committed policy maker is not unambiguously preferred to his discretionary counterpart. Ruge-Murcia (2001) finds that the central banks in UK, Sweden and Canada weight more heavily positive deviations of inflation from the target than negative one.

The behavior of the central bank raises the issue of the public's uncertainty in relation to the "'type" of central bank (see, Backus and Drifill 1985; Ball,1995).The

[11] Kahneman and Tversky (1979) find that people tend to place more weight on future losses than on prospective gains in the decision process under uncertainty.

'type' is related to the preferences between inflation and output, or to the ability to commit to rules. The type can be classified as a "hawkish" with higher weight on inflation relative to the output or "dovish" with higher weight on output.The central bank's reaction function or "rule" describes its behavior and allows to analyze what are the implicit goals and the importance it assigns to different economic indicators. If the central bank (government) has a poor reputation, and her "self-perceived" type is not believed by the public, a credibility problem may arise.

2.2.2 Institutions and Credibility

Credibility of the central bank policy requires combination of several institutional features closely related to the central bank's independence and accountability (operational targets, appointment procedures, duration of governors mandate, incentive schemes of the executives, structural reorganizations of supervisory systems, etc). The set of institutional arrangements should be constructed in a way to reduce the costs of the commitment problem. The main goal is to establish a central bank, which is both credible, yields low inflation and maintains enough flexibility to respond to shocks in order to be able to pursue socially optimal monetary policy. The academic debate so far could not reach a unanimous conclusion about an optimal institutional mechanism to enhance credibility. There are two problems related to the theory of incomplete contracts - the inability to enforce commitment and the inability to predict the future state of the world (i.e. to know what will be optimal in the future). The role of the institutions, therefore, is to increase the costs of abandoning the pre-announced policy and to allow a leeway for "constrained discretion", by updating the policy goals.

The first of three main monetary policy institutional arrangements is related to the delegation to a conservative central banker with less weight on the output target. This incorporates a reputation cost as in the basic repeated game version of the Barro-Gordon model. The second option is to arrange institutional reforms in the form of explicit contracts between the central bank and the government. One possibility is the government to appoint an independent central banker who weighs inflation stabilization heavily[12]. Another possibility is to appoint a central banker with a contract including compensation penalty scheme, which raises the marginal costs of inflation. The third option is to establish targeting rules on the macroeconomic variables, which limit central banker's desire to inflate. Her credibility is judged by the ability to meet the target. Rules defined over some intermediate targets, such as the exchange rates, seem to be enforced in practice more strictly, than rules for other intermediate targets[13].

[12] Using the standard terminology the central banker are stylized being "hawk" or "dove" type (Siebert and Mihov, 2004), "wet" or "dry" type (see among others Backus and Drifil(1985), Muscatelli (1998)) or "strong" and "weak", Ball (1995) , etc. The classification is done on the basis of inflation and output (unemployment) stabilization.

[13] A problem that follows from the folk theorem is that there is no unique equilibrium between commitment and discretion. Credible monetary rules can, however, help to find an optimal solution. Thus, reputation is essential, given that there is incomplete information and the central bank's preferences are not directly observable.

A general conclusion is that by reducing principle's interference, central banks become more independent, private sector better estimates the preferences and hence the policy is more credible. The most of the work, so far, has been concentrated on the link between the central bank independence and the inflation rates in different countries. In general, there is negative correlation between central bank independence and the average inflation rates. Significant research has focused on developing escape clause models (among others Flood and Isard 1989, Obstfeld, 1991). Lohmann (1992) showed that certain institutional settings can lead to strong welfare increasing effects. She proposed that a conservative central banker should run monetary policy in normal times. In case of large shocks, the government might dominate the central bank if the latter does not stabilize inflation and output. This possibility enters into the society's loss function as a strictly positive and finite cost:

$$L_t = \frac{1}{2}\left[\left(\pi_t - \pi^b\right)^2 + \chi(y_t - y^*)^2\right] + \delta c \tag{2.8}$$

with δ being a binary variable taking values 1or 0. McCallum (1995) however, doubts that punishing the central bank and closely monitoring it by the government solves the dynamic inconsistency problem. Rather, it reallocates the problem from the central bank to the government. Lohmann's model is interesting from institutional point of view because it requires unlimited credibility granted by the private agents to the government, and not to the institutions set by the government[14].Also the inflation targeting can be a type of an optimal contract. Another problem, related to the monetary policy rules is that they cannot take into account the unexpected shocks, which are one of the main reasons for inflation .

Committing central bankers to low inflation targets (and thus removing the inflation bias) reduces their ability to respond to stochastic shocks. Hence, there is a trade off between short-term credibility benefits, based on commitment to rules and limited discretion, and the long-term costs, which may arise if rules are not optimal anymore and discretion is required. This trade off is related to uncertainty and has an impact on which instruments are chosen, and how actively they are being used. Goodhart (1993) points another key aspect of the principle-agent relations:

> "...the Governments have never been willing to delegate to their Central Banks the right to take the strategic decisions on the exchange rate regime [...] Central banks have one major instrument, their ability to vary interest rates. As a generality this cannot be used to hit two objectives simultaneously, e.g. an external objective for the exchange rate and an external objective for price stability, except by a fluke."

It is well accepted, that financial markets have multiple equilibria, and economy passes through different levels of credibility (or devaluation expectation) (see also Jeane

[14]Such solution may lead to multiple equilibria and thus be destabilizing (see Obstfeld, 1991)

and Masson, 2000). Devaluation expectations shifts are exogenously driven by uncertainty (i.e. sunspots) and play an important role in generating cyclical fluctuations. This means that with time monetary rules can become sub-optimal because incentives change, and the expected policy rules cannot update through learning and past experience. Hence, there is clear inconsistency between on the one hand optimizing monetary policy through learning, which requires flexibility, and on the other hand gaining credibility through commitment by fixed rules.

Persson and Tabelini (1993) discuss a specific problem related to the "second best institutional design", namely a central bank governed by legislative rules, or by targets set up by the government. They propose two types of institutions that may help to resolve the incentives problem a) legislative approach - to create by law an independent central bank, (an example is the Deutsche Bundesbank) and b) targeting approach - imposes explicit inflation targeting. They conclude that building credible monetary policy institutions is a slow process, because credibility and reputation require clear objectives and long term commitment. Such commitment needs sufficient reputation as part of the institutional structure of the central bank.

Further theoretical developments concentrate on a comparison between backward- and forward-looking rules, as well as rules with interest rate smoothing. The most popular simple rule, due to Taylor (1993), was designed for a closed developed economy, without taking into account the exchange rate transmission mechanism (2.9).

$$i = r + \pi_t^* + \beta(\pi_t - \pi_t^*) + \alpha(y_t - y_t^*) \tag{2.9}$$

A Taylor rule is an instrument rule for setting the interest rate, as a function of inflation and output gap. It assumes that the central bank reacts to the deviation of inflation and output from the target. It describes how short-term interest rates could be adjusted in a systematic way to keep inflation close to the target. The original Taylor rule comprised a feedback parameter of 1.5 on inflation and 0.5 on the output gap. The conclusions of the mainstream economic literature is that the Taylor rule has characterized very well the behavior of the FED and the other central banks in the developed countries. The empirical estimations proved to be robust and conformed that in most of the time the inflation or output gap deviations from the target level were stabilized. The main open economy alternatives are a rule by Ball (1999), based on a Monetary Conditions (MCI) and the Monetary Financial Conditions Index (MFCI).

2.2.3 Monetary Policy Rules in Central and Eastern European Countries

The literature on monetary policy rules has grown substantially in the last two decades resulting in vast volume of papers. The research on monetary policy rules in emerging markets and transition countries, compared to developed countries, however is parsimonious. The main reasons are that on the one hand very little research has

been done on monetary policy rules in transition countries and on the other hand findings often changed from study to study, depending on the data, the time period and the model specification. Therefore there is not agreement between researchers on the estimation of the monetary policy rules in transition countries. Some of the reasons for the controversy in these studies are as following: low level of maturity of the financial markets; pegged exchange rate strategies adopted by most of the transition countries; the process of transition itself related to changes in the economy as a whole and in the monetary policy in particular; model specification difficulties and data problems. Nevertheless the recent research confirmed that in practice central banks in transition countries do follow some sort of fixed rules in response to macroeconomic shocks. Instead of assigning coefficients, the current theoretical models estimate weights for the reaction function. Estimating monetary rules is very important for economies, which have often faced high inflation and large exchange rate volatility. In the light of the future euro adoption, countries have simultaneously to fulfil all the convergence criteria and to meet all the challenges related to participation in the ERM II. The first question to address for transition countries is whether the central bank follows a contemporaneous (or an outcome-based) policy rule or whether the central bank follows a forward-looking (or a forecast-based) policy rule. When the central bank uses a contemporaneous policy rule, there is a problem of data uncertainty. Ex-post data which is typically used in econometric estimations is often revised several times so that it does not reflect the information at the time when the interest rates are set. Real-time data solves this problem. Orphanides (2001) finds that traditional exchange rate models consistently perform better using original release data, than using revised data. Unfortunately, it is rarely available as time series, and therefore it has to be constructed from the press releases of the statistical offices.

The other main open economy alternatives, (for example, the rule by Ball (1999) based on a Monetary Conditions Index (MCI)), may perform poorly in the face of specific types of exchange rate shocks and thus cannot offer guidance for the day-to-day conduct of monetary policy. Therefore at present we only have a choice of ignoring the exchange rate channel of monetary transmission (Taylor rule) or including it in an ad hoc way that may not always prove right (MCI-based rules) for transition economies. Based on the above considerations and on the behavior of the central banks in the advanced countries, we assume that preferences of the CEE central banks are dependent on the likelihood of a recession. If the economy is in an expansionary phase, the central bank will react more to inflationary pressure, than in recession. The minimization of the loss function leads to two-state Taylor rule.

$$L(\pi, y) = \left\{ \begin{array}{l} \alpha(\pi - \pi^*) + (1-\alpha)(y - y^*) \\ \beta(\pi - \pi^*) + (1-\beta)(y - y^*) \end{array} \right\} \tag{2.10}$$

where in the case of $\alpha > \beta$, the state variable $\mathsf{S_t}$ which follows a Markov process is in expansion and alternatively in the case of $(1-\alpha) < (1-\beta)$ the state variable $\mathsf{S_t}$ is in recession. This is the base specification of the Markov-switching model, where one regime is anti-inflationary, while the other one allowes higher weights on the output

stabilization and where the switching between regimes occurs with certain probability and have certain persistence.

2.3 Markov Regime-Switching VAR Model

Macroeconomic time series often undergo significant changes and breaks in their behavior, due to financial crises or government switches (Hamilton 1989, Sims and Zha 2004), which is the case in transition countries. The hypothesis, that shocks to the economy have larger effects during different regimes, implies that aggregates should be modeled in a non-linear framework. Moreover, theoretical models based on asymmetric central bank preferences imply a time varying reaction of monetary authorities to economic variables. Therefore, Markov regime switching VAR (MS-VAR) approach is an adequate and consistent instrument to assess the transition probabilities of the information variables . The model is useful for its flexibility, as well as in describing variables that follow different time series process over different sub samples [15] This class of models provides possibility to estimate VAR models with changes in the regime. Such changes are also predominant for the financial data where Markov-switching models capture the volatility dynamics (Haas, Mittnik and Paolella, 2004). In a specification, subject to changes in the regime, the parameters θ of VAR can vary through time. But the process s_t may be time invariant depending on the unobservable regime variable. If $m \in \{1, ...M\}$ is the number of regimes, then the *pdf* of the time series vector y_t is given by:

$$p(y_t \mid Y_{t-1,}s_t) = \left\{ \begin{array}{c} f(y_t \mid Y_{t-1,}\theta_1) \quad \text{if } s_t = 1 \\ \vdots \\ f(y_t \mid Y_{t-1,}\theta_M) \quad \text{if } s_t = M \end{array} \right| \tag{2.11}$$

where θ_m is the VAR parameter vector and Y_{t-1} are the observations. The time series vector y_t is generated by the vector autoregressive process of order p given by:

$$E\left[y_t \mid Y_{t-1,}s_t\right] = \nu(s_t) + \sum_{j=1}^{p} A_j(s_t) y_{t-j} \tag{2.12}$$

where the innovation $u_t = y_t - E\left[y_t \mid Y_{t-1,}s_t\right]$ is assumed to follow a Guassian process $u_t \sim NID(0, \sum(s_t))$. The change in the regime itself can be regarded as a random variable (see Hamilton, 2003). MS-VAR allows to test whether macroeconomic variables affect the transition between different levels of credibility over different time series

[15] MS-VAR belongs to class of models that transfer a non-linear data generating process to be linear in each regime. Detailed studies on MS-VAR include also Krolzig (1997), and Clements and Krolzig (2002,2003).

sub-samples. Their path depends on unobserved stochastic state variables, thereby enabling the unobserved component to follow a Markov chain. Another advantage is that specification co-movements between macro aggregates can be better estimated by using MS-VAR. Jeane and Masson (2000) argue that in sunspot equilibrium the economy passes through different states of devaluation expectations, each having own threshold where the currency crisis could be foreseen. Transition across the devaluation expectations is governed by an unobserved state variable $\mathsf{S_t}$ which follows first order Markov process. The general specification takes form:

$$y_t = \nu(s_t) + A_1(s_t)y_{t-1} + ... + A_p(s_t)y_{t-p} + u_t(s_t) \tag{2.13}$$

which can be reformulated as the mean adjusted form of a VAR model

$$\begin{aligned} \Delta y_t - \mu(s_t) = A_1 \left[\Delta y_{t-1} - \mu(s_{t-1})\right] + A_2 \left[\Delta y_{t-2} - \mu(s_{t-2})\right] ... \\ . + A_p \left[\Delta y_{t-p} - \mu(s_{t-p})\right] + \sum u(s_t) \end{aligned} \tag{2.14}$$

where $y_t = (y_{1t}...y_{nt})$ is n dimensional times series vector, μ is the regime dependent vector of intercepts $\mu = (I_k - \sum_{j=1}^{p} A_j)^{-1}$, $A_{1..p}$ are matrices with autoregressive parameters, s is the state variable which controls the switching between different states and u is the white noise process with $N[0, \sum(s_t)]$[16]. The conditional mean $\mu(s_t)$ switches between the two states:

$$\mu(s_t) = \left\{ \begin{array}{l} \mu_1 > 0, s_t = 1 \\ \mu_2 \leq 0, s_t = 2 \end{array} \right\} \tag{2.15}$$

where state 1 is the high credibility (low volatility) state and the state 2 is the low credibility (high volatility) state. Thus, we take into consideration that the impact of the output gap and the inflation on the monetary policy preferences is regime dependent. The transition probability p_{ij} that the current regime s_t depends only on the regime one period ago and event i will be followed by event j is given by $P\left\{s_t = j/s_{t-1} = i, s_{t-2} = k..., y_{t-1}, y_{t-2....}\right\} = P\left\{s_t = j/s_{t-1} = i\right\} = p_{ij}$. This is an example of a Markov chain where the probability P a random variable s to be equal to some particular value j depends on the most recent past value s_{t-1}. The same presented in a transition matrix form

[16] The dynamic response of the regime shift in the intercept term is equivalent to a shock in the white noise process $\mathsf{u_t}$

$$P = \begin{bmatrix} p_{11} & p_{21} & \cdots & p_{N1} \\ p_{12} & p_{22} & \cdots & p_{N2} \\ \cdots & \cdots & \cdots & \cdots \\ p_{1N} & \ldots & \cdots & p_{NN} \end{bmatrix} \tag{2.16}$$

with $\sum_{j=1}^{N} p_{ij} = 1$ where $i = 1, 2....N$ and $0 \leq p_{ij} \leq 1$.

The process of regime generating is assumed to be a two state hidden Markov chain where p_{12} is the probability to switch from high credibility state to low credibility state and p_{21} is the probability to switch to high credibility state. If the macroeconomic variables are subject to shifts in the regime, the mean and other variables will vary with the state S_t. Maximum likelihood estimation of the model is based on the Expectation Maximization (EM) algorithm proposed by Hamilton (1989), which first estimates smoothed probabilities of the unobserved state, and then conditional regime probabilities are replaced with the smoothed probabilities. This technique (referred to as expectation and maximization step) produces by iteration new joint distribution that increases the probability of the observed data.

This section employs the heteroscedastic bivariate Markov switching VAR (MSMH (2)-VAR(3)) model[17]. We test the credibility of monetary policy of central banks in eight Central and Eastern European countries (Czech Republic, Hungary, Poland, Lithuania, Slovenia, Slovakia, Croatia, Romania) for the period 1994 - 2004. The paper follows the methodology and is consistent with the work by Dahlquist and Gray (2000) and Mouratidis (2003). These studies investigate the probability to switch across two regimes of low and high credibility during the EMS period as a function of certain macroeconomic variables - interest rate differentials, exchange rate in a band, output gap variability and inflation variability. Based on their methodology, we evaluate the preferences of the central banks in the euro area candidate countries over the conduct of monetary policy. Chosen monetary policy concerns stabilization of the output-gap variability, or of the inflation variability in the period before joining a monetary union. The results derived in the paper allow a comparison of the preferences of the EMS central banks on the basis of the results, reported by Mouratidis (2003). Asymmetry will imply that transition countries have not been integrated economically. If this is so, the preferences of the median voter may not be captured by the ECB regarding the formulation of the monetary policy. This will imply pressures for different voting schemes once these countries become fully fledged members of the euro area.

2.3.1 Data

The study uses the International Financial Statistics (IFS) database. The three aggregated series are industrial production (IP), taken from line 66, consumer prices index

[17]The first bivariate MS-VAR model was analyzed by Phillips (1991). Filardo and Gordon (1994) have extended it to the three-variety case using leading indicators to predict the turning points.

(CPI), line 64 and money market rates (IR), line 66b for the eight Eastern European countries (Croatia, Czech Republic, Hungary, Lithuania, Poland, Romania, Slovakia and Slovenia) and Germany . The choice of Germany is justified by the fact that it was the leading country in the EMS and other members were following its monetary and exchange rate policy. The data consists of monthly observations and covers the period from 1994:1 to 2004:6 (see Table 2.1)

IP, CPI, IR are seasonally adjusted by the additive moving average method. The annualized inflation and the output-gap are measured using the twelve order difference (IP-IP_{12})/IP_{12} and (CPI-CPI12)/CPI_{12}. These measures are used mainly because central banks concentrate on the annual inflation rate. The output gap series have been measured assuming a random walk plus drift process. In order to achieve stationary we take the natural logarithm of the time series. We also experimented with a model with one lag, but we found that the value of the likelihood function increases when three lags are used. Therefore, the preferred bivariate model is with three lags and two regimes. Moreover, the non-linear specification of the bivariate VAR yields a higher maximum likelihood function for each sample country than the linear VAR does. It measures the goodness of fit for the maximum likelihood estimator, which represents the value of the model's parameters most likely to have been observed. The normal Likelihood Ratio (LR) test does not apply here, because of the existence of nuisance parameters. The LR test statistics is compared to where the degrees of freedom r and n are the nuisance parameters. In all sample countries, the LR test statistic exceeds the critical value, thus the null hypothesis of linearity has been rejected at high significance levels. As a result, the non-linear regime switching specification is more appropriate compared to the conventional linear approach.

The specification of the two state Markov switching model is given as an extension to a vector autoregression in the following form:

$$y_t = \nu + A_{11.i} y_{t-1} + \sigma_i u_t \quad \text{with } y_t = \begin{bmatrix} i^H & i^G \\ & x_t \end{bmatrix} \tag{2.17}$$

where y_t and x_t denote either inflation variability or output variability. Equation (2.18) also can be re-written in a matrix form as:

$$\begin{bmatrix} \left(i^H - i^G\right)_t \\ x_t \end{bmatrix} = \begin{bmatrix} \alpha_{11.i} & \alpha_{12.i} \\ \alpha_{21.i} & \alpha_{22.i} \end{bmatrix} \begin{bmatrix} \left(i^H - i^G\right)_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} \sigma_{11.i} & \sigma_{12.i} \\ \sigma_{21.i} & \sigma_{22.i} \end{bmatrix} u_t \tag{2.18}$$

where u_t $NID(0, I_n)$, σ_{it} denotes the square root of the variance-covariance matrix in regime $i = 1, 2...n$, A_{pi} is the $(m \times m)$ matrix of autoregressive coefficients with $p = 1, 2..j$ lags and i^H is the interest rate at the home country and i^G is the interest rate in Germany.

2.3.2 Empirical Results

This section presents the results of the Markov switching model specification MSM (2)-BVAR(3) . We test the probability to switch between regimes as a function of some macroeconomic variables. We study the variability of the interest rate differentials between each country and Germany as the benchmark case [18]. The size of the differentials reflects the risk premium for the domestic central bank to deviate from the target interest rate. It also reveals the central bank's preferences concerning growth and inflation stabilization. Asymmetries in the preferences are due to different weights on the inflation and output gap in the national welfare function, as well as to structural differences and country specific shocks. By assumption, analyzed countries follow two different regimes of credibility throughout the estimated period - high credibility regime and low credibility regime, where high credibility regime is characterized by expansion. The probability of regime switching is a function of inflation and output gap. Also the operability of transition between regimes and inflation variability/output-gap variability depends on the current regime. In the estimation, we use the variables in the transition probability, first to test whether they are significant, and second to investigate the preferences of the central bank regarding the stabilization of the output-gap variability or the inflation variability.

High credibility regime: In the case of significant inflation variability, interest rate differentials will be high and monetary authorities will react to stabilize inflation[19]. If output gap variability is stronger, then monetary authorities will stabilize output. The credibility depends not only on the significance of these variables in the transition probabilities, but also on their signs. If both variabilities are significant with the same sign, we compare the size of the coefficients in order to derive conclusions regarding the central banks preferences. When the interest rate differential is in the high credible regime, then an increase of inflation variability reduces the credibility of monetary authorities, and therefore increases the probability to switch to a low credible regime. A negative coefficient implies that with high variability of inflation, the transition probability decreases[20].

Low credibility regime: The low credibility regime is associated with recession due to high inflation expectations. The variability is high and the central bank has incentives to deviate from the common monetary policy. The output gap can be expected to be significantly influencing interest rate differentials. In this case, high inflation variability, reduces the probability to switch to high credibility regime. If output is significant, monetary authorities put more emphasis on output stabilization, and the opposite is

[18] According to Drazen and Masson (1995) interest rate differentials provide a good proxy for the expected devaluation and for the lack of credibility of fixed parities.

[19] Small output variability in the high credibility regime might be due to the absence of shocks. In expansion, inflation expectations are low (as well as incentives to inflate), which results in higher economic growth.

[20] Clarida at al (1999) explains that such states are a consequence of high credibility. The central bank is able to convince the agents that in the case of supply shocks inflation will not increase. This reduces inflation expectations, thus lowering the probability to switch between regimes.

true if inflation is significant. If both are significant, central bank preferences depend on the relative size of the coefficients.

Table 2.2 presents equations estimated with respect to the output gap and the interest rate differential. It combines statements about the durability of a regime for a certain outcome at date t with information on its probability. The reported transition matrices and the regime duration make it clear that the credibility regimes in transition countries are characterized by different degrees of persistence. A general observation is that the high credibility state has lasted much longer for almost all transition countries, concerning the output gap. This indicates that the central European countries have put more emphasis on the objective of stable output from its trend than inflation from its target. Notable exceptions are Romania and Croatia, where the low credibility state lasted longer during the period 1994-2004. For Romania and Croatia the output gap variability is significant in all states. The results show that the probability to stay in the high credibility state was the highest for Slovenia. Romania has the lowest probability to switch from the high credibility state to the low credibility state, and the highest probability to stay in the low credibility state. Romania had a high probability to switch from high to low credibility state. The low transition probability of Croatia suggests that there were no significant changes of the regime. Moreover, there are differences between countries that are already EU members and the candidate countries - Romania and Croatia in the last months before and after EU accession.

Table 2.3 shows the equations estimated with respect to the inflation and the interest rate differential. In Hungary the output gap is significant, but not the inflation in the high credibility state. This is probably due to the high inflation experienced by Hungary during the researched period, and the speculative pressure on the Hungarian forex market, which decreased the transparency and accountability. Poland and Hungary have the highest probability to stay in the low credibility state. In the case of Romania, inflation has a significant effect on the interest rate differentials while the output gap was not significant. An important characteristic of the bivariate specification is that relative to the univariate specification it captures the temporal persistency for the low credibility state stronger. Transition probabilities point out an expected duration of 15.12 months for the high credibility state and 2.97 months for the low credibility state in Germany. The results show that Germany enjoyed high credibility during the researched period. At such circumstances, the central bank can stabilize inflation without increasing output variability. Expected durations for Romania are 1.39 months for the high credibility state and 10.16 months for the low credibility state. Figure 2.1 gives graphical representation of the smoothed and filtered probabilities of the high and low credibility regimes for industrial production (IP) and interest rate differential (IR) in different countries.

Hungary, Czech Republic and Poland display highly persistent upswings in the high credibility state concerning output-gap stabilization. Romania displays persistent downswings in the low credibility regime. We also have estimated the fit for the MSMH(2)-VAR(3) model with filtered and smoothed probabilities of the high credibility regime (regime 1) and the low credibility regime (regime 2) for inflation (CPI) and interest rate differential (IR) in various countries. The results show that smoothed

probabilities determine longer periods with recession for Poland, Slovakia and Hungary. It can be seen that most of the transition countries did not aim to stabilize inflation during the researched period.

A conclusion could be made that the monetary policy in transition countries was more directed to correct deviations of the output from its trend than inflation from its target.High credibility regimes lasted longer for almost all CEE countries with respect to the output gap than with respect to inflation. Also calculated smoothed probabilities for the high and low credibility regimes for inflation reveal that most of the transition countries did not aim at stabilizing inflation.

The results show that the monetary policy in CEE was not in line with the objective of price stability followed by ECB. Our findings can be compared with those reported by Mouratidis (2003) for eight EMS countries. His findings suggest that monetary authorities in all former EMS and currently Euro zone countries put more weight on the deviation of inflation from its target, than on the output gap. Therefore, it is arguable to what extent transition countries will be able to follow the ECB objective of price stability. The need for further structural reforms in the new EU members can put strong pressure on the ECB, once they join the monetary union, thereby undermining its credibility. Economic costs are likely to increase as a result of the aforementioned heterogeneity.

The results show, however, that there is convergence in the monetary policy objectives with those of ECB during the last years, when the EU accession was envisaged. This supports the argument that incentives matter for transition countries. Results help in understanding the determinants of the central banks policy during transition.

2.4 Conclusion

This paper examines the stabilization policy of the central banks in eight Central and Eastern European countries. We have investigated the issue of credibility, based on the trade-off between inflation variability and output gap variability. The chapter employs a Markov switching VAR model for empirical analysis of this questions. Based on time series data, we test the probability of changes in credibility through time as a function of inflation and output gap. The results show that there are different groups of countries among CEE, concerning their credibility. In general, monetary policy followed by the CEE countries during the ten years before becoming EU members, was not consistent with the objective of price stability, introduced by the ECB. In the latter case, monetary authorities had put more weight on the output gap stabilization, than on the deviation of inflation from the target. These are due to either different preferences concerning the monetary policy or to different economic structures, and different degrees of credibility. These findings differ from results reported for the EMS countries, concerning the same period. The result underlines the structural differences and asymmetries between the new EU members and the euro area. Nevertheless, we also find a convergence in the stabilization preferences during the last years before EU

accession. The results show that there is convergence in the monetary policy objectives with ECB during the last years when the EU accession was envisaged. This implies that for the new EU members gaining monetary and fiscal credibility - apart from importing it – is a gradual process, which can be expected to develop, and thereby reduce possible heterogeneity before the euro adoption.

Part III

Real Appreciation and Oil Prices in Russia

Chapter 3

"Dutch Disease": Does Russia Have the Symptoms?

3.1 Introduction

Russia is one of the world's primary producers of oil and gas after the United States and Saudi Arabia. The country is estimated to hold between 6 and 13 percent of the world's proven crude oil reserves, and around 30 percent of the proven gas reserves. The dramatic increase of the world oil prices since 1999 have boosted Russian oil exports. Crude oil, oil products, and gas together account for roughly 50 percent of Russia's total export revenues, and for some 20 percent of Russia's Gross Domestic Product (GDP).

Despite of the current high world market oil prices, which bring significant revenues, growth has dramatically slowed down. From 1995 to 1998, oil prices were relatively low, and Russian GDP growth was largely negative. While growth became briefly positive in 1997, it plunged again in 1998 as a result of the Russian financial crisis, which coincided with a large drop in oil prices. Following the crisis, both oil prices and Russian growth rates recovered quickly. During the period 2000-2004, Russia boasted GDP growth rates of around 7 percent, current account surpluses of 11 percent, and fiscal surpluses of 2.5 percent on average. Given Russia's dependence on oil and gas, it does not seem surprising that there is a close relationship between oil prices and Russian growth (Figure 3.1). Nevertheless, Russian growth has recently slowed, suggesting that the relationship between Russian growth and oil prices is breaking down. In both 2003 and 2004, Russia's gross domestic product (GDP) still grew by 7.25 percent - sufficiently fast to fulfill the goal of doubling GDP in ten years. However, GDP growth has decelerated sharply since the middle of 2004, and the Ministry of Economics projects 5.9 percent growth for 2005 as a whole, in spite of the fact that oil prices have continued to soar and are projected to grow by more than 50 percent in 2005 [1]. If these projections materialize, this would constitute a clear break in the high

[1] The year-on-year GDP growth rate slowed from 7.5 percent in the first half of 2004 to a provisional 5.5 percent in the same period of 2005. Additional possible reason for this slowdown may be the

correlation between oil prices and Russian growth observed during the previous decade. Given these stylized facts, the question arises as to whether Russia may be suffering from a "natural resource curse." The notion that there may be such a curse is based on the empirically robust finding that resource-rich countries, on average, experience lower growth rates than resource-poor economies (Sachs and Warner, 1995, 2001). This finding has led economists to conclude that the "blessing" of natural resource abundance may, in fact, turn out to be "cursed."

One possible explanation for the natural resource curse is that the large and often unexpected windfall revenues from natural resources tend to give rise to rent-seeking behavior and a fight over the distribution of these revenues. Such a fight appears to be very much present in Russia today.

While most observers would agree that rent seeking has played a role in Russia, this chapter focuses on another explanation for the natural resource curse, i.e., Dutch Disease. Briefly summarized, the Dutch Disease hypothesis states that the windfall revenues resulting from an increase in natural resource prices, or from a discovery of new natural resources, give rise to real exchange rate appreciation, which, in turn, hurts the competitiveness of the manufacturing sector.

This chapter contributes to the debate by carefully defining the symptoms of Dutch Disease, and then testing whether the Russian economy has the symptoms. We first provide a literature review, where we explain the link between Dutch Disease and the natural resource curse. We then test for the main symptoms of Dutch Disease, which include (i) a slowdown in manufacturing growth, (ii) an increase in the overall wage level, and (iii) real appreciation. Concerning the latter, we investigate whether oil prices were a main determinant of the observed real appreciation, after controlling for other real exchange rate determinants, such as the productivity differential, government consumption, net international reserves, and corruption.

3.2 Explaining The Natural Resource Curse

The "natural resource curse" hypothesis states that resource-rich economies grow slower, on average, than resource-scarce countries. This hypothesis is based on the observation that many resource-rich countries, such as Nigeria, Venezuela, Angola, and Ecuador, have failed to prosper during the past few decades, while resource-poor societies in Asia have enjoyed rapid economic growth. In a well-known paper, Sachs and Warner (1995) report a robust negative relationship between real GDP growth per capita and the ratio of resource exports to GDP in a sample of 97 developing countries during the period 1970-1989. They find that this negative relationship holds up for a variety of measures of resource abundance, and even after controlling other possible growth determinants, such as initial per capita income, trade policy, government effi-

existence of capacity constraints (Oomes and Dynnikova, 2005).

ciency, and investment rates [2]. Following the methodology of Sachs and Warner and extending their basic chart to the year 2000, we still find a clear negative relationship between the share of primary exports in GDP in 1971 and GDP growth (Figure 3.2)[3].

Vast literature is looking for explanations of the differences in growth rates. Natural resource abundance poses a difficult macroeconomic challenge to policymakers. Yet, for many countries, in the long run, the "blessing" of the resource fortune turns out to be cursed. The positive externalities of the newly discovered wealth are replaced by excess inflation, unemployment, and loss of competitiveness. Sala-i-Martin and Subramanian (2003) find empirically robust non-linear impact of poor institutions on growth in the resource-rich societies. On the example of Nigeria, they argue that political reasons, mainly corruption, are to blame for the poor long run growth[4]. Indeed, there are exceptions among resource-rich countries (for example Botswana and Indonesia), which achieve rapid development and stable growth, despite of the adverse effects, attributed to the resource revenues[5]. Among the reasons for their success are prudent macroeconomic policy, hard budget constraints and reduction in the government debt burdens (Acemoglu, at al. 2001).

Nonetheless, large flow of resource revenues allows the national government to stretch beyond its means, as well as to reduce the role of the private business. Corruption and misrule constraint market forces to operate without interference, resulting in serious misallocation of resources. Finally, the lack of forward saving policy fails to counteract pro-cyclicality of the government spendings. In summary, numerous studies have given several explanations for the poor growth performance of the resource dependant countries: (1) socioeconomic reasons – (i.e. ethnical diversity, insufficient infrastructure) (Easterly and Levine, 1997), (2) government policies and distortions (Barro,1997), (3) institutions (Knack and Keefer, 1995, Hall and Jones, 1999, Rodrik, 1999), (4) geographical factors (Bloom and Sachs, 1998) (5) political instability (Alesina et al. 1996), (6) inequality (Alesina and Rodrik, 1994, Persson and Tabellini, 1994).

Yet, theoretical studies have focused on three main explanations for the natural

[2]Sachs and Warner (2001) show that the negative relationship also holds up when controlling for omitted variables, proxied by lagged growth rates. They therefore conclude that the natural resource curse is not just a statistical mirage that results, e.g., from the fact that natural resources may be the only surviving sector in countries that have grown more slowly for other reasons. Similar empirical results are reported in Gylfason and others (1999). In addition, Gylfason (2004) finds that natural resource dependence is negatively correlated with trade, foreign investment, domestic investment, equality, political liberty, education, and financial depth.

[3]Primary exports are defined as the categories "non-fuel primary products" and "fuels" in the United Nations Comtrade database.

[4]From 1965 to 2000 Nigeria has accumulated oil revenues of US$350 billion at constant 1995 prices. Nevertheless, the population living with less than one US$ per day have increased from about 36 percent in 1970 to just under 70 percent in 2000. Sala-i-Martin and Subramanian (2003) provide evidence that waste rather than Dutch Disease is the explanation for the Nigeria's poor performance.

[5]Botswana has averaged annual economic growth of 8.7% over the past 30 years. Isham et al (2003) provides excellent detailed country-case study, emphasizing the endogenously driven differences in the institutional capacity to manage shocks, being detrimental for growth.

resource curse – one political and two economical. The first explanation is that natural resource wealth gives rise to rent-seeking behavior. The second explanation is that natural resource dependence implies terms of trade volatility. The third explanation is that of Dutch Disease.

3.2.1 Rent-seeking

Political approach studies the political determinants of the slower growth. Weaker economic growth performance is explained by a political economy rent seeking behavior (Lane and Tornell, 1996, Mauro, 1995, Auty, 2001). The argument here is that the large rents that can be obtained from natural resources create incentives for governments and private agents to engage in rent-seeking behavior, "voracity"[6], corruption[7], or even civil conflict[8], thus crowding out of entrepreneurial activity and other pro-growth activities. Incentives for rent seeking arise because it may be more beneficial for agents to engage in unproductive activities (e.g., corruption, conflict) to appropriate the existing wealth, than it is to engage in productive activities to create wealth. Countries rich of natural resources benefit from of easy earned funds, and base their investment decisions on bright terms of trade assumptions. They spend the resource revenues to finance current consumption and do not take into account the uncertain future developments. However, such economic behavior has strong political grounds –alleviating the social pressure, merging the interest of certain political groups and lobbies, granting political votes. Due to political incentives public oil revenues are spent on social projects, inefficient investment, or subsidies of inefficient industries. In addition, the fight over the resource revenues between the private and the public sector leads to higher uncertainty and worse investment climate. Hausmann and Rigobon (2003) argue that the presence of common-pool problems or uncertainty related to property rights over the resource income leads to inefficient fights over existing resources and, thereby, may generate lower growth. Sala-i-Martin and Subramanian (2003), who call this the "institutional impact of natural resources," find empirical evidence that some natural resources (in particular, oil and minerals) exert a robust negative and nonlinear impact on growth via their deleterious impact on institutional quality. In a similar study, Isham and others (2003) find that countries that export fuels, minerals, plantation crops, and coffee or cocoa do worse across an array of governance indicators, even when controlling for other potential determinants of governance.

[6]The voracity effect, coined by Lane and Tornell (1996) and Tornell and Lane (1999), refers to a more-than-proportionate increase in fiscal redistribution following a terms-of-trade windfall.

[7]On corruption, see, e.g., Mauro (1995) and Leite and Weidmann (1999). Gylfason (2004) finds empirically that natural resource dependence is positively related with corruption.

[8]Collier and Hoeffler (2002) find a strong and nonlinear effect of the share of natural resources in GDP on the probability of civil conflict in a country.

3.2.2 Volatility

A second explanation for the natural resource curse is that resource rents tend to be volatile. This volatility arises, in part, from the fact that natural resources typically have low price elasticities of supply. Volatility, in turn, has been shown to be negatively correlated with growth (Ramey and Ramey, 1995) and investment (Aizenman and Marion, 1999), including investment in education (Flug, Spilimbergo, and Wachtenheim, 1996). Hausmann and Rigobon (2003) explain this negative effect on growth by the volatility of real exchange rates, the government spending, as well as the level of intra-industry trade. Large non-tradable sector makes relative prices stable even though the resource sector generates significant demand volatility for nontradables. However, the smaller the manufacturing sector, the more difficult it becomes for the economy to absorb shocks by labor mobility. If the country looses its non-resource tradable sector, the economy becomes much more volatile, because demand shocks for nontradables will not be accommodated by movements in the allocation of labor[9]. In the extreme case, if the oil sector does not employ any labor and the manufacturing sector disappears, all shocks will have to be absorbed by expenditure switching and unemployment, implying increased volatility, which, as argued above, implies lower growth under financial market imperfections.

3.2.3 "Dutch Disease"

The third explanation is that of "Dutch Disease"[10]. The definition of the term refers to a decline in the tradable export industries (de-industrialization) due to a temporary boom in the resource sector, caused by an increase in the resource prices or by technological progress[11]. The Dutch Disease hypothesis, going back to Corden

[9] The main findings in the paper are that (i) nontradables specialization increases relative price volatility. (ii) due to financial frictions the economy further specializes which reduces the tradable sector. (iv) such specialization also reduces the investment in nontradables. As a result, the economy will face higher cost of capital and low welfare.

[10] The asymmetric shock, which plagued the Netherlands and the fear that similar symptoms could spread to Britain were first reviewed by the magazine "The Economist" in 1977 under the term "Dutch disease". The term described how the windfall gas revenues paradoxically caused recession between 1970 and 1977 in the Netherlands. Two contradictory developments took place at the same time - strengthening the external position but harming the national economy. The guilder appreciated by 16.4% and the current account surplus reached nearly $2 billion per year within 1972-76. At the same time unemployment increased from 1.1% to 5.1% and employment in the manufacturing industry fell by 16%. In addition, exploration led to relatively high productivity growth in the energy sector but the wage inflation and the public expenditures also grew rapidly. Wages in the non-energy sectors rose as well, but these were not corresponding to higher productivity growth. The rise in the unit labor costs boosted inflation and resulted in a wage-price spiral. In addition, the windfall revenues for the government were spent on improvements of the social security system. The natural gas revenues had contracting effect on the competitiveness of the manufacturing sector and the other export-orientated industries. When the gas prices fell and the gas deposits started gradually to diminish, the Netherlands went into deep recession.

[11] Although most likely, the booming sector is related to the natural resources, it is not always necessary the case. Dutch Disease can be caused by a high volume of foreign exchange inflows in the

(1982) and Corden and Neary (1984), implies that an exogenous increase in resource prices or in resource output (for example, resulting from the discovery of new natural resources, as in the original Dutch case that gave the disease its name) results in real exchange rate appreciation and a decline in the manufacturing sector. It is not obvious, however, that Dutch Disease can, indeed, explain the natural resource curse. During times of high oil prices, it is only natural, and in fact optimal, for resources to move out of the manufacturing sector, and into the oil and services sectors. If oil prices were to stay high forever, it may well be optimal to specialize in oil and eliminate the manufacturing sector altogether. So why would de-industrialization and specialization in oil lead to lower growth? One reason why Dutch Disease may lead to lower growth is that manufacturing sectors tend to be more competitive and innovative than other sectors. Manufacturing companies produce tradable goods for the domestic market and for exports. Their prices are determined on the international markets. First, due to the absence of large rents, manufacturing firms typically are less concentrated and face more competition than natural resource firms, which improves their efficiency. Second, due to the nature of manufacturing process, there is more scope for technological progress in manufacturing, than in resource extraction or in services. Finally, there tend to be vertical and horizontal spillovers from technological progress in manufacturing. As a result, even a temporary contraction in the manufacturing sector can have permanent effects on growth[12]. Moreover, governments may protect industries that are inefficient and otherwise may contract, which leads to resource misallocation and lower growth. If manufacturing sector is crowded out, and there are no incentives for the resource sector revenues to be invested productively, the social welfare is reduced and growth may slow down.

Since 1960, the rate of technological change worldwide has been much higher in manufacturing than in other sectors. In order to keep the competitive edge on the other producers, manufacturing companies have higher incentives to invest in innovations. In case of "deindustrialization", the economy loses the gains stemming from horizontal and vertical technological spillovers. In addition, companies cannot take advantage of learning-by-doing effects and lose incentives to diversify and develop new products. Krugman (1997) shows theoretically, that if industries are crowded out (move abroad), it is difficult to bring them back and restore the equilibrium, once the favorable conditions for raw material exports are exhausted.

Corden and Neary (1984) find that the natural resources in the long run cause lower

form of international aid or loans. Younger (1992) shows on the example of Ghana, that since the government is the recipient of these loans, it can increase the aggregate domestic demand and crowd out the private manufacturing sector.

[12]In a theoretical model of learning-by-doing, Krugman (1997) shows that, once manufacturing industries are crowded out and move abroad, it is very difficult to bring them back when the favorable conditions for resource exports are exhausted. However, Torvik (2001) shows that, if both the tradables and the nontradables sector can contribute to learning, and if there are learning spillovers between the sectors, then a foreign exchange gift results in a real exchange rate depreciation in the long run, due to a shift in the steady-state relative productivity between the tradables and the nontradables sector.

external competitiveness, reduction in the manufacturing export - "de-industrialization" and inflation (and/or nominal appreciation). Buiter and Purvis (1981) further analyze three possible sources of "de-industrialization" namely monetary disinflation, positive oil shock (or the Dutch Disease) and oil discoveries, to highlight the similarities between the UK economy and the North sea oil. They present the Dutch disease, resulting from the higher oil prices, as a transitional phenomenon with short-term impact on growth, compare to the oil discoveries, which generate a permanent growth effect[13]. This chapter follows their approach to study whether Russia experiences adverse effects due to the high oil prices.

3.3 Theoretical Framework

We present a stylized model of a resource boom, which can explain the de-industrialization and the disappointing growth results in Russia. The boom in the resource sector raises the marginal factor productivity there, thus attracting mobile factors from the tradable to the booming and the non-tradable (service) sector. Increased foreign exchange inflows boosted aggregate demand, resulting in higher relative price of the non-tradables and a real exchange rate appreciation (Corden and Neary,1982)[14]. In addition, as shown by Sachs and Warner (1999) the natural resources make the economy less competitive in the manufacturing sector and reduce growth by taking away the learning spillovers generated in this sector.

The theoretical hypotheses based on three-sector model, that has dominated the literature and were inspired by the Dutch case are as follows:

- appreciation of the real exchange rate.
- output and exports decline ("de-industrialization") in the manufacturing (non-booming) sector;
- production of non-tradable (services) sector increases;
- increasing aggregate demand and import growth.

In addition, according to the Balassa-Samuelson model, countries with high productivity growth in the tradable sector have appreciated exchange rate when:

- the relative price of non-tradables is determined by the productivity differentials
- real wages depend on productivity in the tradable sector;
- deviations from PPP are due to the difference in the relative price of the non-tradables.

[13]In Russia no new oil discoveries were made. The high oil prices generated investment boom through collaboration with western investors for better exploitation of the existing deposits.

[14]For a detailed review, see the Appendix Box 3.1 "Corden - Neary model".

The basic predictions of the Corden and Neary (1984) model of Dutch Disease are summarized in Table 3.1, and can be broken down into a resource movement effect and a spending effect. For simplicity, it is assumed that the economy only produces three types of goods: natural resources (which we refer to as "oil"), non-resource tradable goods (which we refer to as "manufacturing"), and nontradable goods (which we refer to as "services"). By definition, tradable goods (oil and manufacturing) are subject to international competition; hence, their prices are determined by world demand and supply, and we assume that the country is small enough so as to not be able to influence these prices. Services, on the other hand, are not subject to international competition, and therefore their prices depend only on domestic demand and supply.

The resource movement effect only occurs if factors are sufficiently mobile and when supply curves are upwards sloping. Given the increase in marginal factor productivity in the oil sector, factor mobility implies that resources (in this case, capital and labor) will move from the non-oil sector to the oil sector. Under these conditions, an increase in the oil price raises the demand for labor in the oil sector, implying higher oil sector wages. Because of this, labor will move from the manufacturing and services sectors to the oil sector, and oil sector output will increase at the cost of a decrease in output and employment in manufacturing and services. Corden and Neary (1984) refer to this fall in manufacturing output as "direct de-industrialization". The movement of labor out of the services sector also leads to fall in the supply of services, leading to an excess demand for services, and therefore an increase in the price of services. The price of manufacturing goods does not change because it is given from abroad.

The spending effect occurs regardless of whether labor is mobile. Higher oil prices generate higher wages and profits in the oil sector, thus raising aggregate demand. This again raises the prices of services, but does not affect the prices of oil and manufacturing goods. The result is an increase in the price of nontradables relative to tradables, implying real exchange rate appreciation[15]. If labor is immobile (i.e. in the absence of a resource movement effect), then the supply of services and the only effect of a shift in demand is an increase in the relative price of services. If labor is mobile, however, then an upward shift in the demand for services will lead to an increase in the supply of services and the demand for labor in the services sector, thus pushing up service sector wages. This will encourage workers to move from the manufacturing and oil sector to the services sector, thus forcing manufacturing and oil firms to raise their wages, as well[16]. Since they cannot compensate for this by raising their price levels, they will see their profits squeezed and will have to downsize. The resulting drop in manufacturing output and employment is referred to by Corden and Neary (1984) as "indirect de-industrialization."

[15]If the nominal exchange rate is fixed, then this real appreciation will take place in the form of inflation. However, if the nominal exchange rate appreciates sufficiently so as to eliminate windfall profits in the oil sector, then the spending effect will not take place, but there would be an equivalent amount of real appreciation, this time in the form of nominal appreciation.

[16]To keep things simple, it is assumed that skill levels in all sector are similar, so that, under perfect labor mobility, wages in all sectors would always be equal in equilibrium.

3.3.1 The Model

In this section, we present simple three sectors open economy model in order to analyze the basic aspects of the Dutch Disease [17]. The model highlights stylized facts of the Russian economy in the light of temporary or permanent oil price shock.

The model follows De Gregorio and Wolf (1994) by estimating the role of productivity and terms of trade shocks in the determination of the real exchange rates. They find that the terms of trade shock affects the real exchange rate mainly through the income effect. They argue on the sample of fourteen OECD countries from 1970 to 1985 that faster productivity growth in the tradable relative to the non - tradable sectors results in real appreciation, which is an evidence of the Balassa-Samuelson effect.

We start with the standard expression of the real exchange rate:

$$q = s + p - p* \tag{3.1}$$

where q is the log real exchange rate, s is the nominal exchange rate defined as unit of domestic currency in terms of foreign currency, p and $p*$ are the logs of the domestic and the foreign prices. The domestic and foreign prices represent the weighted averages of log prices of tradables and nontradables at home and abroad.

$$p = \mu p_T - (1-\mu)p_N \tag{3.2}$$

where μ and ν are the weights of the tradables in the overall price indices at home and abroad

$$p^* = \nu p_T^* - (1-\nu)p_N^* \tag{3.3}$$

Substituting (3.3) and (3.2) into (3.1) yields:

$$q = s + \mu p_T - (1-\mu)p_N - \nu p_{_T}^* - (1-\nu)p_N^* =$$

$$= s + [\mu p_T + (1-\mu)p_T] + [(1-\mu)\, p_N - (1-\mu)p_T] -$$

[17] Other models Corden and Neary (1982), Van Wijnbergen (1984), Krugman (1987), Matsuyama (1992) and Gylfason et al. (1999) assume that productivity growth is driven by learning-by-doing. It is generated in the tradable (T) sector as productivity in the rest of the economy is constant. Thus, these studies involve models of unbalanced growth. Sachs and Warner (1995), on the other hand, have balanced growth, as they assume that the learning benefits the traded and non-traded sector in the same way.

$$\left[\nu p_T^* - (1-\nu)p_T^*\right] + \left[(1-\nu)\, p_N^* - (1-\nu)p_T^*\right]$$

$$q = s + p_T - p_T^* + (1-\mu)(p_N - p_T) - (1-\nu)(p_N^* - p_T^*) \tag{3.4}$$

From (3.4) follows that the real exchange rate includes the terms of trade, the relative price of the domestic nontradables in terms of tradables, adjusted for the share of the nontradables in the overall price index and the adjusted relative price of the nontradables in terms of tradables abroad. We consider an economy, which produces oil (O), non-oil trading (manufacturing) sector (M) and non-tradable services (S) sector. Thus, two goods (O and M) are traded on the international market with prices determined there. Wages in these two sectors reflect the labor productivity in the tradable sector. The price of S is determined by the domestic supply and demand in the home economy. Wages in S follow the wages in the tradable sector.Two sectors use specific factor capital (K) and one sector (S) uses only labor (L), where labor is perfectly mobile between the sectors [18]. The nominal exchange rate is the relative price of two tradable goods P_O/P_M. The real exchange rate is the relative price of the non-traded to traded goods Ps/P_M. Since the prices of tradables are exogenously determined on the world market, a rise of the relative price of services is equivalent to real appreciation[19]. The sectoral production is given by a Cobb-Douglas function:

$$Y_i = A_i K_i^{\alpha} L_i^{1-\alpha} \text{ and } \; Y_S = P_s A_S L_S \tag{3.5}$$

where $i = O, M$ and is the relative price of S in terms of M, where the price of traded goods is normalized to one. It is assumed that the O and M sectors are capital intensive.The producer maximizes the following profit functions with respect to labor:

$$\prod = A_i L_i^{\alpha} K_i^{1-\alpha} - rK_i - wL_i$$

$$\prod = P_s A_S L_S - wL_S \tag{3.6}$$

The market clearing condition for the non traded goods market S yields:

[18] This assumption reflects the fact that the services are mainly labor intensive.

[19] In the simple Dutch Disease model currency devaluation has no impact on relative prices or competitiveness, since domestic prices adjust instantaneously so that the real exchange rate remains unchanged. In the real world,however, domestic prices are sticky, and overvalued exchange rates could persist for years.

$$A_S L_S = C_S + g_S \tag{3.7}$$

where g_S is the is the government consumption of nontradables. The total labor demand is equal to the sum of the labor demand in the tradable and non-tradable markets, which we obtain by the respective first order conditions of (3.6)

$$L^D = K_i \frac{r(1-\alpha)}{w\alpha} + \frac{(C_S + g_S)w}{p_s} \tag{3.8}$$

We maximize the utility of the representative consumer by assuming that the CES utility function is in the form[20]:

$$\max\ \Omega = \left[\lambda \mathsf{c}_\mathsf{S}^\theta + (\mathsf{1}-\lambda)\mathsf{c}_\mathsf{M}^\theta\right]^{\frac{1}{\theta}} \tag{3.9}$$

with $\theta < 1$.

Imposing the consumers' budget constraint:

$$p_S c_S + p_M c_M = I \tag{3.10}$$

and given that $q = P_S/P_M$, we obtain the Marshallian demand functions, where the optimum consumption decision is given by:

$$\mathsf{C_S} = I\left(p_S + p_M\left[\frac{q(1-\lambda)}{\lambda}\right]^{\frac{1}{1-\theta}}\right)^{-1} \tag{3.11}$$

$$\mathsf{C_M} = I\left(p_M + p_S\left[\frac{q(1-\lambda)}{\lambda}\right]^{\frac{1}{\theta-1}}\right)^{-1} \tag{3.12}$$

[20] $\mathsf{C_O}$, $\mathsf{C_M}$ and $\mathsf{C_S}$ can be seen as types of goods, for which there exists a continuum of brands. Therefore, CES function aggregates the consumption across brands for a particular brand x where $\mathsf{1<\ q}$ is the elasticity of substitution between two brands produced in the same sector:

$\mathsf{C_O} = \left[\int_0^1 (\mathsf{C_O}(\mathsf{x}))^{\frac{\theta-1}{\theta}}\mathsf{dx}\right]^{\frac{\theta}{\theta-1}}$ $\mathsf{C_M} = \left[\int_0^1 (\mathsf{C_M}(\mathsf{x}))^{\frac{\theta-1}{\theta}}\mathsf{dx}\right]^{\frac{\theta}{\theta-1}}$ $\mathsf{C_S} = \left[\int_0^1 (\mathsf{C_S}(\mathsf{x}))^{\frac{\theta-1}{\theta}}\mathsf{dx}\right]^{\frac{\theta}{\theta-1}}$

In equilibrium, the total labor demand is equal to the total labor supplied, which includes the labor supplied for the production of nontradables and the labor supplied for the tradables, whereas the labor supply of nontradables is equal to the consumption of nontradables plus government purchases.

$$L = K_i \frac{r(1-\alpha)}{w\alpha} + \frac{\left[I \left(p_S + p_M \left[\frac{q(1-\lambda)}{\lambda} \right]^{\frac{1}{1-\theta}} \right)^{-1} + g_S \right] w}{p_s} \tag{3.13}$$

The labor market equilibrium condition shows the effect of the public and private consumption on wages. Wages, in turn, have effect on the relative price of the nontradables and on the real exchange rate.

3.4 Dutch Disease in Transition Countries

As much research was devoted to the Dutch Disease in the resource-rich industrial and developing countries, relatively less was the attention to transition countries. The process of transition contains its own unique factors and effects, which need to be taken into account when diagnosing the Dutch Disease. Rosenberg and Saavaliajn, (1998) underline three specific factors, reflecting the change from planned to market-driven economy: (i) initial undervaluation of the real exchange rate; (ii) strong capital inflows; and (iii) infancy of the financial markets. All three must to be taken into account in order to create clear understanding for the causes behind the economic slowdown in transition. After the beginning of transition, the real exchange rate followed a U shape – initially depreciating and possibly undershooting its equilibrium level. Afterwards, the real RER started to appreciate due to the trade liberalization, productivity gains i.e. the Balassa-Samuelson effect[21], capital inflows and the increase of the administrated prices. Following in time increase in the world oil prices and the resulting windfall revenues, additionally build on the nominal real appreciation, which is the so-called "Dutch Disease" effect. The resource revenues also shift upward the level of the equilibrium real exchange rate (RER). However, the Dutch disease effect maybe stronger and result in exchange rate overshooting and loss of competitiveness.

Another surprising fact is that, in recent years, Russia has grown more slowly than other members of the CIS (Figure 3.3)[22]. During the period 2000-04, the Russian

[21] The Harrod –Balassa -Samuelson effect features a situation at which the productivity growth in the tradable sector outpaces those in the non-tradable sector. This results in higher wages in the both sectors and higher relative prices of the nontardables. As a consequence the equilibrium exchange rate appreciates (Obstfeld and Rogoff, 1999)

[22] We use the concept of the CIS-12, thus excluding the Baltic states. Besides Russia, the CIS-12 includes Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

economy grew by an average of 6.9 percent. This seems high, but the other eleven CIS countries grew by 8.5 percent on average. This is not because the other CIS countries benefited more from high oil prices than Russia; in fact, even the oil importing countries in the CIS grew faster than Russia during 2000-04: by 7.5 percent on average (Nkusu, 2005). Two other former Soviet Union countries – Azerbaijan and Kazakhstan, also depend on natural resources, and already experience the Dutch disease effects on the competitiveness of their non-oil tradables. Using autoregressive conditional heteroscedastic (ARCH) model Kutan and Wyzan (2000) find that there are insignificant Balassa-Samuelson effects present in Kazakhstan. The Dutch Disease-type symptoms, however, are statistically significant: ARCH indicates that an increase in oil prices of 10 percent leads to an appreciation of the real exchange rate of the tenge by 0.34 percent. Their results suggest that oil prices between 1996-2003 had considerable effect on the real exchange rate[23]. Moreover, since the beginning of the market economy in 1992, the decrease in the manufacturing was stronger relative to the resource sector and some sub sectors were completely crowded out. Hence, Kazakhstan's current economic development depends on the hydrocarbon sector and the international oil prices. (Kutan and Wyzan, 2000, Rosenberg and Saavalainen, 1998)

Employment figures illustrate the effects of the natural resource boom on the former Soviet countries. Because the oil sector does not generate many new jobs, when the non-oil sectors are crowded out and there is high initial unemployment rate, the country suffers from even higher unemployment and painful adjustment costs. On the basis of a cross-sectional regression analysis from 50 non-transition economies for 1995, Raiser, Schaffer, and Schuchhardt (2004) create market economy benchmarks for the structure of employment in transition economies. They compare the anticipated sectoral structure of employment at a given gross domestic product (GDP) per capita and the actual structure of employment in individual countries. The authors find evidence of significant Dutch Disease effects for Kazakhstan, Azerbaijan, and Russia. Hence, a relevant question is to what extent it is optimal for these economies to specialize in favor of the natural resource sector. In the case of Kazakhstan almost all of the FDIs (since its independence approximately $10 billion) are directed the sector with highest marginal profit, the oil and gas industries (EIA, 2002).

Stiglitz (2003) points out that the Dutch Disease problem is of particular concern for Azerbaijan, which resource wealth is limited and will be enough for roughly 20 years. The discoveries of new oil reserves led to strong increase in the share of oil in the total exports - to over 80 present in 2004. Oil production is projected to increase seven times, starting in 2005 when the new oil and gas are developed - from 175,000 to 1.25 million barrel per day by 2010. The revenues from oil exports are expected to grow about 65 percent in 2005, and by over 128 percent per year during 2006–09. Yet, the resources will be depleted by 2024, therefore a key challenge for Azerbaijan is to manage wisely its fortune. If the revenues are used for supporting the non-competitive industries and for social measures, when the resources are depleted, the economy will not be able to sustain its growth and its public sector expenditures. Wakeman, et

[23] Although, Westin (2005) points out that due to the high rouble weight, the real effective exchange rate of the two countries did actually depreciate in response of the rouble real appreciation.

al (2004) recommend Azerbaijan to use the oil money for investments rather than for consumption and to protect the non-oil competitiveness in order to generate new employment and achieve economic growth.

3.5 Evidence of Dutch Disease in Russia

3.5.1 De-industrialization

The main symptoms of Dutch disease are decrease in the manufacturing output, exports and employment (i.e de-industrialization), and increase in the production and wages of the services sector, appreciation of the real exchange rate and overall slower pace of economic growth. The symptoms appear mostly in countries with high export shares of raw materials, and become stronger as the world market price of these raw materials increases. Because of the huge inflow of foreign currency revenues, the domestic currency appreciates. The cheap foreign currency is favorable for the importers, who become highly competitive and crowd out domestic producers. Thus, domestic producers lose their competitive advantage, which leads to stagnation in the manufacturing industries. Higher profitability of the resource industry leads to concentration of the production in that sector and in a small group of services related to it. As labor tends to move to the sectors with the highest profitability, there is also a decline in the industrial employment.

Exogenously driven high resource prices (or new discovery of natural resources) result in real exchange rate appreciation, thus reducing competitiveness and slowing down industrial output and employment, which is vital for growth[24]. The dramatic increase of the world oil prices since 1999 have boosted Russian oil exports and brought significant windfall revenues. Currently, the share of oil and gas in the Russian exports accounts for more than fifty percent. However, there are risks similar to those in the Netherlands in 1970s, as the high dependence on commodities makes Russia vulnerable to sudden changes in the world oil prices. At the same time, the large windfall revenues are associated with upward pressure on the exchange rate. In addition, inflation may exceed the target of 8.5 to 10 percent in 2005 and together with the real wage growth and the pressure for fiscal loosing may hamper the competitiveness in the non-oil sector. In 2004, Russia's gross domestic product (GDP) grew by 7.1 percent, and was mainly driven by the strong private consumption growth. Industrial production grew by 7.3 percent. According to the federal statistics service, however, the overall growth fell to 5.2 percent in 2005 compared with 7.6 percent in 2004. The industrial sector value added rose only by 0.6 percent compare with growth at 7.4 percent in the first quarter of the last year. The manufacturing sector, which represents larger share of the industrial value added went down by 0.4 percent as the natural resource sector grew by 3 percent. Notwithstanding, the final consumption growth speed up modestly.

The low level of competitiveness, apart from the resource-based industries, is among

[24] Sachs and Warner (2001) provide empirical evidence supporting this hypothesis.

the main problems of the Russian industrial development and a primary source of concern. While the dominant industries – oil and gas, metallurgy and agriculture are growing at a slower pace, other sectors like manufacturing risk crowding out effects because cannot compete with the relatively better quality and getting cheaper import goods and cannot keep up with the rising input costs. Currently authorities preserve industrial competitiveness by not allowing the rouble to appreciate. This monetary policy is regarded as a way to support the domestic industries, to reduce volatility and to create stable investment climate in Russia. However, this could also be a way to avoid the necessary restructuring of the manufacturing sector, which has been less competitive compare to, for example, Central European countries due to the inherited from the Soviet past low productivity and high labor costs. Additionally, the 2004 labor productivity growth is lagging behind the wage increase in all sectors except telecommunications. Despite of all these warning signals, authorities doubt that there is "Dutch Disease" in Russia. The explanation is that several non-oil sectors suffer from the loss of competitiveness, but others do not. Sectors, directly witnessing the impact of the consumption boom, namely extractive industries, consumer and banking services, are still performing well. Nevertheless, instead of financing sectors with low productivity and relaying on the oil revenues, the government must seek to diversify and speed up reforms in the traditional industries, as well as to develop new internationally competitive industries.

In order to test, whether Russia has the main symptoms of Dutch Disease, we use sector-level data to compare the growth rates in output, employment, and real wages across Russian sectors. Our sectoral data is based on the Russian Federal State Statistics Service's industrial classification system that was in force until December 2004. Using this classification system, we define Russia's resource sector as the "fuel" sector, which consists of oil extraction, oil processing, gas, and coal. We define "manufacturing", as consisting of all industrial sectors excluding the fuel sector, which gives us a list of nine sectors: electricity, ferrous metals, non-ferrous metals, chemical and petrochemical, machinery, forestry and woodworking, light industry, and food. Finally, we define the "services" sector, as consisting of construction, communication, transportation, and trade.

The first symptom of Dutch Disease, de-industrialization, appears to be clearly present. Rather than interpreting de-industrialization strictly, as negative manufacturing growth, we interpret the concept broader, as a decline in the share of the manufacturing sector. That is, we consider de-industrialization to occur when the manufacturing sector is growing at a slower rate than the other sectors. Indeed, as the top left of Figure 3.4 shows, manufacturing output growth was very high in 1999 and 2000, following the large depreciation of the rouble in 1998. Since 2001, however, manufacturing output growth was consistently below that in other sectors, implying a fall in the share of the manufacturing sector. Moreover, the top right panel shows that manufacturing employment growth between 2000 and 2004 was not just decelerating, but even negative. Figure 3.5 breaks down manufacturing growth by sub sector, and shows that the slowdown in manufacturing growth has occurred more or less across all sectors. Comparing the period 1997-2000 with the period 2001-2004, we find that

only the fuel sector, the food sector, and the electricity sector experienced an increase in their output growth. A growing share of exports is concentrated in the oil and gas sector. Energy exports have increased to about 50 percent of total exports and to almost 20 percent of GDP (see Figure 3.6). All other manufacturing sectors experiencing substantially slower growth during 2001-2004, when oil prices were high. An exception is the food industry where the volume of imported food is small and the used imported components benefit from the exchange rate appreciation. In addition, the manufacturing industries in Russia are not prepared to produce tradable, internationally competitive goods. The manufacturing industry makes products that cannot compete on equal terms on the world markets and the market is dominated by raw materials and semi-processed products with low added value. We also find evidence that the share of the services sector has increased, suggesting that the spending effect has been more important in Russia than the resource movement effect. As the top left panel of Figure 3.4 shows, the growth in services did not just exceed the manufacturing growth, but, since 2002, has also outpaced the growth rate in the fuel sector, implying an increase in the relative size of the services sector. The top right panel shows that employment growth in the services sector has been positive since 2000, and exceeded employment growth in the other sectors in the years 2002 and 2004.

Critiques contend that deindustrialization is not necessarily malignant for Russia and is a natural consequence of the market mechanisms. Deindustrialization is regarded as a market economy response and reflects the low competitiveness in the manufacturing sector. The message is that further specialization in the oil sector and increased oil exports at the current high prices are the best policy advice for Russia (assuming that oil prices will not increase further). To the contrary, this chapter argues that the manufacturing sector is vital, because it has relatively higher rate of technical change and Russia will lose its prospects for technological leadership if de-industrialization continues. Currently manufacturing sector employs the biggest share of the working age population. If more enterprizes close down because of failure to beat competition with the cheap imports, more people may become jobless and start relying on social benefits. Spending the natural resource money on covering social costs was one of the main reasons for spreading the "disease" in the Netherlands in 1960s. Those employed in the rest of the economy may get higher wage, additionally contributing to higher inflation. Moreover, how to spend the oil revenues is a crucial question with a decisive importance for the future of the Russian economy. The fight over the oil revenues with the private sector gives the state a leading role upon the investment decision. It is questionable, however, to what extent such decisions will be market driven and will reflect the ongoing reforms. The past experience of soviet planning shows inefficient and economically unjustifiable projects when the state invested public money.

While the first symptom "de-industrialization" does seem to be present, it is difficult to conclude from this statistical analysis that the observed patterns are, indeed, the result of resource movement or spending effects. In fact, there may be other reasons why the manufacturing sector has shrunk and the services sector has expanded, beyond the sheer fact of the still incomplete "transitional" adjustment in the Russian manufacturing sector. Employment and output in the Russian manufacturing may be

contracting as a result of a global de-industrialization. Many advanced industrial nations show diminishing shares of their manufacturing sectors. For example, a similar pattern has been observed in the United States and other advanced industrial countries that are not necessarily resource-rich. As McKinnon (2005) notes, there are three main reasons why manufacturing sectors are expected to shrink over time, relative to services. First, opportunities for technological progress are much greater in manufacturing than in services. Second, there is evidence that, as households become richer; demand naturally shifts away from goods toward services. Finally free trade and outsourcing result in manufacturing industries being continuously replaced as a consequence of international competition. Controlling for this effects is not possible in a study for a single country with short time series, but may be possible in a cross-country study; hence, we leave this as a suggestion for further research.

Russia's booming oil sector, however, may facilitate shrinking the output and employment in the manufacturing sector well beyond those of the advanced industrialized countries. In the long run, as services are not subject to international trade, Russia's trade deficit may increase together with loss in jobs due to the contraction of the manufacturing sector. Labor productivity and wages are one-fifth of those prevailing in the advanced countries. Therefore global de-industrialization may further aggravate the problems and eventually cause lower growth in addition to possible "Dutch disease" effects.

Previous studies have found that the spending effect is stronger in Russia compare to the resource moving effect. Westin (2005) argues that the growth of the non-tradable sector is mainly related to the spending effect but there are no signs of resource moving effect i.e. labor moving from the services to the resource sector. Using two PPP measures, Westin shows that the post-1998 rouble is undervalued and concludes that there is a room for further appreciation. This conclusion, however, should be considered with caution because detailed employment data is available only up to 2002 and the author is using proxies to average certain sectors and prices, which may distort the picture. Gurvich (2004) finds that from 6% to 11% every year is reallocated from the oil sector to the tradable sector by the mechanism of the transfer pricing. This reduces the tax burden on the oil and gas sectors. If taken into account, the share of the resource sector in GDP would be up to 21% in 2003. Also the vulnerability to international price changes is decreasing as the tendency that growth has increased above five percent only when hydrocarbon prices have increased, is diminishing. Nevertheless, the main indicators for the role of the oil sector in the Russian economy have been stable or decreasing in 2000-2003. The reason is the export contraction due to the rouble appreciation, which is a symptom of the Dutch Disease hypothesis. Furthermore a study done by the World bank (2004) finds that natural-resource and export-oriented industries are increasing their share in the total industrial output, rather than decreasing it, so that exposure to risk of external price shocks is currently increasing.

3.5.2 Wage Growth

As for the second symptom, there is clear evidence of high real wage growth in all sectors since 2000, which is consistent with both the resource movement and the spending effect. As the bottom left panel of Figure 3.4 indicates, the sharpest increase in real wages occurred initially in the fuel sector, likely as a result of soaring oil prices in 2000, which could have given rise to either a resource movement or a spending effect, or both. However, wage growth in the other sectors was also rapid and quickly caught up with fuel sector wage growth, as predicted by the Dutch Disease hypothesis. In fact, in 2002 and 2003, wages in manufacturing and services rose even more rapidly than in the fuel sector. Though, real wage growth did not differ much between sectors since 2002. This is true even for productivity-adjusted wage growth, which is equivalent to the growth in unit labor costs, depicted in the bottom right panel of Figure 3.4. According to our calculations (which are based on several assumptions, missing data, and therefore should be interpreted with caution), unit labor cost growth was close to zero in all sectors since 2002, and was even slightly negative in 2004, suggesting a slight improvement in competitiveness.

Inflation is already soaring in Russia due to the huge budget surplus (US$ 26.33 billion) and the consumption boom. The government inflation target of 8.5 percent for 2005 is well below the inflation figures of 11.7 percent in 2004, but is expected to remain in double digits, which may encourage the Russian authorities to tolerate further nominal rouble appreciation. Spending the windfall revenues in the economy through fiscal loosening in the form of social spending and tax cuts is a direct way to fuel inflation. Meanwhile, foreign currency reserves grew rapidly in 2004 bringing Russia up to the world's seventh position. Thus, the budget balance has significantly benefited from the high oil prices. This additionally contributes to the inflation and adds up to the strong domestic currency. Foreign direct investment (FDI) into Russia reached $ 11.7bln which is the highest level of FDI since reforms began in 1992. However they are still low as a percent of GDP . In addition, the foreign portfolio investment were 17 percent less than in 2003 following the Yukos's affair, which resulted in lost investor's confidence and US$7.8 billion capital outflow from Russia in 2004. This affair involved the arrest in October 2003 of Mikhail Khodorkovsky, former CEO and principal owner of Russia's largest private oil company, Yukos, on charges of tax evasion and embezzlement, which eventually gave rise to the sale of Yukos' largest production unit, Yuganskneftegaz, to state-owned oil company Rosneft. This effective "renationalization" of a successful private company undoubtedly damaged the investment climate, and even led to a significant slowdown in oil production growth that cannot be only explained by supply disruptions caused by the change in ownership[25].

Recent evidences suggest that Russia's growth may be slowing down, as the increased taxes over the oil industry hurt future investments. International Energy Agency forecasts Russian oil output to rise 3.8 percent in 2005, less than half the

[25]Since mid-2004, when it became clear that Yuganskneftegaz was going to be sold, the annual rate of oil production growth in Russia slowed down significantly, from 11 percent in 2003 and 9 percent in 2004 to only 2.5 percent in the first half of 2005.

average during the past five years and the lowest since 1999. Russian oil output rose 9 percent in 2004 to 9.2 million barrels a day and reached a 11 percent record in 2003. In addition to the capacity constraints, the current economic policy favors the establishment of state-controlled conglomerates in the natural resource sectors, which discourages market competition and investments. The state has expanded its role in the oil sector through export quotas and access tariffs to the state-owned pipeline system. Another possible reason for the slowdown in oil production growth is the increase in oil taxation: oil export duties were raised in August 2004, and the mineral extraction tax was raised in January 2005. With a strong government control over the oil industry and a lack of diversification, the country risks drying out its main source of wealth and economic growth. Additional spur to growth is the poor access to investment financing due to the underdeveloped banking sector. Therefore sound fiscal policy is especially necessary in order to provide agents with effective tax system which does not hinder investment in the resource sector. By increasing its consumption, the government might speed up the short term growth but could not continue in the long-run without structural reforms and improvement in the overall investor's climate. Reforms in utilities and health care rather than social spendings would contribute to a sustainable growth and overall economic stability.

3.5.3 Real Appreciation

While the Russian real effective exchange rate has appreciated substantially in recent years, this cannot necessarily be regarded as evidence of the Dutch Disease. As Figure 3.7 shows, the level of the real exchange rate is positively correlated not only with oil prices, but also with the productivity differential and government consumption. In addition, there may be an effect on the real exchange rate from changes in net international reserves or the level of corruption. Thus, we need to control for all these factors in order to establish whether the effect of oil prices on the real effective exchange rate is significantly positive.

One main alternative reason for real appreciation is the fact that Russian productivity has grown faster than that in advanced economies. Indeed, Figure 3.7 shows a clear correlation between the real exchange rate and the productivity differential with the U.S. and the Euro area. This is a commonly observed phenomenon for developing and transition economies, and is referred to as the Balassa-Samuelson effect[26]. According to the Balassa-Samuelson hypothesis, the real exchange rate should appreciate in line with the "relative productivity differential". If productivity growth in the tradables sector exceeds productivity growth in the nontradables sector, prices of Russian nontradables will tend to rise over time, while prices of Russian tradables will not (assuming they are determined abroad). This would imply a rise in the overall price level, but it does not yet imply real appreciation: if Russian trade partners were to experience the same relative productivity growth, the price levels in trade partner countries would rise at the same rate as Russian prices, and the inflation differential would be

[26] See, e.g., Krajnyák and Zettelmeyer (1998), Égert (2002), and Oomes (2005)

unaffected. However, if Russian trade partners experience lower relative productivity growth than Russia, which has generally been the case, then there would be a positive inflation differential, and the real exchange rate would appreciate.

The real exchange rate is also expected to increase with government consumption. The intuition behind this is that, unless governments consume only imported goods, an increase in government consumption is likely to lead to a rise in the relative price of nontradables, and therefore to real appreciation. Of course, one could argue that government spending will eventually have to be financed through higher taxes, which would offset the effect on real appreciation through a decline in disposable income and a fall in the private demand for nontradables. However, as Edwards (1989) finds, the first effect is likely to dominate the second effect, and this is generally confirmed by empirical studies [27].

The relative price level in Russia (measured as the distance to PPP) is still below the level given Russia's relative income level (measured as PPP GDP per capita relative to the euro area) in comparison to other transition economies (Figure 3.8). Although the real exchange rate is still remains under its estimated equilibrium level, the undervaluation is small and it has depleted the positive effect on exports of the Russian currency devaluation in 1998 (see Figure 3.9).

According to the theory, the "Dutch disease" is accompanied by inflationary pressures and an exchange rate appreciation as a result of inflow of revenues from the export of natural resources. The Russian authorities keep the increase in the money supply under control by transferring the excess revenues into the stabilization fund and constraining the rise in the administrative prices. Russia's Stabilization Fund (SF) was established from the taxes on companies' windfall oil profits to guard against drop in the world oil prices. It amounted RUR 106.33bln on January 1, 2004, when was set up and rose to RUR 768.45 bln (approx. US$28 billion) on April 1, 2005. According to the forecasts, the accumulated resources are likely to exceed one trillion roubles by the end of 2005. The harmful consequences of massive windfall revenues bring in a strong upward pressure on the exchange rate but do not result yet in exchange rate appreciation. The Central Bank of Russia (CBR) is balancing two monetary objectives – stable nominal exchange rate and low inflation. The authorities make all the efforts to restrain inflation within the range of 8.5-10 percent and the real effective exchange rate appreciation below 8 percent. On the one hand, suppressing the rouble appreciation benefits the non-oil exporters but is done at the expense of the domestic market producers actively using import components. On the other hand, spending the oil revenues inside the country would provoke inflation and therefore result in nominal salaries and pensions being decreased. In addition, taxes are paid in roubles, which requires exporters to sell their currency holdings inducing further appreciation. Inflation is running ahead of the target and the strong real exchange rate hurts Russia's economic competitiveness. In 2004, inflation in Russia reached 11.7%, which was above

[27] In an important cross-country study, Froot and Rogoff (1991) found that the real exchange rate appreciates more in countries with a high growth rate of government consumption. Égert, Halpern, and MacDonald (2004), Table 5, list ten more papers that find a positive effect of government consumption on the real exchange rate, and only two papers that find a negative effect.

the official government target of 10.0%. As Standard&Poors (2005) and IMF (2004) argued, the real appreciation of the rouble is unavoidable if authorities want to leverage inflation. The question is how it will take place - through nominal appreciation or through higher inflation. Finally, Russia could benefit from a stronger real rouble rate, which would stimulate restructuring and increase competitiveness. Nevertheless, the persistently high inflation figures and the steady real exchange rate appreciation suggest that the policy of balancing two economic targets is no longer fruitful.

Thus far, opinions are divided as to whether the Russian economy has been suffering from Dutch Disease. A detailed analysis by Westin (2004), based on data through 2003, concluded that, despite the existence of some Dutch Disease symptoms, Russia had not yet contracted the full-blown disease. More recently, however, Standard and Poor's (2005) warned that Russia is "fast becoming a classical victim" of Dutch Disease, and Latsis (2005) argued that "Russia has all the classical symptoms of Dutch Disease". Finally, even high-ranked Russian government officials, including the Minister of Economy and the Economic Advisor to the President, have argued that Russia runs the risk of contracting the disease, or has already contracted it[28].

3.6 Empirical Tests and Results

3.6.1 Cointegration

Below we use cointegration and vector error correction (VEC) technique to assess the determinants of the real appreciation in Russia. Our empirical estimates represent the long-run sustainable path of the real exchange rate conditional on the time-series evolution of its fundamentals. The notion of equilibrium is an essential concept in economics, which includes 1) internal equilibrium – tradable versus non-tradable balance based on the Balassa-Samuelson effect and 2) external equilibrium based on the net foreign asset approach and a balanced current account. The equilibrium could also be defined, as a long run steady state.

Many economic time series follow nonstationary behavior. A linear combination of two or more series, however, can be stationary. Such series are said to be cointegrated. If a vector process is cointegrated, then the time series share "common trends". The cointegration relationship $\beta_i^{b4} y_t$ is interpreted as a stable long-run equilibrium among the variables. Any deviations given by the stationary process $z_t = \beta^{b4} y_t$ are of temporary nature and are expected to disappear over time. Assuming that y_t is a m-dimensional nonstationary vector I(1) with $m > 2$, there could exist r linearly independent cointegration vectors $\beta_i^{b4}, i = 1, ...r$ with $0 < r < m$, such that

$$\beta^{b4} y_t = z_t \tag{3.14}$$

[28] For the statements of Russian government officials, see http://www.rg.ru/2005/06/03/illarionov-ekonomika.html and http://www.polit.ru/documents/332657.html (in Russian).

where z_t is a r dimensional stationary vector process, β^{b4} is $m \times r$ matrix of cointegration vectors and r is the cointegration rank. If two series are following an equilibrium relationship, even though they may be non-stationary, in the long run they will move closely together and the difference between them will be stationary. Hence, if non-stationary variables are cointegrated, the regression provides meaningful information about their long-run relationship[29]. In the previous chapters, time series by differentiating were transformed into stationary. Differenced series, however, cannot provide information about the long-run behavior of the economic time series. They provide only description of short run interdependence. Testing for cointegration is a useful method to test if variables converge to a time varying equilibrium in the long-run [30].

The empirical literature on cointegration analysis distinguishes between two main estimation methods: single equation and system methods. Maddala and Kim (1998) present several approaches for cointegrated analysis. Single equation method estimates one specific cointegrating vector, in comparison to the systems methods, where the number of cointegrating vectors is determined in the process of estimation. Real effective exchange rate is estimated in a vector error correction model (VECM) based on the Johansen procedure(1991). Among the systems methods, Johansen maximum likelihood procedure is the most widely applied in the literature for estimation and testing the number of cointegrating vectors in the cointegrating systems. It consists of estimation of error correction system of a VAR model.

$$\Delta x_t = \prod x_{t-1} + \sum_{j=1}^{k-1} \Gamma_j \Delta x_{t-j} + \mu + bz_t + \epsilon_t \tag{3.15}$$

where x_t is an n-dimensional column vector, μ a vector of constants, z_t a vector of deterministic (exogenous) variables, such as seasonal dummies and intervention dummies, and t e denotes the vector of white noise disturbances. In out setting, the variable vector consists of four variables, Γ_j represents the short-run dynamics and the lagged level term, and $\prod x_{t-1}$ is the error correction term of stationary linear combinations of the x variables. Phillips (1991) proves that this approach produces coefficients that are unbiased, symmetrically distributed and the standard Chi-square tests are valid for hypothesis testing.

Using a Behavioral Equilibrium Exchange Rate (BEER) model, we estimate the statistical long-run relationship between the real exchange rate and its fundamentals.The cointegration technique is a standard way in the literature of estimating equilibrium

[29] Testing for cointegration is also a useful way to avoid "spurious" regressions. Granger and Newbold (1974) showed that if a variable I(1) is regressed on another I(1) variable, the regression can be spurious. If this is the case, the residuals should be non-stationary I(1). If however the residuals are stationary there is no spurious regression problem and no "long-run" information is lost.

[30] The test for cointegration consists of estimating the cointegration regression and obtaining the residuals and applying the unit root test. The hypothesis that the residuals have a unit root is a hypothesis that there is no cointegration.

exchange rates, also for transition economies with available short data sample and poor data quality. Studies using Johansen cointegration include Egert (2002), Golinelli and Orsi (2002) , Jazbec (2002) and Lommatzsch and Tober (2002) among others (as cited in Egert, 2004).

Our benchmark specification of the VEC model includes the following variables [31]:

- the log of the real exchange rate (REER)
- the log of the productivity variable (PRD_DIFF)
- the log of the oil prices (OIL_PR)
- the log of the government consumption (GOV1)
- the log of the net international reserves (NIR)
- the log of the corruption variable (COR)

The real exchange rate variable is defined as the CPI-based REER, the labor productivity variable is defined as the ratio between the indices of industrial output and employment, the productivity differential is defined as the ratio of Russian labor productivity to the equally weighted Euro area and US labor productivity (where labor productivity is measured as industrial output per worker). The oil prices are monthly Urals crude oil prices published by Bloomberg. We use one government variable – the government consumption defined as the ratio of the general government non-interest expenditures and the nominal GDP. Net international reserves are defined as the gross international reserves (incl. gold) minus the liabilities to the IMF. Corruption is interpolated by the yearly corruption index for Russia published by the Transparency International We include also a dummy for the period August – October 1998, which coincides with the Russian financial crisis. Our empirical results report evidence of stable cointegration relationships between the real exchange rate, the oil prices, the productivity differential, government consumption, net international reserves (NIR), and the corruption index. The expected effects of all of these variables on the equilibrium exchange rate are summarized below, where the sign according to the theory is given in brackets:

$$\underset{}{reer} = f(\underset{(+)}{oil\_pr},\ \underset{(+)}{prd\_diff}\ ,\underset{(+)}{gov1},\ \underset{(-)}{NIR},\ \underset{(-)}{cor}) \tag{3.16}$$

We have ten years of monthly data, covering the period January 1995-December 2004, although we use shorter sample periods in our regressions. The data description,

[31] Besides the above listed variables, we also have tested with several other variables including: the log of the terms of trade measured as a percentage change of the export to import ratio (TOT) the log of the government variable (GOV), the log of the deflated oil prices (OILPR_DEF), the log of the corruption index (COR_IDX),the log of the net foreign assets (NFA), the log of the net foreign assets, including bank assets (NFA_BNK), the log of the administrated electricity prices (PPI_ELC), the log of the consumer price index of inflation (CPI_SRV). However, all the above variables did not produce stable cointegration relationship with the real exchange rate.

including the sources and the data correlation matrix, is given in Table 3.2 and Table 3.3. In order to test for the order of integration, we perform Augmented Dickey Fuller (ADF) test whether a variable follows a unit-root process, whereby a constant is included. The null hypothesis is that the variable contains a unit root, and the alternative is that a stationary process generated the variable. The test results in Table 3.4 show that all variables have been non-stationary, integrated in order one - the ADF fails to reject the null hypothesis for the presence of unit root in levels for each of the series. The series are trend-stationary in their first differences. The number of autoregressive lags in the ADF test and the choice of the best model were determined according to the Akaike information and Final prediction error criterion. Nielson (2001) shows that the likelihood information criterion can be used regardless of the assumption for the characteristic roots, i.e. the characteristic roots of the autoregression can be stationary, as well as nonstationary. The test is valid only if the errors in the regression are white noise. This implies that it is necessary to augment the test regression with enough lagged differences to ensure that the residuals are serially uncorrelated. Note, that ADF test is sensible to the number of included lags and/or constant and trends. Table 3.4 shows that all variables are nonstationary, implying that it is legitimate to search for a cointegration relationship [32].

The results of Johansen cointegration tests in Table 3.5 provide evidence that a unique cointegrating vector exists between various combinations of the variables.Table 3.6 summarizes our estimated cointegrating vectors, with the coefficient for the real exchange rate normalized to one. Our baseline estimate, obtained by minimizing the Akaike and Schwartz information criteria, contains all five variables, and is reported in the most-right right-most column (regression 4 for the period April 1997–December 2004). All coefficient estimates in this equation are highly significant and have signs that are in line with theory.

Despite the difficulty of estimating a long-run relationship for a sample period of less than ten years for an economy in transition, our baseline estimates seem unbiased and robust. As Table 3.6 shows, all residuals are well- behaved, in that there is no evidence of serial correlation, non-normality, or heteroscedasticity. With some exceptions, the baseline coefficient estimates reported above are also generally robust to the exclusion of certain variables and to a lengthening of the sample period (starting in February 1996 rather than April 1997)[33]. The estimates provide evidence that higher oil prices imply real appreciation, as predicted by the Dutch Disease hypothesis. Since all variables are in logs, the coefficients can be interpreted as elasticities. This means that a one percent increase in the oil price, according to our baseline estimate, leads to 0.73 percent real appreciation. If the sample period is lengthened to include most of 1996, the estimated oil price elasticity increases to 1.06, but in that case not all variables

[32]That is, the null hypothesis of a unit root in levels generally cannot be rejected (when a sufficient number of lags is included), while the null hypothesis of a unit root in differences can be rejected.

[33]The question of structural break was not addressed here due to relatively short sample length and the well-behaved residuals of the model,which show that the variation in the data is explained by the included variables plus the two crisis dummies. Further points to include are the bootstrapped p-values of the sample-split and the break-point Chow tests.

are significant. When the cointegrating vector is estimated without the productivity differential and the corruption index, the coefficient estimate for the oil price declines to 0.35, which is still high. For example, it suggests that the increase in the Urals oil price by 25 percent in 2004 (from $27.3 to $34.3 per barrel) would, all else equal, have led to 0.35*25 or almost 9 percent real appreciation. In fact, real effective ruble appreciation in 2004 was less than that (7.5 percent according to the IFS measure), possibly owing to reserve accumulation and increased corruption, as suggested below. In addition, the estimates suggest that the real exchange rate appreciates with increases in government consumption and the productivity differential. A one percent increase in either government consumption or the productivity differential leads to approximately 2 percent real appreciation. This is an even stronger effect than the effect of oil prices, and suggests that the authorities' policy of saving a large part of the windfall oil and gas tax revenues in a stabilization fund has been effective in reducing real appreciation. The coefficient estimates for the productivity differential are not very exact, and vary between 0.68 and 2.99 depending on the sample period and which other variables are included. Nevertheless, they suggest that part of the real appreciation may be explained by the Balassa-Samuelson effect.

We also find evidence that pressures on the real exchange rate are eased by NIR accumulation, which has important policy implications. In particular, a one percent increase in NIR is estimated to reduce the level of the real exchange rate by 0.22 percent. The policy implication of this is that the Central Bank can engineer somewhat of a real depreciation by buying up foreign exchange, and thus increasing its reserves. While this contradicts the notion of the long-run neutrality of money, it is consistent with the finding of a low long-run pass-through from the nominal exchange rate to inflation (e.g., Oomes and Ohnsorge, 2005, estimate the pass-through for Russia at 0.5). That is, while foreign exchange purchases by the central bank obviously will be inflationary (assuming they cannot be fully sterilized), our estimates suggest that the obtained reduction in nominal appreciation is not fully translated into higher inflation; hence, there will be an effect on the real exchange rate. However, since our sample period covers less than ten years of data, it is possible that our sample period is simply too short to detect long-run money neutrality.

Finally, we find some evidence that corruption can help to reduce real appreciation pressures. The estimated baseline elasticity is -1.63, but this is estimate does not seem to be very robust, as it ranges from a positive (but insignificant) value of 0.42 to -3.24. This instability in the estimate could be the result of the problems inherent in measuring corruption. Our proxy, the Transparency International Corruption Perceptions Index (CPI), consists of annual data only and is generally considered more useful for cross-country studies than for time series analyses[34]. Nevertheless, it seems intuitive that the effect should be negative, because a corrupt investment climate is likely to

[34]The Transparency International Corruption Perceptions Index (CPI) compiles the corruption surveys and expert assessments available for each given country and pools them into a single measure for corruption, assigning the same weight to each source. However, the observations may not be comparable over time, because the number of underlying sources changes every year (i.e., it is not a balanced sample), and there have been frequent methodological improvements.

lead to capital outflows, and therefore may give rise to exchange rate depreciation (e.g., Wei and Wu, 2001). Interestingly, a negative effect of corruption would imply that the rent seeking behavior induced by higher oil prices may, to some extent, offset the Dutch Disease effects.

We do not find any evidence that the real exchange rate has been overvalued in recent years. Figure 3.10 plots the difference between the actual real exchange rate and its long-run "equilibrium" level. Interpreting these deviations as a measure of misalignment, we see that the real exchange rate was overvalued from the end of 1997 until the August 1998 crisis, after which it remained undervalued until the end of 2000. There was another brief period of overvaluation from the end of 2000 until the end of 2001, followed by a period (2002-2003) during which the real exchange rate was roughly in equilibrium. Interestingly, our estimates suggest that, if anything, the real exchange rate was undervalued, rather than overvalued in 2004, thus contradicting the Dutch disease hypothesis.

If the slowdown in the Russian manufacturing sector is, indeed, the result of excessive real appreciation, which is a question that remains to be answered, then limiting real appreciation may be important to reduce the effects of Dutch Disease. Our estimates suggest that foreign exchange interventions (reflected in reserve accumulation) may help somewhat in this regard, but likely only to a limited extent. More effective ways to reduce real appreciation pressures would include fiscal consolidation (i.e. lowering the ratio of government consumption to GDP) or an increase in corruption. The latter strategy, however, will likely be counterproductive, in that it would limit Dutch Disease, but would worsen the natural resource curse.

3.7 Conclusion

This chapter analyzed if Russia has Dutch Disease symptoms and what is the impact of the high oil prices. A shift in the oil prices trend would have strong economic, as well as political consequences for Russia. Capitalizing on resources could speed up Russia's economic development. It could also deter the economic diversification and endanger the current financial stability by increasing the risk of economic and political crises. The three main symptoms we have tested for include (i) a decline in the share of the manufacturing sector (de-industrialization), relative to the services sector; (ii) an increase in the overall wage level, and (iii) an appreciation of the real exchange rate.

Regarding the first symptom, we find clear evidence that output and employment have decreased more rapidly in the manufacturing sector than in the services sector. In particular, our sectoral data show that the manufacturing sector has grown more slowly than other sectors since 2001, while manufacturing employment growth has fallen. We also find evidence that the share of the services sector has increased, suggesting that the spending effect has been more important in Russia than the resource movement effect.

The second symptom appears to be present as well, in that there is clear evidence

of high real wage growth in all sectors since 2000. This is consistent with both the resource movement and the spending effect, but could naturally be explained by other factors as well (e.g. de-shadowization of wages and rapid productivity growth).

Finally, there is evidence that oil prices have pushed up the real rouble exchange rate. Based on cointegration techniques, we found that a one percent increase in the Urals oil price leads to a 0.73 percent appreciation of the real exchange rate, although the estimated elasticity ranges from 0.35 to 1.06. These estimates were derived while controlling for other real exchange rate determinants. We found that the level of the real exchange rate is positively correlated with Russia's productivity differential and government consumption, while it is negatively correlated with net international reserves and corruption.

However, we do not find evidence that the real exchange rate has been overvalued. While there was a brief period of overvaluation in 2001, according to our estimates, the real exchange rate was roughly in equilibrium during 2002-2003, and may even have been undervalued during 2004. While there may thus be evidence for Dutch Disease (in the sense that higher oil prices have given rise to real appreciation), it is not clear that this real appreciation has been responsible for the observed slowdown in manufacturing growth. In order to establish this connection, further sector-level or even firm-level research would be needed to determine the effects of real appreciation on individuals firms or separate sectors. The symptoms studied are real exchange rate appreciation, decline in the manufacturing sector and boom in the services sector. So far, evidences are mixed but Dutch Disease symptoms seem to be present in Russia. Based on cointegration and vector error correction technique we find that current real appreciation depends significantly on oil prices and government consumption and affects negatively growth. Moreover this result is robust even when controlling for corruption and the Balassa-Samuelson effect. Also there is increase in services output and employment. Yet, one of the main symptoms "de-industrialization" does not seem to be in place. There is a slowdown in some, but not all manufacturing industries. The reasons are low factor mobility in the economy and the short period in which Russia is benefiting from the high international oil prices. Nevertheless, the risk of Dutch Disease exist and its hedging will be a challenge for the authorities in the in the future. Prudent and transparent macroeconomic policies are the key for a successful management of the Russia's oil wealth. We conclude that, while Russia does appear to have most of the symptoms, it does not yet have the full-fledged Dutch Disease. Although we find evidence of a shrinking manufacturing sector, an expanding services sector, and rapid real wage growth, we do not yet find evidence of an overvalued real exchange rate. Nevertheless, given that oil prices have continued to soar in 2005, and are projected to remain high, the risk of Dutch Disease certainly exists, and warrants close monitoring. Furthermore, restructuring, diversification and improvement of current institutions and administrative mechanisms could help Russia achieve faster economic growth.

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Appendix

Table 1.1: ERM II participation and euro adoption by the new Member States

Country	ERM II participation	Euro adoption
Estonia	Participates since 28 June 2004	1 January 2007 (Estonia wants to be "technically ready" for euro adoption by mid-2006, but has not planned actual euro entry before 2008)
Lithuania	Participates since 28 June 2004	1 January 2008
Slovenia	Participates since 28 June 2004	1 January 2007
Slovakia	Participates since November 2005	1 January 2008
Cyprus	Participates since 2 May 2005	Euro entry envisaged "as soon as possible" likely 1 January 2008
Malta	Participates since 2 May 2005	Official target date and fiscal consolidation path would suggest 1 January 2008
Latvia	Re-pegged from SDR to euro on 1 January 2005. Application for ERM II entry was planned in close connection with re-pegging, but has been delayed. Participates since 2 May 2005	1 January 2008
Czech Republic	Possibly during 2008-2009 (based on 2011 euro entry scenario)	"Around 2009/2010". Convergence Programme foresees meeting deficit criterion in 2008-9, consistent with 2011 entry. Decision to adopt euro is based on broader assessment of "readiness to join the euro area".
Hungary	Not specified.	2012/2014 appears most likely target date (although aiming for 2010 has not been ruled out by the authorities)
Poland	Possibly during 2008/9, depending on progress with fiscal consolidation and pension fund accounting along the lines of the CP	Official target date has yet to be set, although could allow euro adoption in 2012.

Source: European Commission Convergence Report, National central banks

Table 1.2: Current accounts in CEEC (as percent of GDP)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Bulgaria	-4.2	-10.1	-0.3	-1.5	1.7	10.1	-0.5	-5.0	-5.6	-6.2	-4.6
Czech Rep.	n.a.	1.3	-1.9	-2.6	-7.1	-6.7	-2.2	-2.7	-5.3	-4.6	-3.4
Hungary	0.9	-11.0	-9.8	-5.7	-3.7	-2.2	-4.9	-4.4	-2.9	-2.1	-4.3
Poland	-0.2	0.3	-2.5	-0.1	-4.8	-6.1	-6.9	-8.5	-10.3	-9.0	-7.9
Romania	-7.7	-4.7	-1.5	-5.0	-7.3	-6.1	-6.9	-3.6	-3.7	-5.9	-5.2
Slovakia	n.a.	-4.4	4.4	2.0	-10.2	-9.3	-9.0	-4.8	-3.4	-8.6	-8.4
Slovenia	7.4	1.5	4.0	-0.5	0.2	0.1	-0.7	-3.9	-3.4	-0.4	-1.2
Estonia	3.5	1.3	-7.2	-4.4	-9.1	-12.2	-9.1	-5.7	-5.6	-6.1	-10.2
Latvia	14.2	19.2	5.5	-0.4	-5.5	-6.1	-10.7	-9.9	-6.9	-9.7	-9.2
Lithuania	n.a.	-3.2	-2.2	-10.2	-9.2	-10.2	-12.1	-11.2	-6.0	-4.8	-6.1
CEECs average	2.0	-1.0	-1.1	-2.8	-5.5	-4.9	-6.3	-6.0	-5.3	-5.7	-6.1

Source: IFS, EC

Table 1.3: Central and Eastern European Countries (CEEE) – economic indicators 2000-2001

	External debt/GDP	*External debt/Exports*	*FDI /GDP*	*Current Account/ GDP*
Bulgaria	86.4	148.3	8.3	5.9
Czech R	42.8	56.2	9.1	4.8
Estonia	61.4	64.6	6.4	6.8
Hungary	67.3	97.3	2.6	3.9
Latvia	65.9	144.0	5.6	6.8
Lithuania	42.9	95.1	3.3	6.0
Poland	42.9	214.5	5.9	6.3
Romania	27.0	81.7	2.7	3.7
Slovakia	56.3	76.5	10.7	3.7
Slovenia	34.3	58.1	0.2	3.3
avg. CEECs	52.7	103.6	5.5	5.1

Source: Datastream, IFS, WIIW

Table 1.4: Volatility in CEEC countries

	GDP	*Terms of trade***	*Real effective exchange rate***	*Real interest rate***	*Gov't revenue/GDP*
*CEECs**	4,10	4,40	12,66	6,34	2,31
Latin America	3,74	8,70	18,00	13,18	2,19
Emerging Asia	4,11	5,92	8,65	2,52	1,82
Advanced countries	2,09	3,73	5,90	2,07	1,02

*1993-2001
**Only Czech republic, Hungary, Poland and Romania

Source: Datastream

Table 1.5: Progress towards Maastricht (2004/2005 data)

Country	**Inflation (June 04 – June 05)**	**Government deficit (%GDP)**	**Government debt (% GDP)**	**Maastricht criteria met**
Maastricht reference value	2.3	-3.0	60.0	
Cyprus	2.5	-4.1	71.9	0
Czech Republic	2.1	-3.0	37.4	4
Estonia	4.1	1.8	4.9	3
Hungary	5.0	-5.4	60.4	0
Latvia	7.0	-0.7	14.3	3
Lithuania	2.7	-2.5	19.7	3
Malta	2.4	-5.2	75.0	1
Poland	3.8	-6.8	47.7	1
Slovakia	4.5	-3.3	43.6	2
Slovenia	3.0	-1.9	29.4	3

Source: Eurostat and Fitch Ratings

Table 1.6. CEEC exchange rate regimes

	Fix	Intermediate	Float
Stabilisation phase 1990-1994	Czech Rep. Estonia Hungary Latvia Lithuania Malta Poland Slovakia	Cyprus	Bulgaria Slovenia Romania
Transition phase 1995-2000	Bulgaria Estonia Latvia Lithuania Malta	Czech Rep. Cyprus Hungary Poland Slovakia	Slovenia Romania
Preparatory phase 2001 - ERMII	Bulgaria Estonia Latvia Lithuania Malta	Cyprus Hungary Romania	Czech Rep. Poland Slovakia Slovenia

Note: De jure classification according to the IMF. Fix: currency board, conventional peg, narrow band: Intermediate:tightly managed, broad band; Float: managed float, free float

Table 1.7:Correlation of GDP and prices between acceding countries and EU countries

	1996.1-2002.4		1996.1 – 1999.4		2000.1-2002.4	
	GDP	Prices	GDP	Prices	GDP	Prices
Czech Republic	0,11	-0,15	-0,31	0,32	0,48	0,41
Estonia	0,18	0,18	0,22	0,86	0,65	0,71
Hungary	-0,07	-0,01	0,51	0,91	-0,36	0,25
Latvia	0,17	0,19	0,32	0,95	0,26	0,15
Lithuinia	-0,27	0,20	-0,06	0,92	-0,65	0,36
Poland	0,55	-0,04	0,11	0,92	0,81	-0,07
Slovak Republic	-0,28	-0,16	-0,18	-0,28	-0,82	-0,26
Slovenia	0,48	0,58	0,31	0,78	0,63	0,31
Denmark	0,45	0,30	0,32	0,04	0,45	-0,28
Sweden	0,43	0,67	0,66	0,33	0,33	0,62
United Kingdom	0,76	0,20	0,37	0,05	0,95	-0,14
Accession countries	0,11	0,10	0,11	0,67	0,13	0,23
Non-Monetary Union	0,55	0,26	0,45	0,14	0,58	0,07

Source: EFN autumn report (2003)

Table 1.8: Correlation of supply and demand shocks between candidate countries and EU countries

Supply Shocks	**Germany**		**France**		**EMU**	**UK**
	a)*	**b)****	**a)***	**b)****	**b)****	**a)****
Bulgaria	n.a	0.13	n.a	-0.29	-0.03	n.a
Czech Rep.	-0.05	-0.02	-0.06	0.13	0.04	-0.14
Estonia	0.08	0.34	-0.05	-0.06	0.25	-0.15
Hungary	**0.28**	-0.10	-0.02	0.65	0.46	-0.30
Latvia	-0.07	0.10	0.18	0.07	0.30	0.16
Lithuania	-0.16	0.00	-0.31	-0.17	-0.11	-0.04
Poland	0.00	-0.04	0.07	-0.17	0.08	0.17
Romania	n.a	-0.08	n.a	-0.02	0.02	n.a
Slovakia	-0.04	0.11	0.26	-0.04	0.05	-0.03
Slovenia	0.02	-0.04	**0.28**	-0.20	0.15	0.28
Demand Shocks	**Germany**		**France**		**EMU**	**UK**
	a)*	**b)****	**a)***	**b)****	**b)****	**a)****
Bulgaria	n.a	-0.17	n.a	0.12	0.03	n.a
Czech Rep.	0.10	-0.30	0.09	0.11	-0.15	0.03
Estonia	0.05	-0.15	0.19	0.20	0.12	0.09
Hungary	-0.40	-0.01	0.26	0.44	0.25	0.52
Latvia	0.11	-0.09	-0.21	-0.16	-0.49	-0.11
Lithuania	**0.33**	0.32	0.18	-0.24	-0.49	-0.03
Poland	0.14	0.24	0.07	0.30	0.28	0.23
Romania	n.a	-0.05	n.a	0.08	0.03	n.a
Slovakia	0.04	-0.29	-0.31	-0.27	-0.05	-0.10
Slovenia	0.03	0.14	**0.29**	0.36	-0.18	0.10

Source: a) Horvath (2002b). Notes: * Computed with quarterly GDP data over 1993:1-2000:3 (Hungary 1995:1-2000:3). Bold figures indicate significance at 5% level

b) Fidrmuc and Korhonen (2003) Notes: ** Computed with quarterly GDP data over 1994:1-2000:4 (Bulgaria, Czech Republic, Hungary 1995 -2000, Baltic Republics 1996 – 2000, Romania 1992 - 2000).

Table 1.9:Correlation of supply and demand shocks between EU countries and the aggregate of the Euro area and Germany

. **Country**	Supply shocks		Demand shocks	
	Euro area	**Geramany**	**Euro area**	**Geramany**
Austria	0.38	0.48	0.08	0.33
Belgium	0.53	0.18	0.00	0.21
Finland	0.30	0.17	0.06	-0.19
France	0.69	0.44	0.30	0.35
Germany	0.66	1.00	0.18	1.00
Greece	0.05	0.05	-0.01	-0.07
Ireland	-0.14	-0.12	0.13	-0.14
Italy	0.52	0.25	0.57	0.27
Netherlands	0.47	0.11	0.04	0.29
Portugal	0.45	0.23	0.09	0.28
Spain	0.22	0b .35	0.16	0.35
Denmark	0.18	0.30	0.13	0.09
Sweden	0.24	0.00	0.09	0.08
UK	0.21	0.12	-0.13	-0.07

Source: Fidrmuc and Korhonen (2003)

Table 1.10: Standard deviations under alternative monetary rules

Standard deviations	**Flexible wages and prices**	**Inflation targeting**	**Taylor rule**	**Taylor rule (CPI)**	**Exchange rate rule**
Baselane					
Output	1.6	2.4	1.1	1.7	5.1
Inflation	2.0	1.3	1.5	1.3	0.5
Real ex. rate	2.8	2.9	2.8	2.7	1.5
Real int rate	2.6	2.5	2.8	2.6	2.1
Price flexible					
Output	1.6	2.4	1.6	1.8	3.8
Inflation	2	1.3	1.8	1.5	2.1
Real ex.rate	2.8	2.9	2.9	2.8	2.9
Real int. rate	2.6	2.5	2.6	2.5	2.4
Wage flexible					
Output	1.6	1.6	1.3	1.5	2.3
Inflation	2	1.2	1.7	1.5	0.5
Real ex.rate	2.8	2.8	3.0	2.8	1.3
Real int. rate	2.6	2.6	2.9	2.6	2.1

Source: Devereux (2002)

Table 1.11:Data description and regime-specific dummies

Country	Variable name	Dummy	Begin date	End date
all	Asian crisis	Dumasia	1997:9	1998:4
all	Russian crisis	dumrussia	1998: 5	1999:1
all	Argentina crisis	Dumarg	2001:9	2002:5
		Dumcz		
Czech Republic	Fixed	0	1994:1	1996:1
	Bands	1	1996:2	1997:4
	Managed float	2	1997:5	2003:12
	Infl. targeting	Dumczinf=1	1998:1	2003:12
Hungary		Dumhu		
	Peg	0	1994:1	1995:3
	Crawling peg	1	1995:4	2001:5
	Crawling band	2	2001:5	2003:12
	Infl. targeting	Dumhuinf=1	2001:5	2003:12
Poland		Dumpl		
	Peg	0	1994:1	1995:4
	Bands	1	1995:5	2000:3
	Float	2	2000:4	2003:12
	Infl. targeting	Dumplinf =1	1998:9	2002:11

Table 1.12: Time series properties of the data

Time series		ADF	Phillips-Perron	Order of integration
CZ	y	-3.474**(c,t)	-4.803***	I(0)**
	d.y	-17.143***(c)	-18.764***	I(0)
	p	-2.486 (c,t)	-2.694	I(1)
	d.p	-9.659***(c)	-9.650***	I(0)
	q	1.515 (c,t)	-2.252	I(1)
	d.q	-8.028***	-8.214***	I(0)
HU	y	-3.783**(c,t)	-6.571***	I(0)**
	d.y	-18.518***(c)	-24.016***	I(0)
	p	-2.220(c,t)	-2.237	I(1)
	d.p	-9.504***(c)	-9.498***	I(0)
	q	-2.103(c,t)	-2.267	I(1)
	d.q	-9.855***(c)	-9.853***	I(0)
PL	y	-2.262(c,t)	-2.897	I(1)
	d.y	-12.706***(c)	-13.138***	I(0)
	p	-3.156*(c,t)	-3.242*	I(0)*
	d.p	-11.564***(c)	-11.593***	I(0)
	q	-2.181(c,t)	-2.297	I(1)
	d.q	-8.028***	-7.832***	I(0)
ES	y	-3.573**(c,t)	-4.705**	I(0)**
	d.y	-14.030***(c)	-14.890***	I(0)
	p	-2.578(c,t)	-2.598	I(1)
	d.p	-9.458***(c)	-9.457***	I(0)
	q	-2.165(c,t)	-2.238***	I(1)
	d.q	-14.675***	-16.269***	I(0)
SL	y	-3.864**(c,t)	-5.418***	I(0)**
	d.y	-16.325***(c)	-20.476***	I(0)
	p	-2.995(c,t)	-2.972	I(1)
	d.p	-9.879***(c)	-10.020***	I(0)
	q	-7.864***(c,t)	-7.882***	I(0)
	d.q	-14.322***	-17.833***	(0)

Source: Model estimates

Notes: d. is the first difference operator, y denotes the relative output, p the relative prices and q the real exchange rate. The asterisks indicates the rejection of the null hypothesis at the 10%(*), the 5%(**) and the 1% (***) level. The critical values of ADF test statistic is -3.540(**) and for the PP test is -2.890(**). The brackets indicate the inclusion of a trend (t) and /or a constant(c)

Table 1.13:Granger causality Wald tests

Country	*Equation*	*Excluded*	*F*	*Prob > F*	*Equation*	*Excluded*	*F*	*Prob > F*	*Equation*	*Excluded*	*F*	*Prob > F*
CZ			0.2969	0.8792			0.2567	0.9048			0.2975	0.8788
HU	**Δy**	**Δp**	0.9543	0.4369	**Δp**	**Δy**	1.7884	0.1385	**Δq**	**Δy**	0.0694	0.9910
PL			0.9611	0.4332			1.9533	0.1089			4.0020	**0.0050**
SL			1.4204	0.2341			0.2486	0.9098			1.8827	0.1208
ES			1.3695	0.2512			1.0877	0.3678			0.8773	0.4811
CZ			1.5728	0.1888			2.4375	0.0531			2.0362	0.0964
HU	**Δy**	**Δq**	0.6408	0.6348	**Δp**	**Δq**	0.5210	0.7205	**Δq**	**Δp**	1.5771	0.1877
PL			4.0917	**0.0044**			0.3939	0.8125			4.6541	**0.0019**
SL			0.3559	0.8392			0.1055	0.9803			0.8005	0.5281
ES			1.4096	0.2376			2.0867	0.0895			1.7231	0.1523
CZ			0.9064	0.5152			1.2539	0.2784			1.1585	0.3336
HU	Δy	**ALL**	0.7018	0.6890	**Δp**	**ALL**	1.1527	0.3372	**Δq**	**ALL**	0.9136	0.5093
PL			2.5768	**0.0143**			1.2836	0.2628			4.3081	**0.0002**
SL			0.8412	0.5691			0.2268	0.9851			1.1608	0.3322
ES			1.3588	0.2263			1.7199	0.1052			1.4534	0.1864

Source: Model estimates

Notes: The null hypothesis that x does not Granger-cause y is rejected if the test statistic is higher than the 5% critical value. We find that the lagged values of the variable x have explanatory power for any of the variables in the system for all the countries except for Poland.

Table 1.14:Forecast error variance decomposition

1.14.1 Czech Republic

	(1)			(2)			(3)		
Step	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**
1	**1**	**.018421**	**.00112**	**0**	**.981579**	**.004315**	**0**	**0**	**.994565**
2	**.973273**	**.027608**	**.006258**	**.019757**	**.966725**	**.004491**	**.006971**	**.005667**	**.98925**
3	**.964474**	**.026025**	**.005862**	**.022603**	**.949043**	**.059886**	**.012922**	**.024933**	**.934252**

1.14.2 Hungary

	(1)			(2)			(3)		
Step	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**
1	**1**	**.001726**	**015499**	**0**	**.998274**	**.000089**	**0**	**0**	**.984412**
2	**| .970514**	**| .002148**	**| .024648**	**.008192**	**.954243**	**| .015195**	**| .014742**	**| .04361**	**.960157**
3	**958272**	**| .002297**	**| .029925**	**.008771**	**| .94947**	**| .014742**	**.032957**	**| .048233**	**| .955332**

1.14.3 Poland

	(1)			(2)			(3)		
Step	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**
1	**1**	**.000838**	**.07016**	**0**	**.999162**	**.000335**	**0**	**0**	**929506**
2	**.924323**	**.115081**	**.072566**	**.041965**	**.881687**	**.002919**	**.033712**	**.003231**	**.924516**
3	**.848956**	**.121994**	**.130839**	**.120101**	**.837098**	**.003018**	**.030943**	**.040908**	**.866143**

1.14.4 Slovenia

	(1)			(2)			(3)		
Step	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**
1	**1**	**.043974**	**026648**	**0**	**956026**	**.018355**	**0**	**0**	**.954997**
2	**.95720**	**.068215**	**.027686**	**.003609**	**.931728**	**.019867**	**.039189**	**.000057**	**.952447**
3	**.956912**	**.07307**	**.028544**	**.003942**	**.91283**	**.02155**	**.039146**	**.014101**	**.949906**

1.14.5 Estonia

	(1)			(2)			(3)		
Step	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**	**Output**	**REER**	**Prices**
1	**1**	**.006243**	**.003011**	**0**	**.996989**	**.014567**	**0**	**0**	**.97919**
2	**.952626**	**004001**	**.006695**	**.039255**	**.995389**	**.054945**	**.008119**	**.00061**	**.938359**
3	**.924594**	**.007208**	**.006631**	**.066058**	**.962553**	**.054032**	**.009348**	**.030238**	**.939337**

Notes: (1) Forecast error variance decomposition due to supply shock, (2) Forecast error variance decomposition due to demand shock, (3) Forecast error variance decomposition due to nominal shock

Table 2.1: Countries and data source

Country	*Data*	*Period*		Source
		From	To	
Croatia	Industrial Production, CPI Money Market Rate	1994(2)	2004(6)	International Financial Statistics
Czech Republic	Industrial Production, CPI Money Market Rate	1994(2)	2004(6)	International Financial Statistics
Germany	Industrial Production, CPI Money Market Rate	1994(2)	2004(2)	International Financial Statistics
Hungary	Industrial Production, CPI Money Market Rate	1994(2)	2004(6)	International Financial Statistics
Lithuania	Industrial Production, CPI Money Market Rate	1997(2)	2004(6)	International Financial Statistics
Poland	Industrial Production, CPI Money Market Rate	1994(2)	2003(12)	International Financial Statistics
Romania	Industrial Production, CPI Money Market Rate	1994(2)	2003(4)	International Financial Statistics
Slovakia	Industrial Production, CPI Money Market Rate	1995(8)	2004(6)	International Financial Statistics
Slovenia	Industrial Production, CPI Money Market Rate	1994(2)	2004(6)	International Financial Statistics

Source: International Financial Statistics, IMF

Table 2.2: Regime switching model: industrial production and interest rates

Classification	*Croatia*		*Czech Republic*	
	IP	IR	IP	IR
Mean (High credibility)	-0.0093	0.0845	0.0061	0.0371
Mean (Low credibility)	0.0065	0.1096	0.0133	0.1453
Std. Err (High credibility)	0.0079	0.5337	0.0100	0.3266
Std. Err (Low credibility)	0.0082	1.9768	0.0062	1.7838
Transition Probailities				
(High cred. - High cred.)	0,9186		0,9488	
(Low cred. - Low cred.)	0,9349		0,7903	
(High cred. - Low cred.)	0,0814		0,0512	
(Low cred. - High cred.)	0,0651		0,2097	
Regime properties	**N.obs Prob. Dur**		**N.obs Prob. Dur**	
High credibility	57.5 0.44 2.29 .		100.8 0.80 19.55	
Low credibility	65.5 0.56 15.35		22.2 0.20 4.77	
LR Linearity test	**72.42****		**121.69****	

Table 2.2: (cont`d) Regime switching model: industrial production and interest rates

Classification	*Hungary*		*Lithuania*		*Poland*	
	IP	IR	IP	IR	IP	IR
Mean (High credibility)	-0.0130	0.0094	-0,0094	-0,1526	-0.0119	0.0176
Mean (Low credibility)	-0.0198	-0.1428	0.0078	0.9188	0.0081	-0.0117
Std. Err (High credibility)	0.0114	0.0537	0.0124	0.9416	0.0079	0.0993
Std. Err (Low credibility)	0.0063	1.1248	0.0149	2.1153	0.0451	0.2804
Transition probailities						
(High cred. - High cred.)	0,9712		0,8065		0,9695	
(Low cred. - Low cred.)	0,3205		0,2564		0,2376	
(High cred. - Low cred.)	0,0288		0,1935		0,0305	
(Low cred. - High cred.)	0,6795		0,7436		0,7624	
Regim e properties	**N.obs Prob. Dur**		**N.obs Prob. Dur**		**N.obs Prob. Dur**	
High credibility	118.5 0.96 35.50		73.4 0.88 40.71		112.3 0.97 32.74	
Low credibility	4.5 0.04 1.45		13.6 0.12 5.41		4.7 0.03 1.31	
LR Linearity test	**280.21****		**149.11***		**66.11****	

Table 2.2: (cont`d) Regime switching model: industrial production and interest rates

Classification	*Romania*		*Slovakia*		*Slovenia*	
	IP	IR	IP	IR	IP	IR
Mean (High credibility)	-0.0029	-0.0657	-0.0012	-0.0035	-0.0025	0.0158
Mean (Low credibility)	0.0094	0.0300	-0.0001	0.1509	-0.0056	0.0308
Std. Err (High credibility)	0.0227	0.2145	0.0045	0.0915	0.0048	0.1769
Std. Err (Low credibility)	0.0068	0.1207	0.0081	0.2928	0.0024	0.5641
Transition Probailities						
(High cred. -High cred.)	0,4178		0,9439		0,9533	
(Low cred. - Low cred.)	0,9345		0,7433		0,7540	
(High cred. -Low cred.)	0,5822		0,0561		0,0467	
(Low cred. - High cred.)	0,0655		0,2567		0,246	
Regime properties	**N.obs Prob. Dur**		**N.obs Prob. Dur**		**N.obs Prob. Dur**	
High credibility	11.1 0.10 1.72		86.4 0.82 17.83		103.5 0.84 21.40	
Low credibility	97.9 0.90 15.26		18.6 0.18 3.90		19.5 0.16 4.06	
LR Linearity test	**30.79****		**36.07****		**43.75****	

Notes:
Non-linear, bivariate heteroscedastic Markov- switching model with regime dependent mean. Number of regimes 2, number of lags 3. Results obtained using Ox ; IP – industrial production, IR- interest rate differential
* indicates that the null hypothesis of linearity has been rejected at 1% level
** indicates that the null hypothesis of linearity has been rejected at 5% level

Table 2.3: Regime switching model: inflation and interest rates

Classification	*Croatia*		*Czech Republic*	
	CPI	IR	CPI	IR
Mean (High credibility)	-0.0037	0.0724	-0.0064	-0.0339
Mean (Low credibility)	-0.0026	0.1331	-0.0060	-0.0263
Std. Err (High credibility)	0.0015	0.6969	0.0034	0.2106
Std. Err (Low credibility)	0.0005	2.6959	0.0005	1.0256
T ransition Probailities				
(High cred. - High cred.)	0,9036		0,6675	
(Low cred. - Low cred.)	0,7156		0,7907	
(High cred. - Low cred.)	0,0964		0,3325	
(Low cred. - High cred.)	0,2844		0,2093	
Regime properties	**N.obs Prob. Duration**		**N.obs Prob. Duration**	
High credibility	91.8 0.75 10.37		47.5 0.39 3.01	
Low credibility	31.2 0.25 3.52		75.5 0.61 4.78	
LR Linearity test	78.36**		192.96**	

Table 2.3: (cont`d) Regime switching model: inflation and interest rates

Classification	*Hungary*		*Lithuania*		*Poland*	
	CPI	IR	CPI	IR	CPI	IR
Mean (High credibility)	-0.0033	-0.0234	-0.0001	-0.3145	-0.0096	-0.0092
Mean (Low credibility)	-0.0020	0.0158	-0.0001	0.1799	-0.0091	0.0181
Std. Err (High credibility)	0.0015	0.1228	0.0021	0.5055	0.0137	0.0879
Std. Err (Low credibility)	0.0007	0.0430	0.0008	1.5949	0.0010	0.1164
Transition Probailities						
(High cred. - High cred.)	0,3314		0,6891		0	
(Low cred. - Low cred.)	0,7723		0,8811		0,8933	
(High cred. - Low cred.)	0,6686		0,3109		1	
(Low cred. - High cred.)	0,2277		0,1189		0,1067	
Regime properties	**N.obs Prob. Dur.**		**N.obs Prob. Dur.**		**N.obs Prob. Dur.**	
High credibility	31.0 0.25 1.50		23.5 0.28 3.2		11.3 0.09 1.00	
Low credibility	91.0 0.75 4.39		63.5 0.72 8.41		105.7 0.90 9.37	
LR Linearity test	**43.97****		**30.06****		**238.15****	

Table 2.3: (cont`d) Regime switching model: inflation and interest rates

Classification	*Romania*		*Slovakia*		*Slovenia*	
	CPI	IR	CPI	IR	CPI	IR
Mean (High credibility)	-0.0565	-0.0987	-0.0068	-0.0011	-0.0068	-0.0030
Mean (Low credibility)	-0.0537	0.0238	-0.0072	0.0070	-0.0070	0.3121
Std. Err (High credibility)	0.0529	0.1917	0.0051	0.1056	0.0007	0.1929
Std. Err (Low credibility)	0.0043	0.1206	0.0008	0.1575	0.0034	0.4831
Transition Probailities						
(High cred. - High cred.)	0,2804		0,3208		0,8838	
(Low cred. - Low cred.)	0,9016		0,8491		0,2438	
(High cred. - Low cred.)	0,7196		0,6792		0,1162	
(Low cred. - High cred.)	0,0984		0,1509		0,7562	
Regime properties	**N.obs Prob. Dur.**		**N.obs Prob. Dur.**		**N.obs Prob. Dur.**	
High credibility	13.3 0.12 1.39		19.1 0.18 1.47		106.7 0.87 8.61	
Low credibility	95.7 0.88 10.16		85.9 0.81 6.63		16.3 0.13 1.32	
LR Linearity test	**200.78****		**101.02****		**100.62****	

Notes:
Non-linear, bivariate heteroscedastic Markov- switching model with regime dependent mean. Number of regimes 2, number of lags 3. Results obtained using Ox (Krolzig ,2004); CPI – consumer price index , IR- interest rate differential
* indicates that the null hypothesis of linearity has been rejected at 1% level
** indicates that the null hypothesis of linearity has been rejected at 5% level

Table 2.4: Regime switching model coefficients in selected countries

Countries/ Coefficients	*Hungary*		*Slovakia*		*Czech Republic*	
	IR	**IP**	**IR**	**IP**	**IR**	**IP**
$(L_1)\ \alpha_{11}\ \alpha_{12}$ (High cred.)	0.175	-0.024	0.264	-0.006	-0.031	0.000
Standard Error	(0.089)	(0.013)	(0.083)	(0.004)	(0.094)	(0.001)
$(L_2)\ \alpha_{11}\ \alpha_{12}$	0.181	-0.002	-0.021	0,006	-0.043	0.001
Standard Error	(0.090)	(0.013)	(0.087)	(0.004)	(0.078)	(0.001)
$(L_3)\ \alpha_{11}\ \alpha_{12}$	-0.136	0.014	0.003	0.002	-0.097	0.001
Standard Error	(0.090)	(0.013)	(0.084)	(0.004)	(0.078)	(0.001)
$(L_1)\ \alpha_{21}\ \alpha_{22}$	-0.842	0.276	-2.996	0.423	-9.954	0.416
Standard Error	(0.584)	(0.085)	(2.220)	(0.096)	(5.172)	(0.082)
$(L_2)\ \alpha_{21}\ \alpha_{22}$	-0.118	0.270	0.575	0.040	6.778	0.194
Standard Error	(0.600)	(0.086)	(2.383)	(0.101)	(5.695)	(0.089)
$(L_3)\ \alpha_{21}\ \alpha_{22}$	1.145	0.331	-2.367	0.190	5.271	0.182
Standard Error	(0.585)	(0.086)	(1.935)	(0.083)	(5.096)	(0.080)
$(L_1)\ \alpha_{11}\ \alpha_{12}$ (Low cred.)	3.366	-0.101	-0.435	0.078	0.660	-0.002
Standard Error	(1.060)	(0.150)	(0.382)	(0.017)	(0.185)	(0.005)
$(L_2)\ \alpha_{11}\ \alpha_{12}$	-2.010	0.236	-0.590	0.010	-0.773	0.002
Standard Error	(1.480)	(0.201)	(0.222)	(0.097)	(0.162)	(0.003)
$(L_3)\ \alpha_{11}\ \alpha_{12}$	9.868	-0.220	2.245	-0.101	1.402	-0.000
Standard Error	(0.719)	(0.101)	(0.370)	(0.016)	(0.190)	(0.003)
$(L_1)\ \alpha_{21}\ \alpha_{22}$	-20.146	1.122	-19.794	2.023	-126.136	-0.750
Standard Error	(4.824)	(0.684)	(7.430)	(0.329)	(33.566)	(0.603)
$(L_2)\ \alpha_{21}\ \alpha_{22}$	36.589	-1.035	-18.002	-0.438	128.775	-0.441
Standard Error	(5.580)	(0.794)	(5.157)	(0.226)	(34.858)	(0.585)
$(L_3)\ \alpha_{21}\ \alpha_{22}$	2.853	0.536	52.285	-1.316	-59.038	0.948
Standard Error	(4.821)	(0.683)	(6.702)	(0.294)	(51.462)	(0.845)
	IR	**CPI**	**IR**	**CPI**	**IR**	**CPI**
$(L_1)\ \beta_{11}\ \beta_{12}$ (High cred.)	-0.119	-0.002	-0.126	0.006	-0.728	0.001
Standard Error	(0.203)	(0.003)	(0.242)	(0.003)	(0.212)	(0.001)
$(L_2)\ \beta_{11}\ \beta_{12}$	0.324	0.001	-0.127	-0.019	-0.618	0.000
Standard Error	(0.165)	(0.002)	(0.222)	(0.003)	(0.269)	(0.001)
$(L_3)\ \beta_{11}\ \beta_{12}$	0.142	0.004	-0.879	0.017	-0.413	0.001
Standard Error	(0.183)	(0.002)	(0.336)	(0.004)	(0.208)	(0.001)
$(L_1)\ \beta_{21}\ \beta_{22}$	38.49	-0.156	-28.608	1.240	-1.755	0.522
Standard Error	(18.044)	(0.270)	(13.30)	(0.179)	(124.37)	(0.255)
$(L_2)\ \beta_{21}\ \beta_{22}$	-33.00	0.932	8.424	-0.356	-1556.127	0.437
Standard Error	(23.889)	(0.300)	(15.31)	(0.204)	(658.19)	(1.421)
$(L_3)\ \beta_{21}\ \beta_{22}$	-29.67	0.412	12.911	-0.031	855.312	0.861
Standard Error	(24.448)	(0.288)	(10.95)	(0.147)	(433.37)	(0.990)
$(L_1)\ \beta_{11}\ \beta_{12}$ (Low cred.)	0.221	-0.001	0.312	0.001	0.185	0.000
Standard Error	(0.097)	(0.001)	(0.124)	(0.002)	(0.086)	(0.001)
$(L_2)\ \beta_{11}\ \beta_{12}$	0.187	-0.000	0.086	0.003	-0.357	-0.000
Standard Error	(0.089)	(0.001)	(0.125)	(0.002)	(0.086)	(0.001)
$(L_3)\ \beta_{11}\ \beta_{12}$	-0.099	0.002	0.252	0.001	0.091	-0.000
Standard Error	(0.087)	(0.001)	(0.123)	(0.002)	(0.090)	(0.001)
$(L_1)\ \beta_{21}\ \beta_{22}$	2.251	0.511	2.134	0.700	-3.118	0.902
Standard Error	(5.82)	(0.073)	(7.74)	(0.108)	(28.086)	(0.080)
$(L_2)\ \beta_{21}\ \beta_{22}$	-2.674	0.121	-2.295	-0.018	-5.210	0.019
Standard Error	(6.23)	(0.080)	(9.40)	(0.125)	(37.662)	(0.101)
$(L_3)\ \beta_{21}\ \beta_{22}$	4.669	0.118	4.202	0.038	36.930	-0.036
Standard Error	(5.68)	(0.075)	(7.03)	(0.093)	(26.423)	(0.0702

Notes:

Estimation of equations (1.16) and (1.17) in the text with regime dependant coefficients. Selected countries. Number of regimes 2 (High and Low cred.), number of lags 3 ($L_{1,2,3}$). Standard errors in parentheses. IP – industrial production, IR- interest rate differential, CPI – consumer price index. Coefficients (α_{11} , α_{12}) and (β_{11} , β_{12}) indicate lagged IR values, (α_{21}, α_{22}) lagged IP values, and (β_{11} , β_{12}) lagged CPI values.

Table 3.1. Summary of Dutch Disease Symptoms

	Output	Employment	Wage	Price
Resource movement effect				
oil sector	+	+	+	given
manufacturing sector	–	–	+	given
services sector	–	–	+	+
Spending effect				
oil sector	–	–	+	given
manufacturing sector	–	–	+	given
services sector	+	+	+	+
Combined effect				
oil sector	indeterminate	indeterminate	+	given
manufacturing sector	–	–	+	given
services sector	indeterminate	indeterminate	+	+

Table 3.2. Data Description and Sources

VARIABLE	SOURCE	FREQUENCY	DESCRIPTION
Real effective exchange rate	IFS	Monthly	CPI-based index, 1995=100.
Oil price	Bloomberg	Monthly	Urals crude oil price per barrel.
Government consumption	IMF, IFS	Monthly, Quarterly	General government non-interest expenditure (monthly) in percent of GDP (quarterly, interpolated).
Productivity differential	Rosstat, Eurostat, U.S. National Census bureau	Monthly	The ratio of Russian labor productivity to the unweighted average of Euro area and U.S. labor productivity (where labor productivity is measured as industrial output per worker).
Net international reserves	IFS	Monthly	Gross international reserves (including gold) minus liabilities to IMF.
Corruption	Transparency International	Annual	Survey-based index (interpolated).

Table 3.3. Correlation Matrix

	Real effective exchange rate	Oil price	Government consumption	Productivity differential	Net international reserves	Corruption index
Real effective exchange rate	1.00	0.14	0.44	0.13	0.56	0.32
Oil price	0.14	1.00	-0.09	0.77	0.74	0.28
Government consumption	0.44	-0.09	1.00	-0.13	0.21	0.42
Productivity differential	0.13	0.77	-0.13	1.00	0.68	0.42
Net international reserves	0.56	0.74	0.21	0.68	1.00	0.41
Corruption index	0.32	0.28	0.42	0.42	0.41	1.00

Table 3.4 Augmented Dickey-Fuller (ADF) Unit Root Tests

ADF tests for unit root in levels[1] 1995:M1-2004:M12			ADF tests for unit root in differences[2] 1995:M1-2004:M12		
ln (REER)			Δln (REER)		
lag	t-adf	beta	lag	t-adf	beta
4	-2.552	0.062	4	-4.057 **	-0.599
3	-2.834	0.067	3	-4.242 **	-0.594
2	-2.200	0.050	2	-4.644 **	-0.597
1	-2.123	0.049	1	-6.613 **	-0.733
0	-1.491	0.035	0	-7.954 **	-0.704
ln (oil price)			Δln (oil price)		
4	-1.902	0.099	4	5.201 **	1.496
3	-2.106	0.106	3	6.288 **	1.537
2	-1.925	0.094	2	6.942 **	1.412
1	-2.353	0.113	1	10.252 **	1.484
0	-2.879	0.134	0	13.287 **	1.217
ln (productivity differential)			Δln (productivity differential)		
4	-2.708	-0.128	4	-5.917 **	-1.307
3	-2.876	-0.133	3	-5.961 **	-1.144
2	-2.367	-0.108	2	-5.593 **	-0.969
1	-2.642	-0.117	1	-8.251 **	-1.132
0	-2,932 *	-0.123	0	-11.761 **	-1.089
ln (government consumption)			Δln (government consumption)		
4	-2.130	0.019	4	-7.861 **	-3.048
3	-2.320	0.200	3	-7.789 **	-2.499
2	-2.689	0.224	2	-9.089 **	-2.203
1	-3,633 *	0.296	1	-12.952 **	-1.993
0	-5,621 **	0.428	0	-17.748 **	-1.477
ln (net international reserves)			Δln (net international reserves)		
lag	t-adf	beta	lag	t-adf	beta
4	-2,240	-0.077	4	-3.999 *	-0.945
3	-1,828	-0.064	3	-4.079 **	-0.890
2	-1,437	-0.051	2	-5.640 **	-1.095
1	-1,748	-0.061	1	-10.131 **	-1.457
0	-2,131	-0.074	0	-13.361 **	-1.216
ln (corruption index)			Δln (corruption index)		
lag	t-adf	beta	lag	t-adf	beta
4	-1.747	-0.053	4	-4793 **	-1.062
3	-1.733	-0.051	3	-5.373 **	-1.048
2	-1.721	-0.049	2	-6.222 **	-1.035
1	-1.710	-0.048	1	-7.642 **	-1.022
0	-1,699	-0.046	0	-10,840 **	-1.011

[1] The regression includes a constant and a trend. The critical values of the ADF t-statistics are -3.45 for the 5 percent level and -4.04 for the 1 percent level (MacKinnon,1996 one sided p-values). The null hypothesis is that of a unit root in levels, i.e., rejection of the null means that the variable is stationary in levels. The symbols * and ** denote significance at the 5 percent and 1 percent level, respectively.

[2]The regression includes a constant and a trend. The critical values of the ADF t-statistics are -3.45 for the 5 percent level and -4.04 for the 1 percent level (MacKinnon,1996 one sided p-values). The null hypothesis is that of a unit root in differences, i.e., rejection of the null means that the variable is stationary in levels. The symbols * and ** denote significance at the 5 percent and 1 percent level, respectively.

Table 3.5. Johansen Cointegration Tests

1996:M02–2004:M12					1997:M04–2004:M12			
(1)					**(1)**			
rank	λ trace	prob.	λ max	prob.	λ trace	prob.	λ max	prob.
r = 0	50.99	[0.025] *	33.86	[0.007] **	49.76	[0.032] *	30.05	[0.024] *
r ≤ 1	17.13	[0.630]	12.19	[0.529]	19.71	[0.443]	14.73	[0.309]
r ≤ 2	4.94	[0.815]	4.70	[0.780]	4.99	[0.810]	4.36	[0.820]
r ≤ 3	0.24	[0.623]	0.24	[0.622]	0.63	[0.428]	0.63	[0.428]
(2)					**(2)**			
rank	λ trace	prob.	λ max	prob.	λ trace	prob.	λ max	prob.
r = 0	60.35	[0.002] **	44.57	[0.000] **	59.01	[0.003] **	43.60	[0.000] **
r ≤ 1	15.77	[0.728]	8.35	[0.881]	15.41	[0.753]	11.21	[0.627]
r ≤ 2	7.42	[0.529]	6.75	[0.520]	4.20	[0.886]	3.83	[0.876]
r ≤ 3	0.67	[0.411]	0.67	[0.411]	0.37	[0.544]	0.37	[0.544]
(3)					**(3)**			
rank	λ trace	prob.	λ max	prob.	λ trace	prob.	λ max	prob.
r = 0	75.63	[0.016] *	38,19	[0.014] **	90.43	[0.000] **	47,90	[0.000] **
r ≤ 1	37.45	[0.327]	21,90	[0.225]	42.53	[0.144]	29,49	[0.028] *
r ≤ 2	15.54	[0.744]	9,66	[0.776]	13.04	[0.890]	8,07	[0.899]
r ≤ 3	5.89	[0.709]	4,87	[0.759]	4.97	[0.813]	4,68	[0.781]
(4)					**(4)**			
rank	λ trace	prob.	λ max	prob.	λ trace	prob.	λ max	prob.
r = 0	126.95	[0.000] **	58.92	[0.000] **	136.02	[0.000] **	61.27	[0.000] **
r ≤ 1	68.03	[0.069]	28.81	[0.179]	74.74	[0.019] *	35.34	[0.033] *
r ≤ 2	39.22	[0.252]	20.56	[0.304]	39.40	[0.245]	25.36	[0.094]
r ≤ 3	18.65	[0.518]	13.94	[0.370]	14.05	[0.838]	10.11	[0.734]

Notes: Estimations include four lags, a restricted constant, and two dummies for September and October 1998 to control for the large real depreciation following the Russian financial crisis in August 1998. The symbols * and ** denote significance at the 5 percent and 1 percent level, respectively. The numbers (1) through (4) refer to the estimated cointegration equations reported in a separate table.

Table 3.6. Estimated Cointegrating Vectors

	(1)		(2)		(3)		(4)	
First observation	1996:02	1997:04	1996:02	1997:04	1996:02	1997:04	1996:02	1997:04
Last observation	2004:12	2004:12	2004:12	2004:12	2004:12	2004:12	2004:12	2004:12
Number of observations	107	93	107	93	107	93	107	93
Ln (oil price)			**0.35**	**0.38**			**1.06**	**0.73**
standard error			(0.13)	(0.14)			(0.25)	(0.21)
Ln (government consumption)	**1.71**	**1.80**	**1.14**	**1.14**	**2.00**	**2.20**	**2.02**	**2.22**
standard error	(0.32)	(0.38)	(0.17)	(0.19)	(0.35)	(0.28)	(0.37)	(0.30)
Ln (productivity differential)	**1.56**	**1.77**			**1.75**	**2.99**	0.68	**1.92**
standard error	(0.46)	(0.63)			(0.46)	(0.60)	(0.45)	(0.67)
Ln (NIR)	**-0.17**	**-0.20**	**-0.06**	**-0.07**	**-0.12**	**-0.09**	**-0.30**	**-0.22**
standard error	(0.05)	(0.06)	(0.03)	(0.03)	(0.04)	(0.03)	(0.06)	(0.05)
Ln (corruption)					**-1.25**	**-3.24**	0.42	**-1.63**
standard error					(0.53)	(0.57)	(0.56)	(0.61)
LM test for serial correlation	0.66	0.48	0.95	0.95	0.07	0.40	0.34	0.36
Jarque-Bera normality test	0.55	0.68	0.69	0.69	0.33	0.34	0.11	0.36
Heteroskedasticity test	0.24	0.20	0.24	0.24	0.67	0.11	0.39	0.61
Akaike information criterion	-5.58	-5.60	-5.51	-5.55	-5.49	-5.54	-5.51	-5.48
Schwartz information criterion	-5.08	-5.06	-5.01	-5.00	-4.89	-4.88	-4.81	-4.72
Log likelihood	318	280	314	277	317	281	322	282

Notes: The dependent variable is the log of the real effective exchange rate. All regressions include four lags, a constant, and two dummies for September and October 1998 to control for the large real depreciation following the Russian financial crisis in August 1998. Coefficient estimates in bold are significant at the 5 percent level.

Figure 1.1 Real and nominal exchange rates – currency board countries

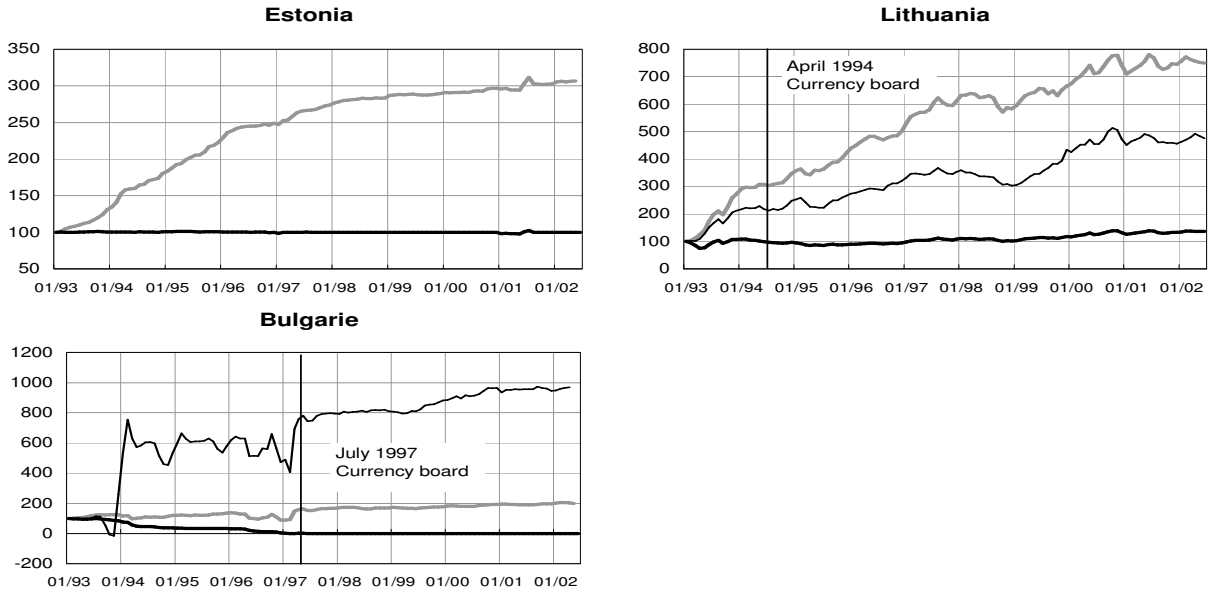


Figure 1.2. Real and nominal exchange rates – crawling pegs

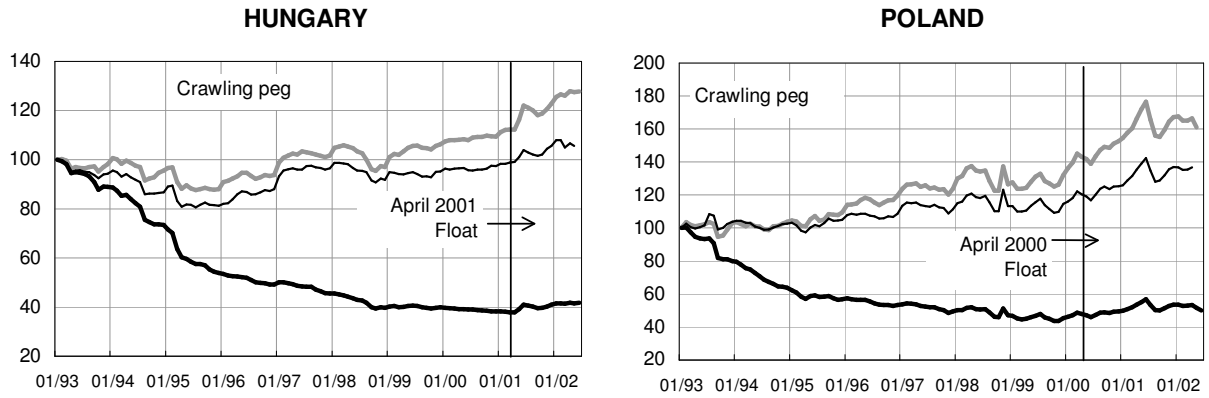


Figure 1.3 Real and nominal exchange rates – managed float

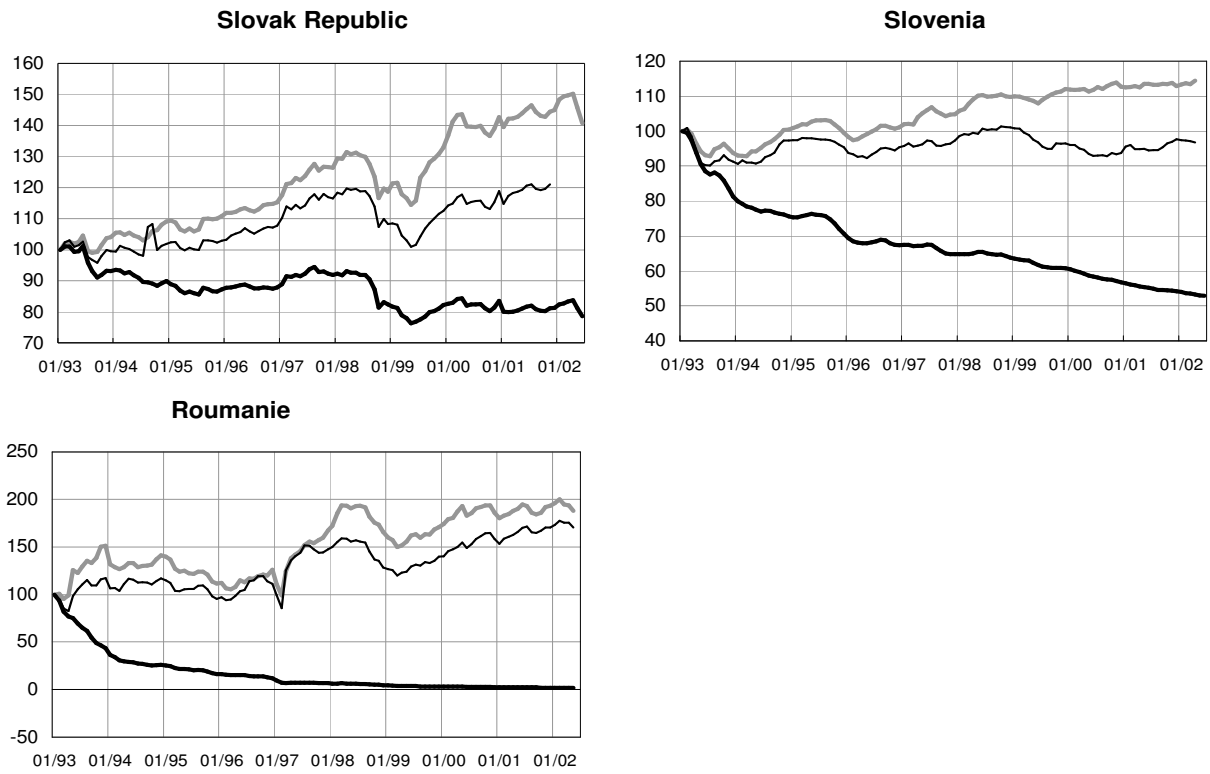
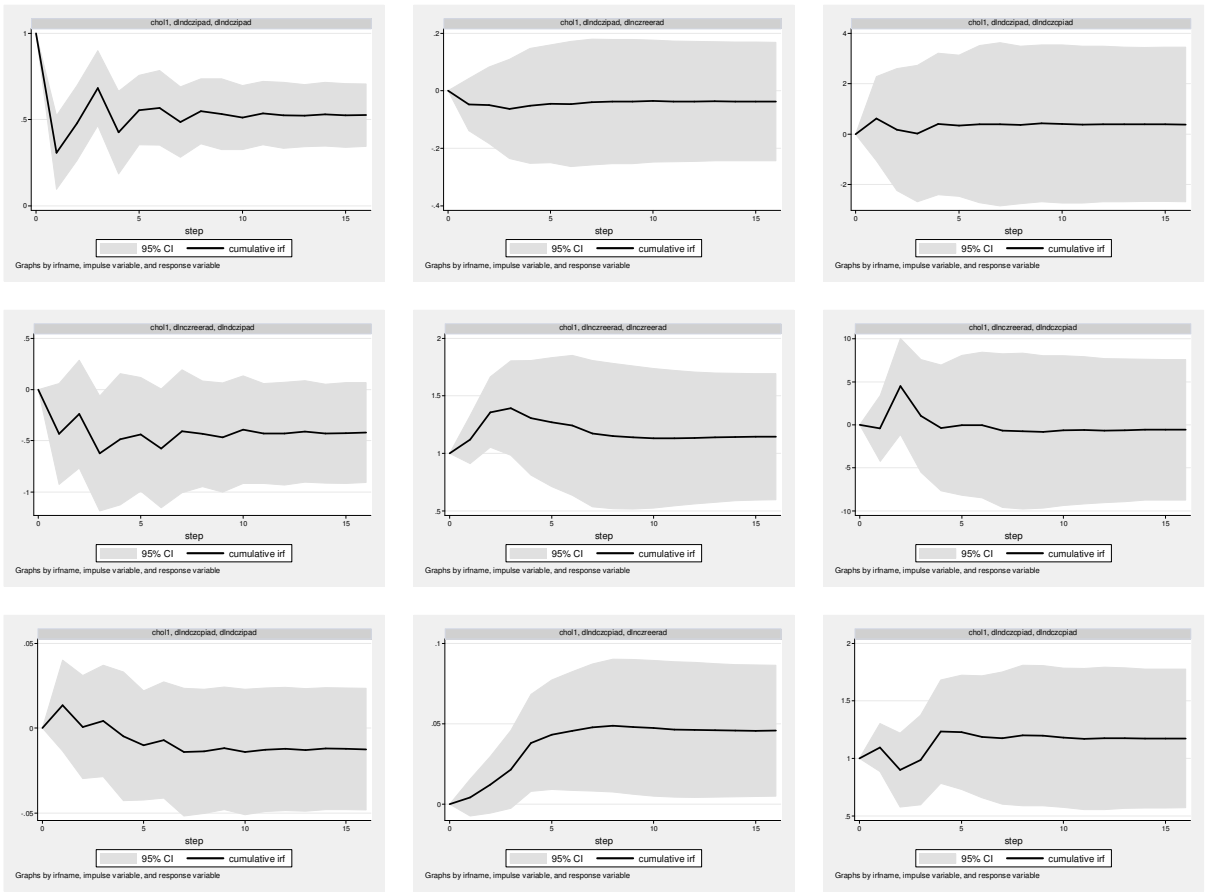


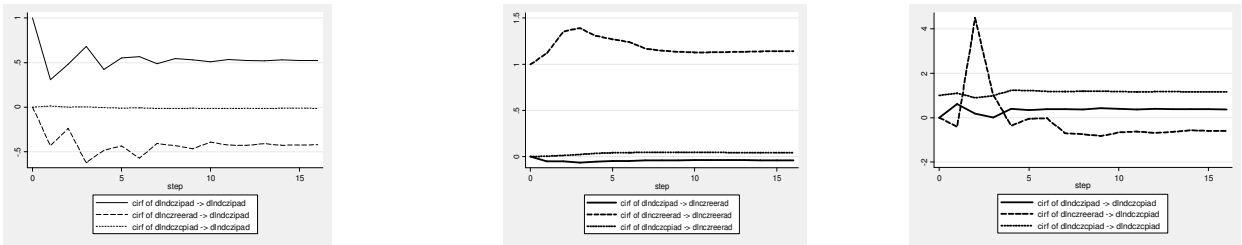
Figure 1.4: Structural VAR - impulse response functions

1.4.1.a. Czech Republic



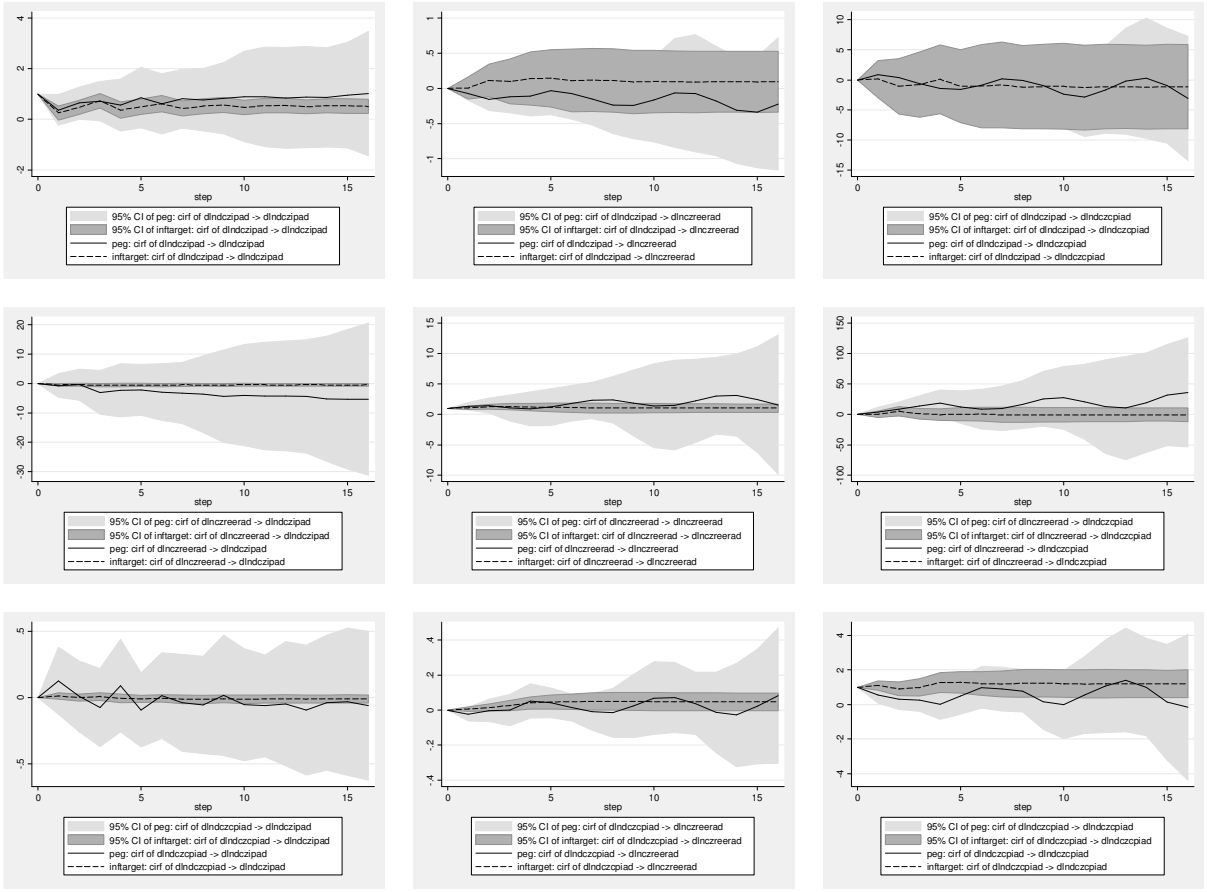
Note: The first permanent shock is assumed to have a long-run impact on all three variables in the system. The transitory shock is assumed to have no long-run effect on any of the variables (since transitory shocks do not persist). (i) Response of relative output, real effective exchange rate and prices to supply, shocks; (ii) Response of relative output, real effective exchange rate and prices to demand shocks; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks

1.4.1b. (a) (b) (c)



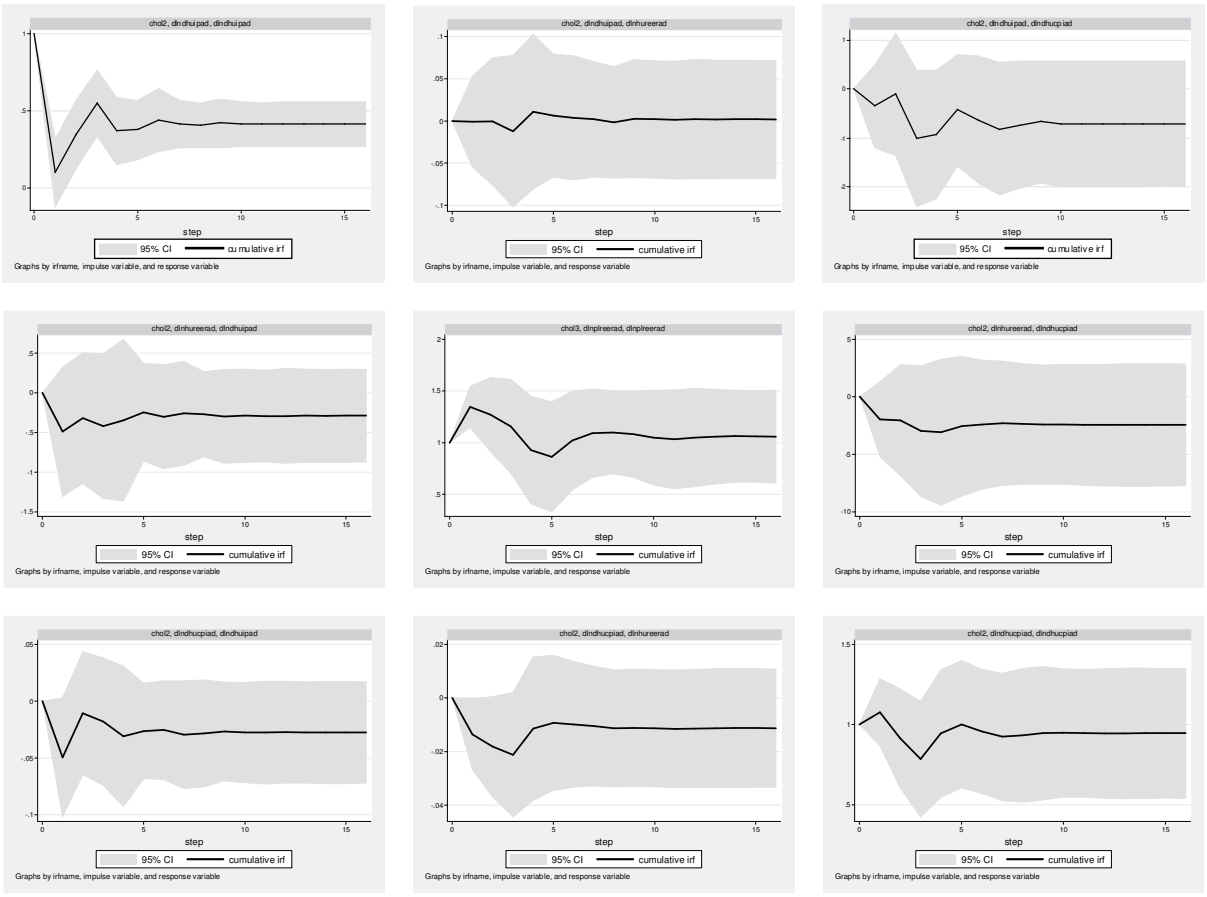
(a) Response of relative output to supply, demand and nominal shocks (b) Response of real exchange rate to supply, demand and nominal shocks (c) Response of relative prices to supply, demand and nominal shocks

1.4.1c.



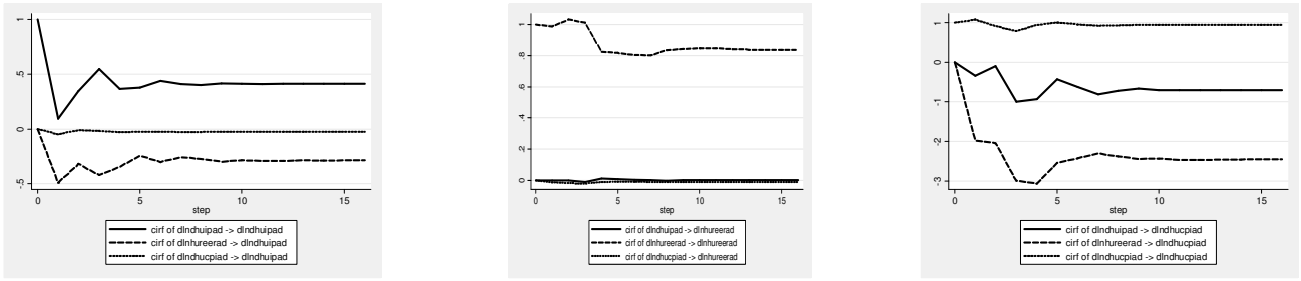
Note: ─ pegged regime, ----- inflation targeting i) Response of relative output, real effective exchange rate and prices to supply, shocks in pegged regime and in inflation targeting; (ii) Response of relative output, real effective exchange rate and prices to demand shocks in peg and in inflation targeting; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks in peg and inflation targeting

1.4.2a. Hungary



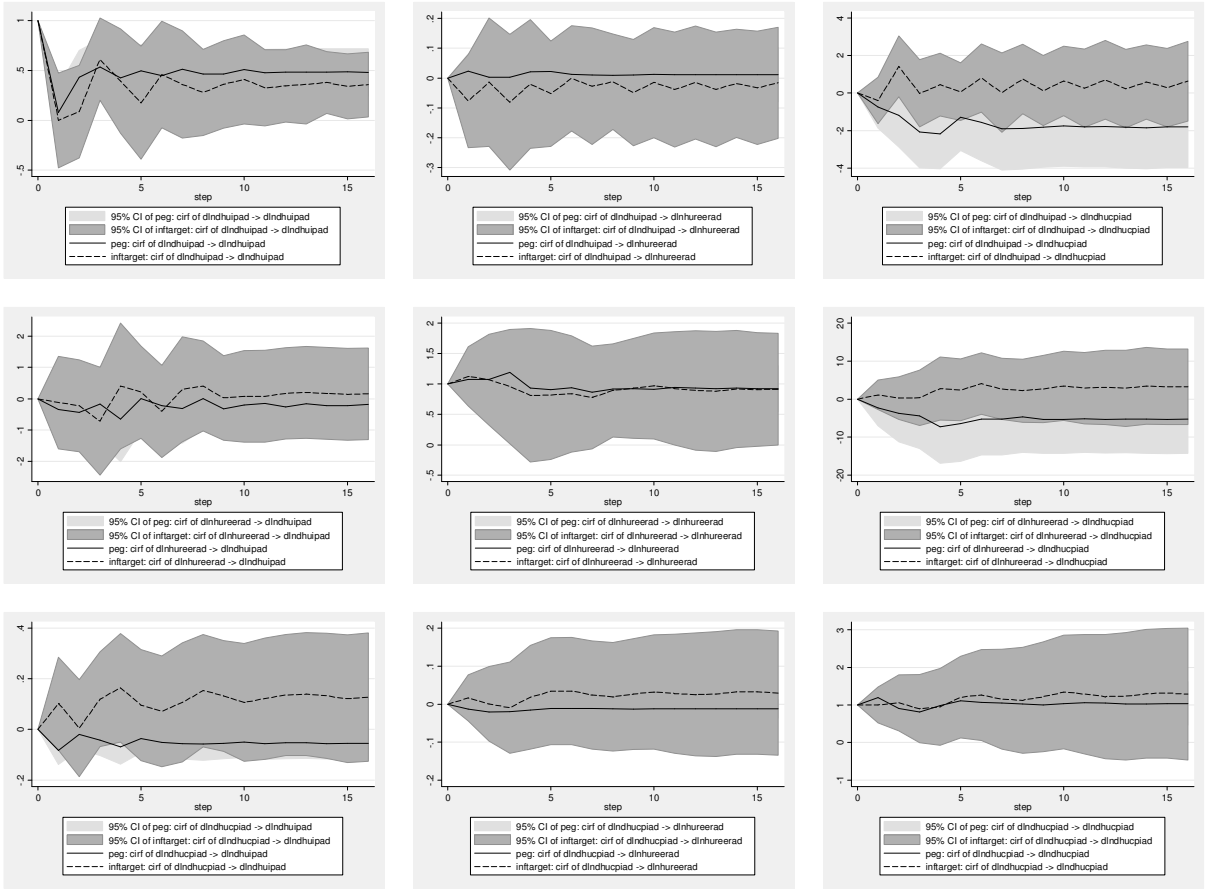
Note: The first permanent shock is assumed to have a long-run impact on all three variables in the system. The transitory shock is assumed to have no long-run effect on any of the variables (since transitory shocks do not persist) (i) Response of relative output, real effective exchange rate and prices to supply, shocks; (ii) Response of relative output, real effective exchange rate and prices to demand shocks; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks

1.4.2b.(a) (b) (c)



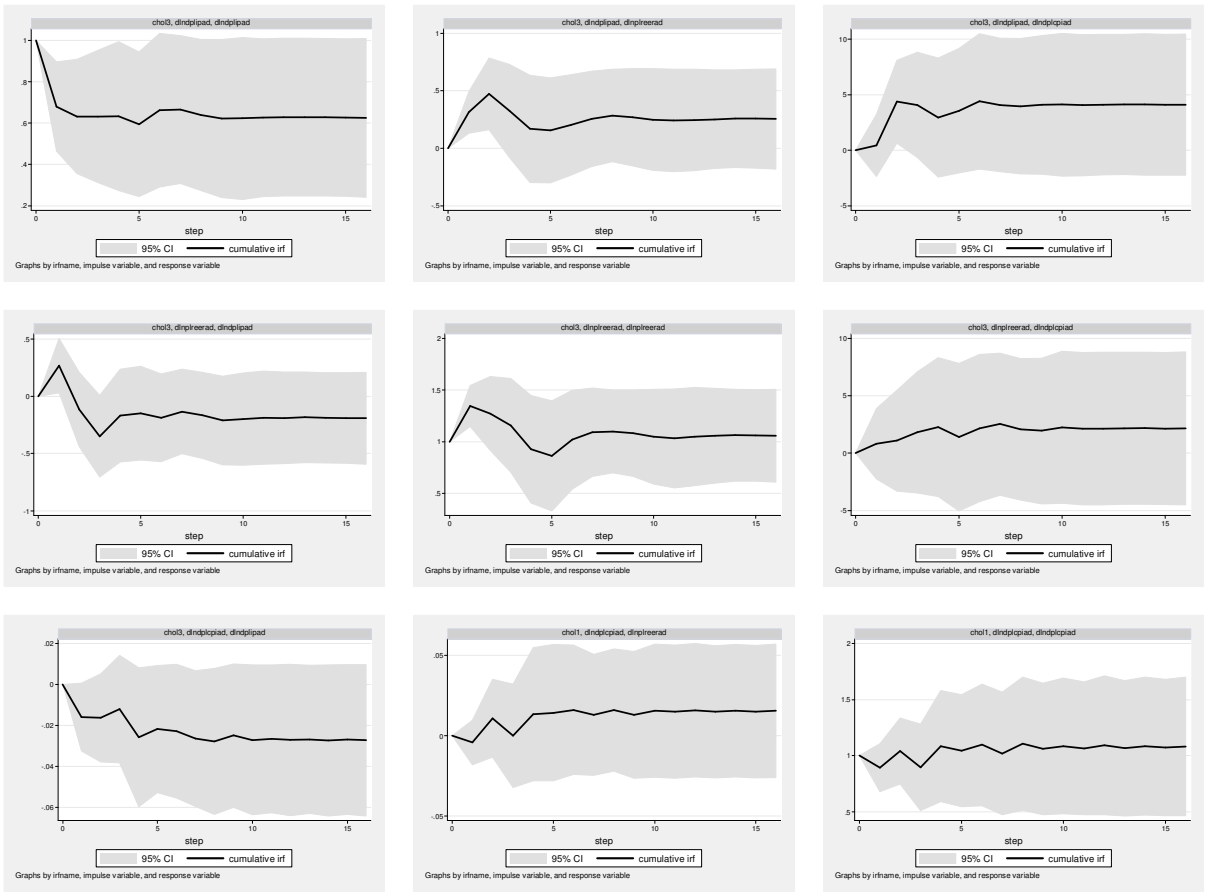
(a) Response of relative output to supply, demand and nominal shocks (b) Response of real exchange rate to supply, demand and nominal shocks (c) Response of relative prices to supply, demand and nominal shocks

1.4.2c.



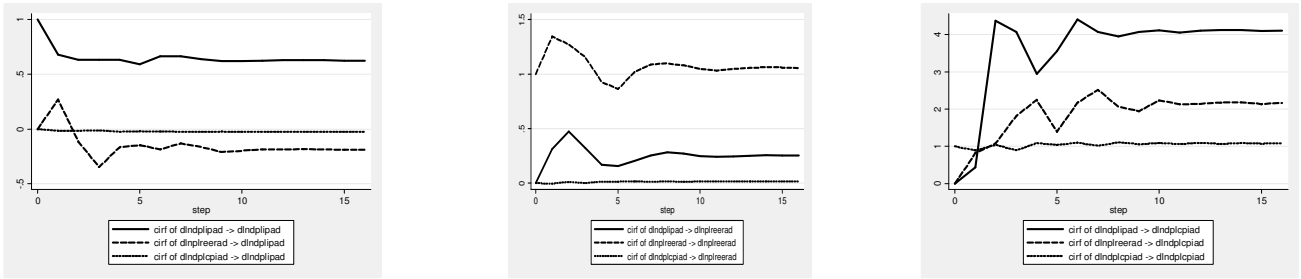
Note: : ─ pegged regime, -----inflation targeting (i) Response of relative output, real effective exchange rate and prices to supply, shocks in pegged regime and in inflation targeting; (ii) Response of relative output, real effective exchange rate and prices to demand shocks in pegged regime and in inflation targeting; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks in pegged regime and in inflation targeting

1.4.3a Poland.



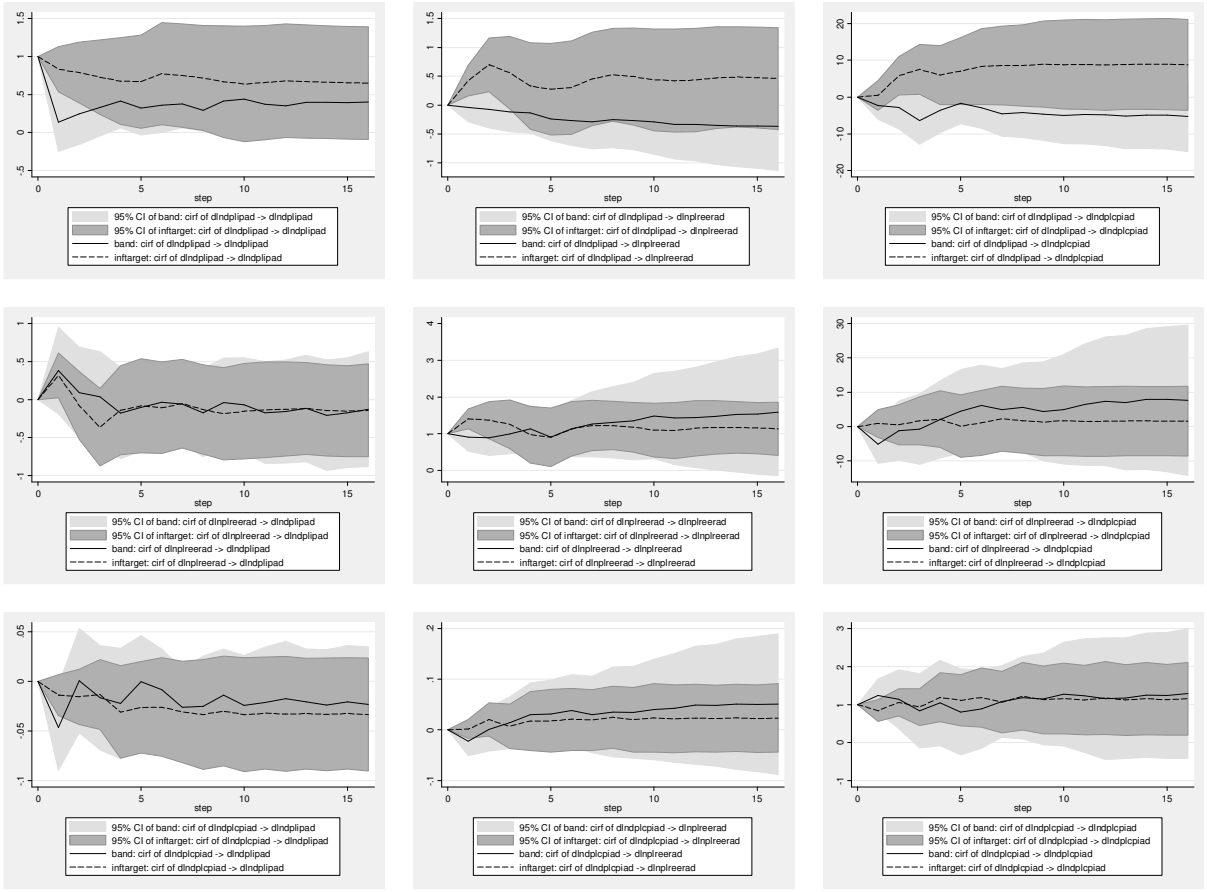
Note: (i) Response of relative output, real effective exchange rate and prices to supply, shocks; (ii) Response of relative output, real effective exchange rate and prices to demand shocks; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks

1.4.3b. (a) (b) (c)



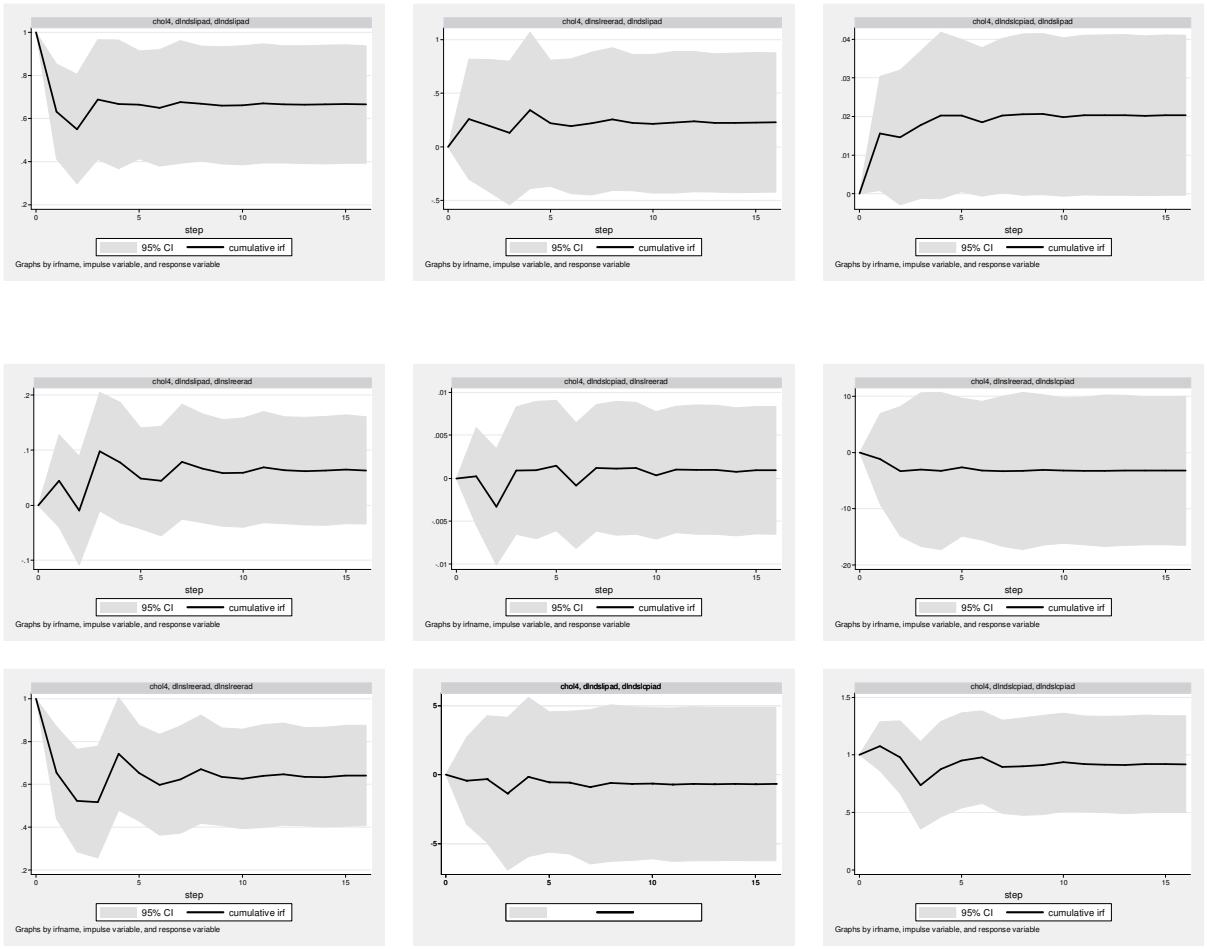
(a) Response of relative output to supply, demand and nominal shocks (b) Response of real exchange rate to supply, demand and nominal shocks (c) Response of relative prices to supply, demand and nominal shocks

1.4.3c.



Note: : - band, ----- inflation targeting (i) Response of relative output, real effective exchange rate and prices to supply, shocks in pegged regime and in inflation targeting; (ii) Response of relative output, real effective exchange rate and prices to demand shocks in pegged regime and in inflation targeting; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks in pegged regime and in inflation targeting

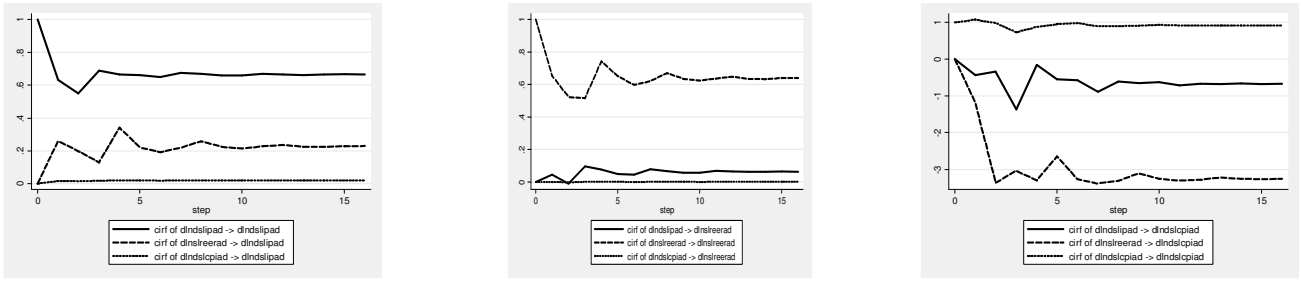
1.4.4a.Slovenia



Note: The first permanent shock is assumed to have a long-run impact on all three variables in the system. The transitory shock is assumed to have no long-run effect on any of the variables (since transitory shocks do not persist) (i)Response Response of relative output, real effective exchange rate and prices to supply shocks; (ii) Response of relative output, real effective exchange rate and prices to demand shocks; (iii) Response of relative output, real effective exchange rate and prices to nominal shocks

1.4.4b.

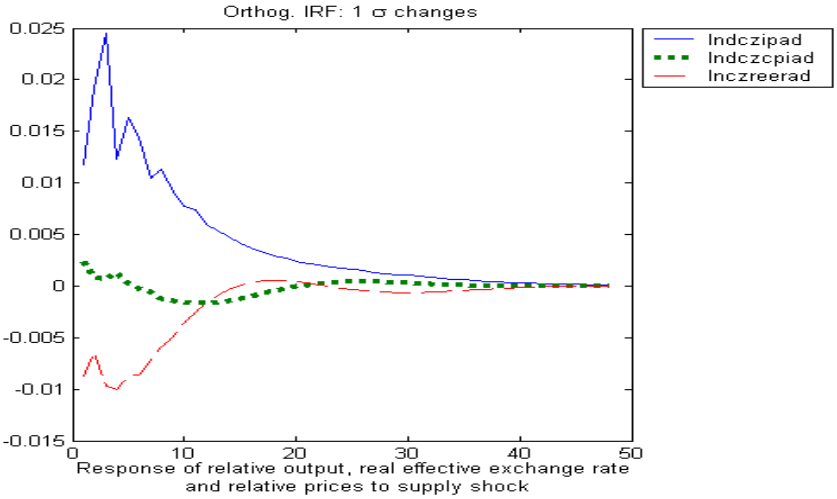
(a) (b) (c)

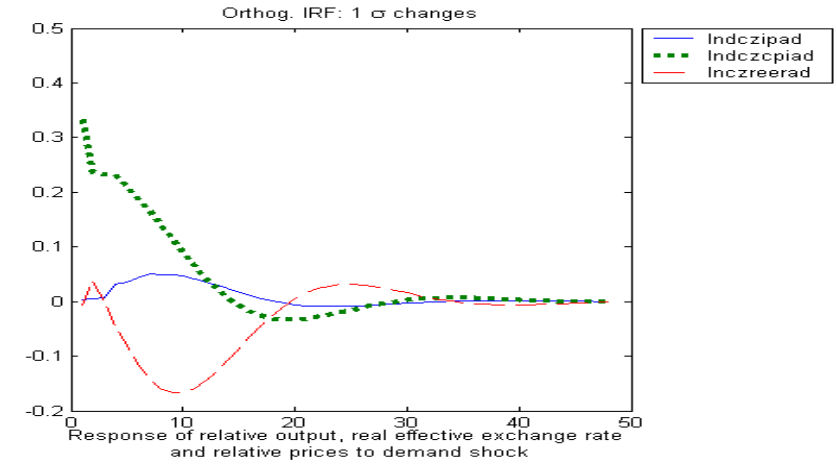


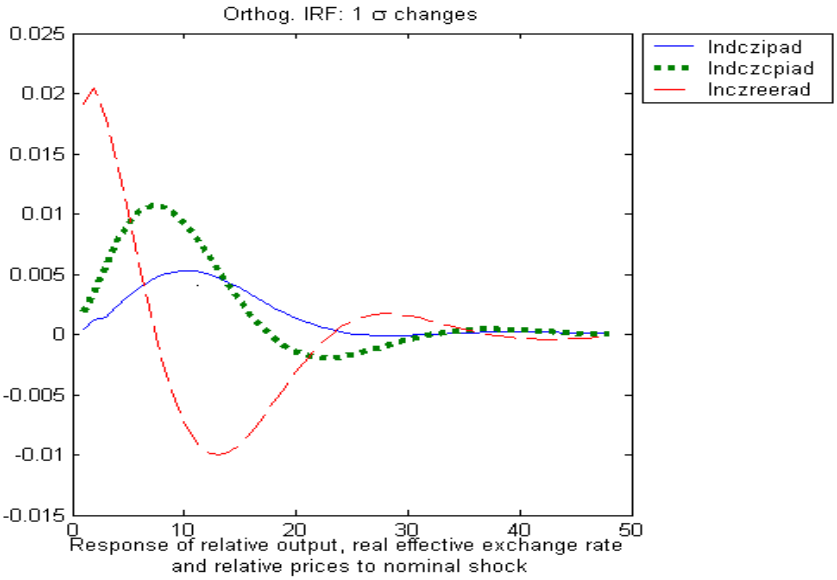
(a) Response of relative output to supply, demand and nominal shocks (b) Response of real exchange rate to supply, demand and nominal shocks (c) Response of relative prices to supply, demand and nominal shocks

1.5 Baysian VAR - impulse response functions

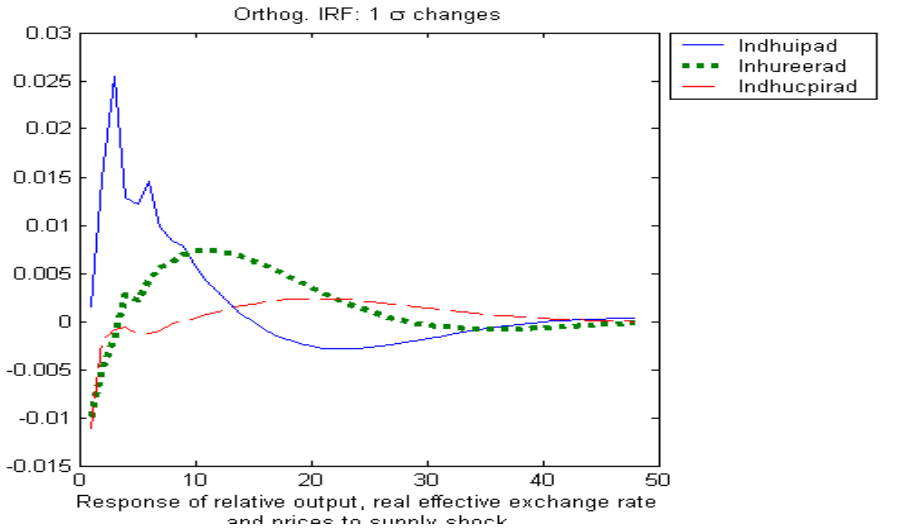
1.5.1 Czech Republic

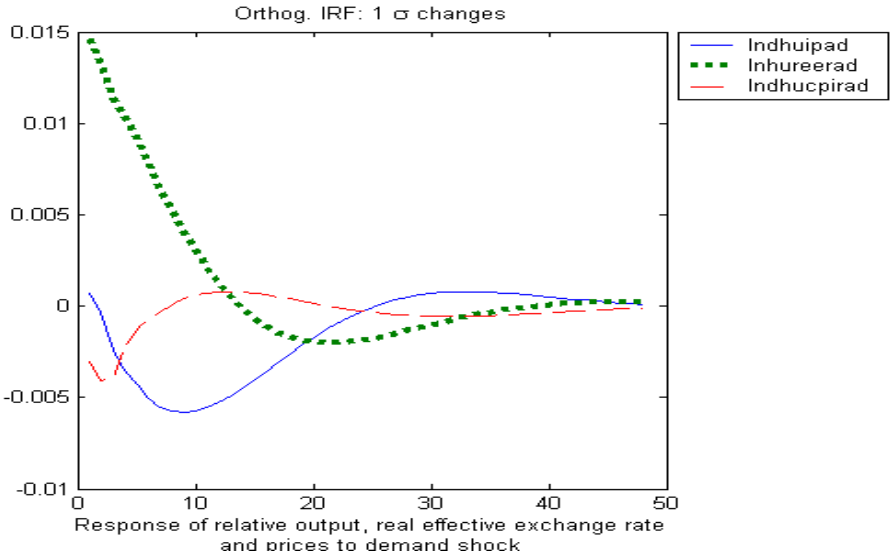


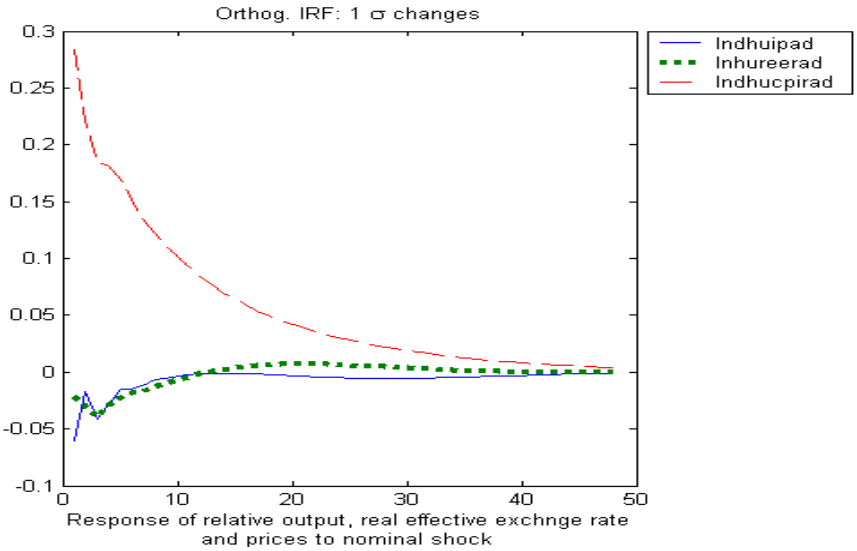




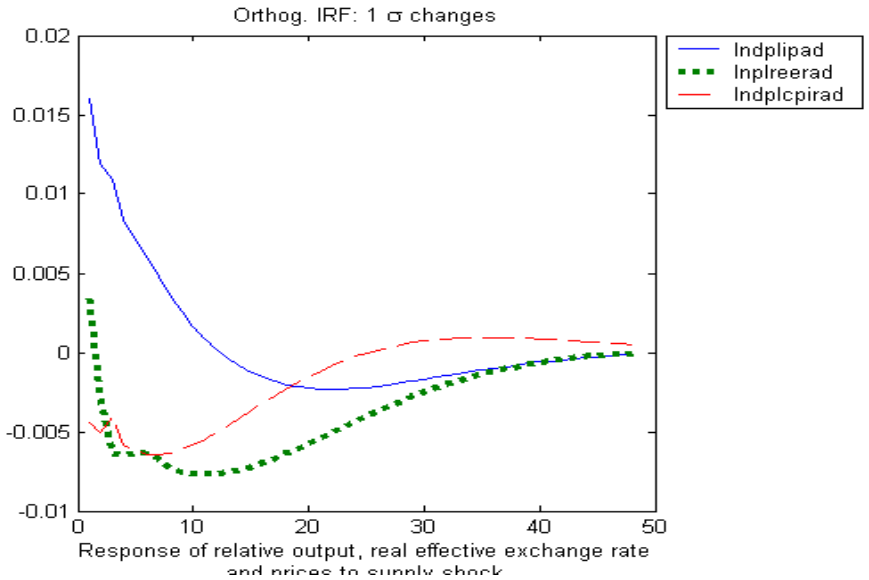
1.5.2 Hungary- Bayesian VAR

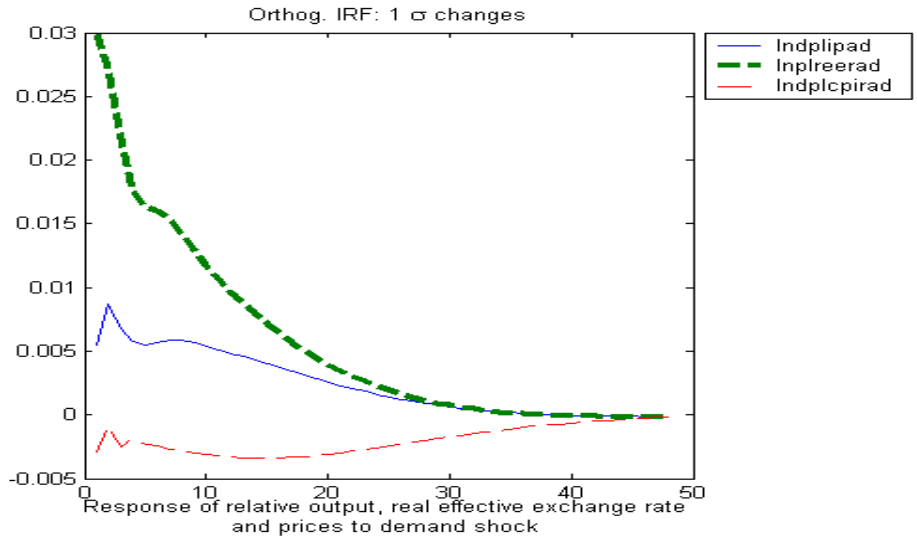


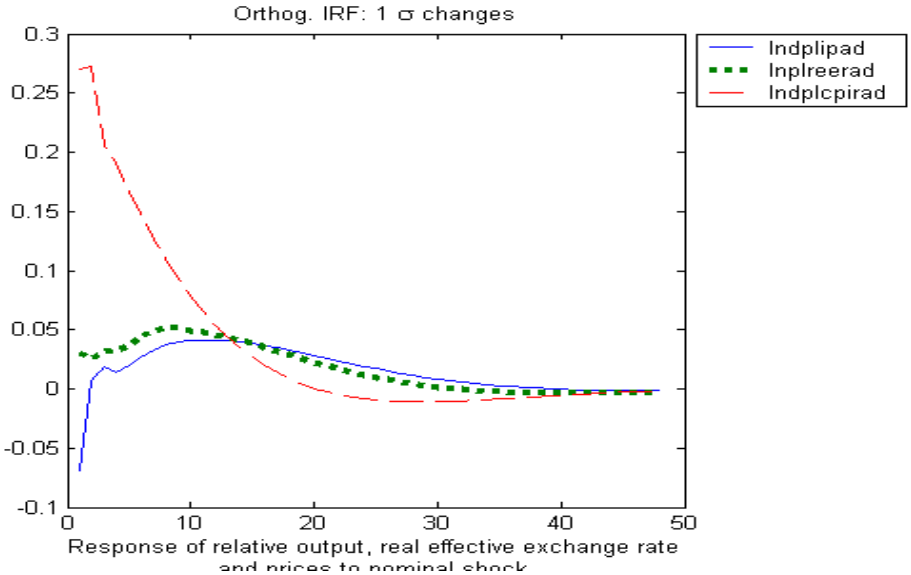




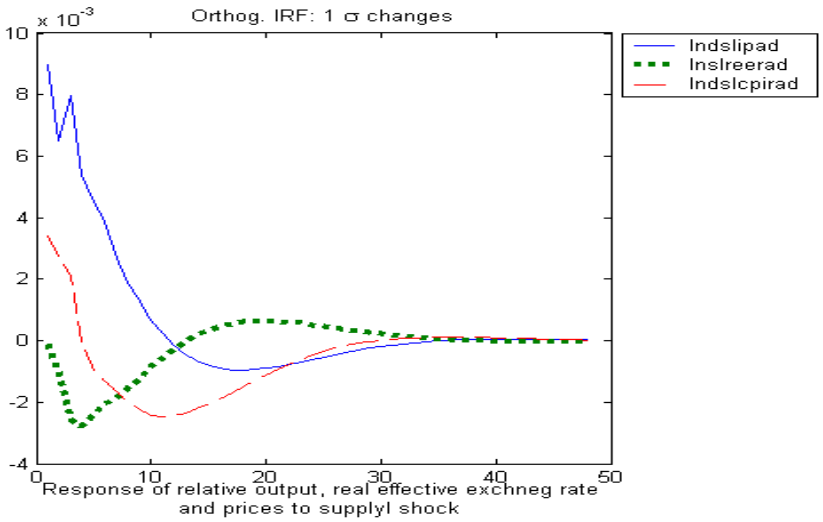
1.5.3 Poland - Bayesian VAR

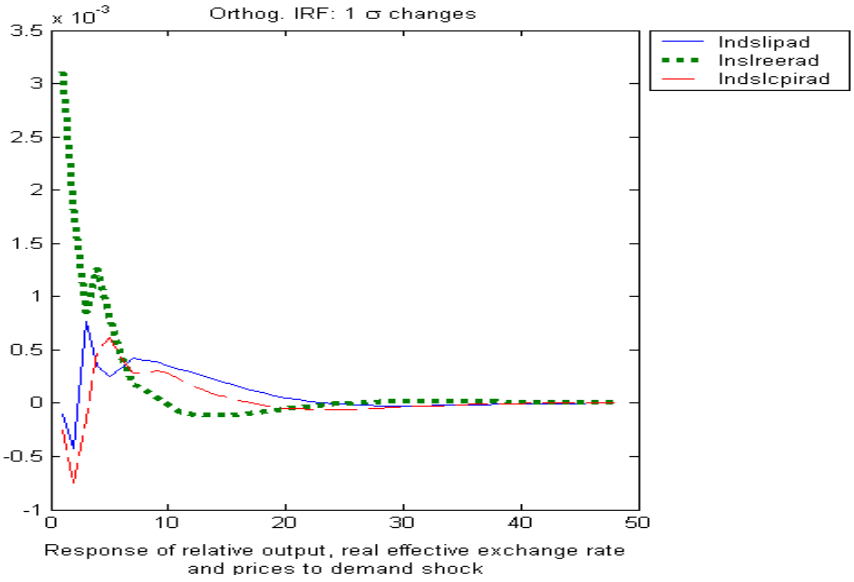






1.5.4.Slovenia- Bayesian VAR





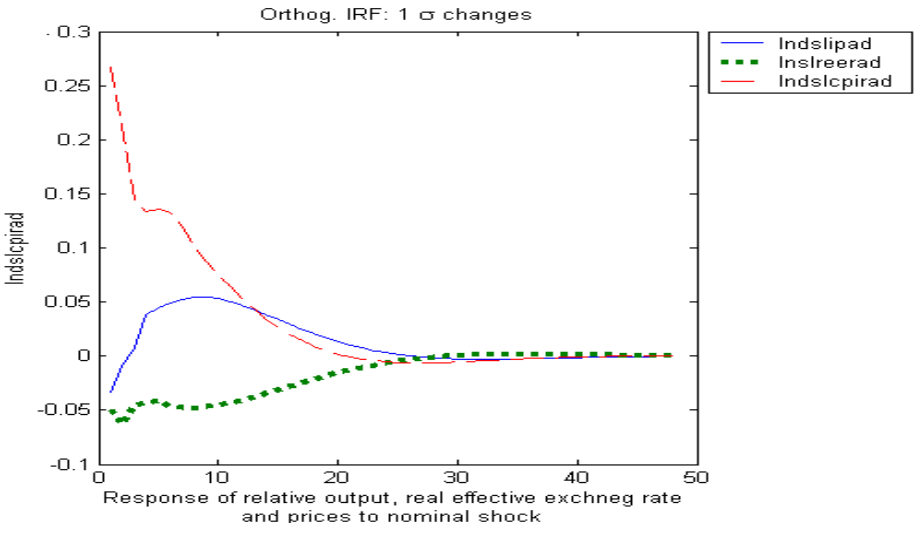
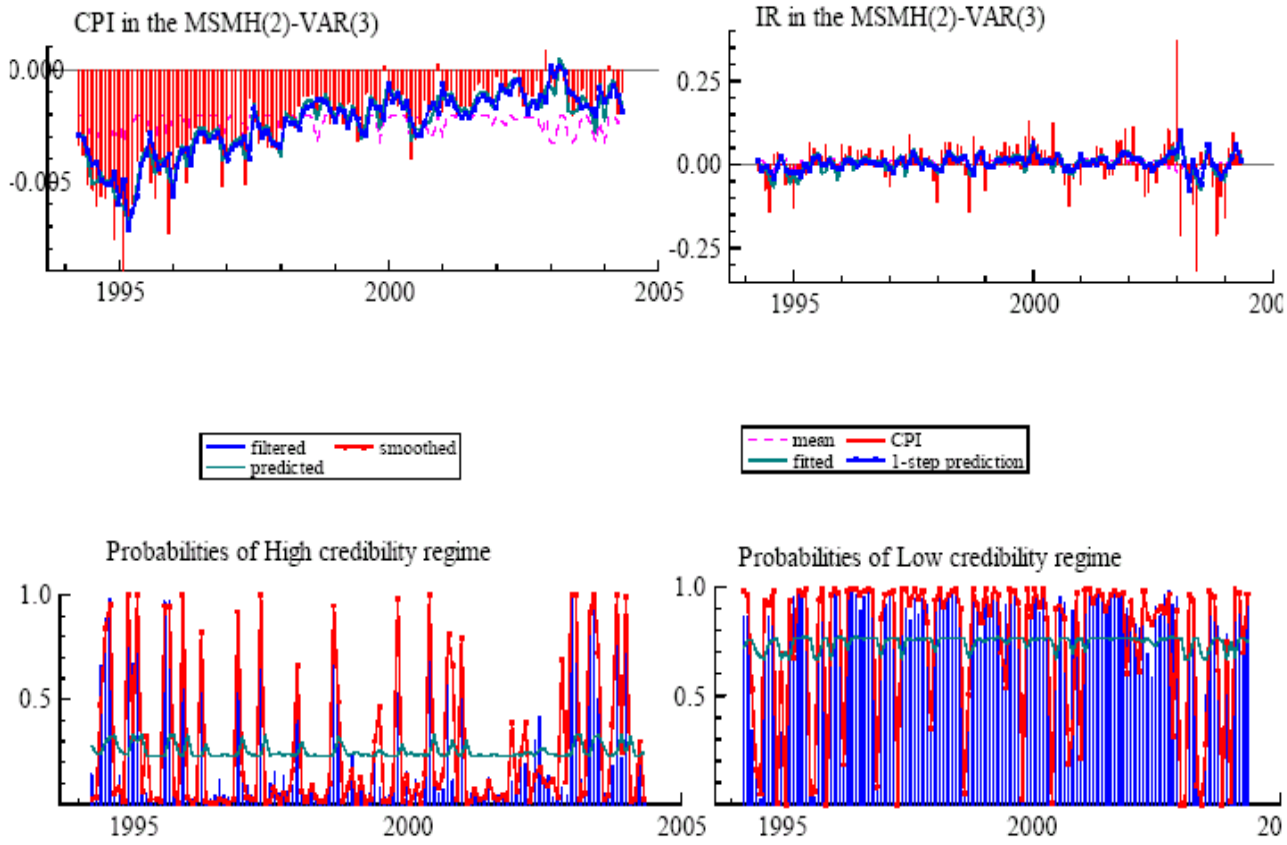
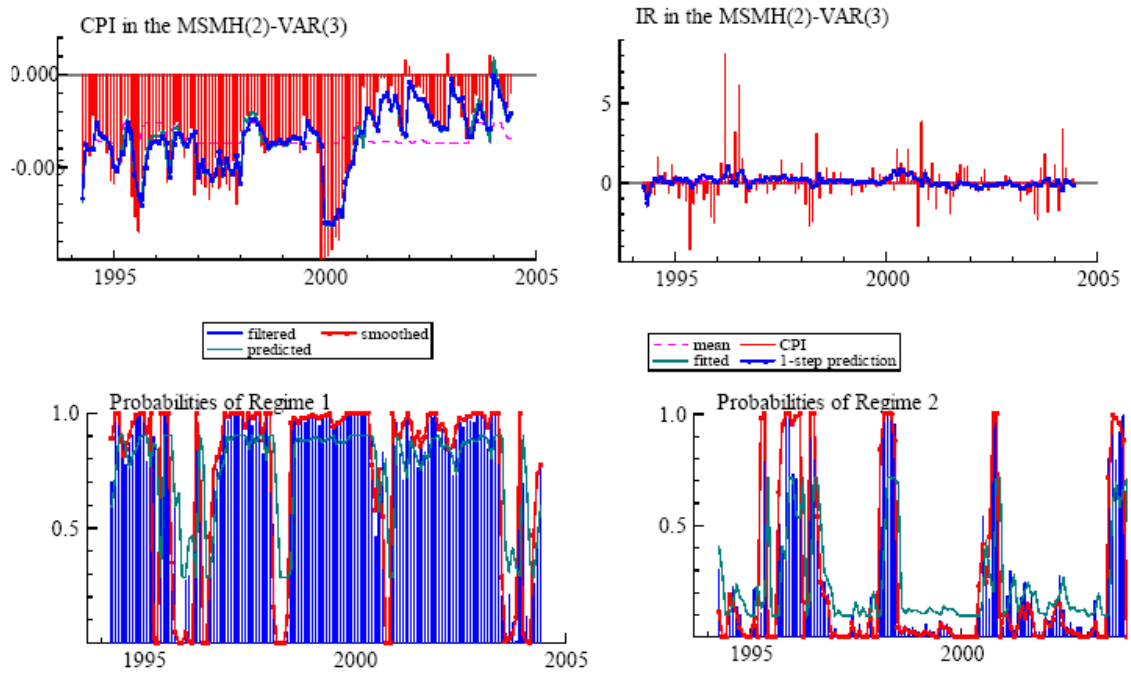


Figure 2.1 Fit for the MSMH(2)-VAR(3) model and filtered and smoothed probabilities:high credibility regime (regime 1) and low credibility regime (regime 2) for industrial production (IP) and interest rate differential (IR) in various countries

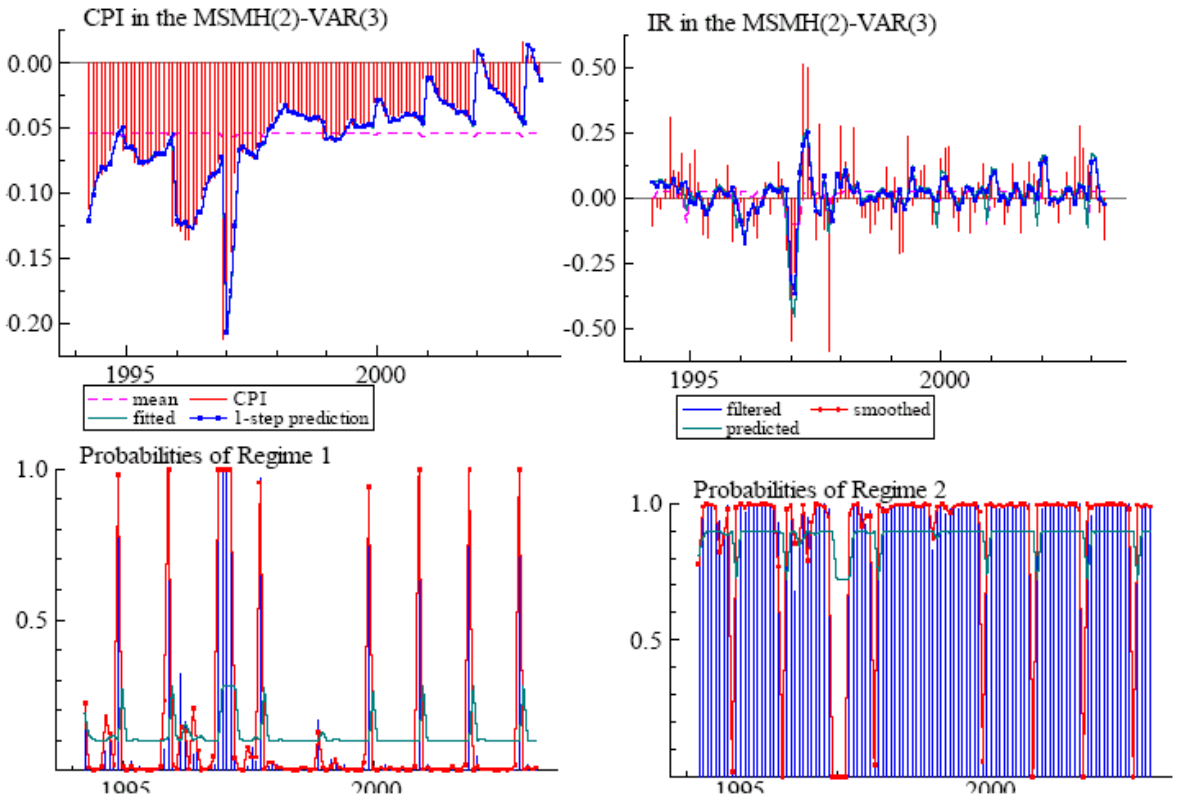
2.1.1 Hungary



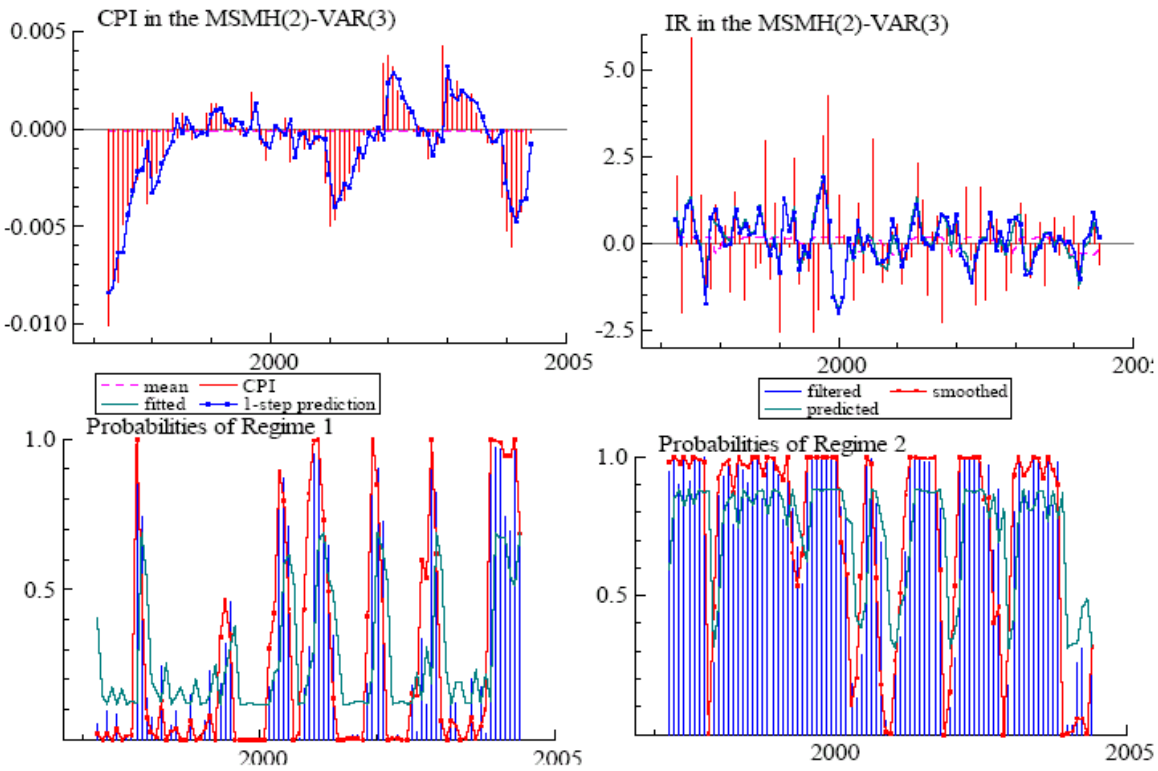
2.1.2 Croatia



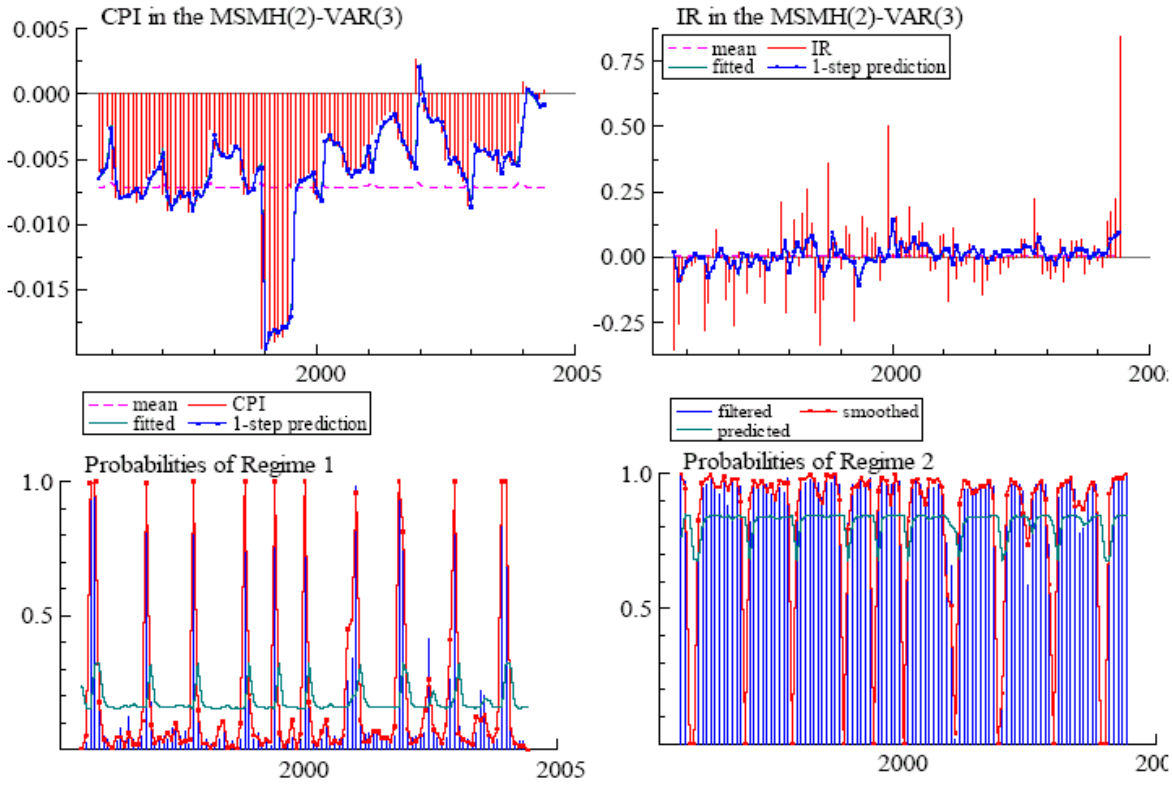
2.1.3 Romania



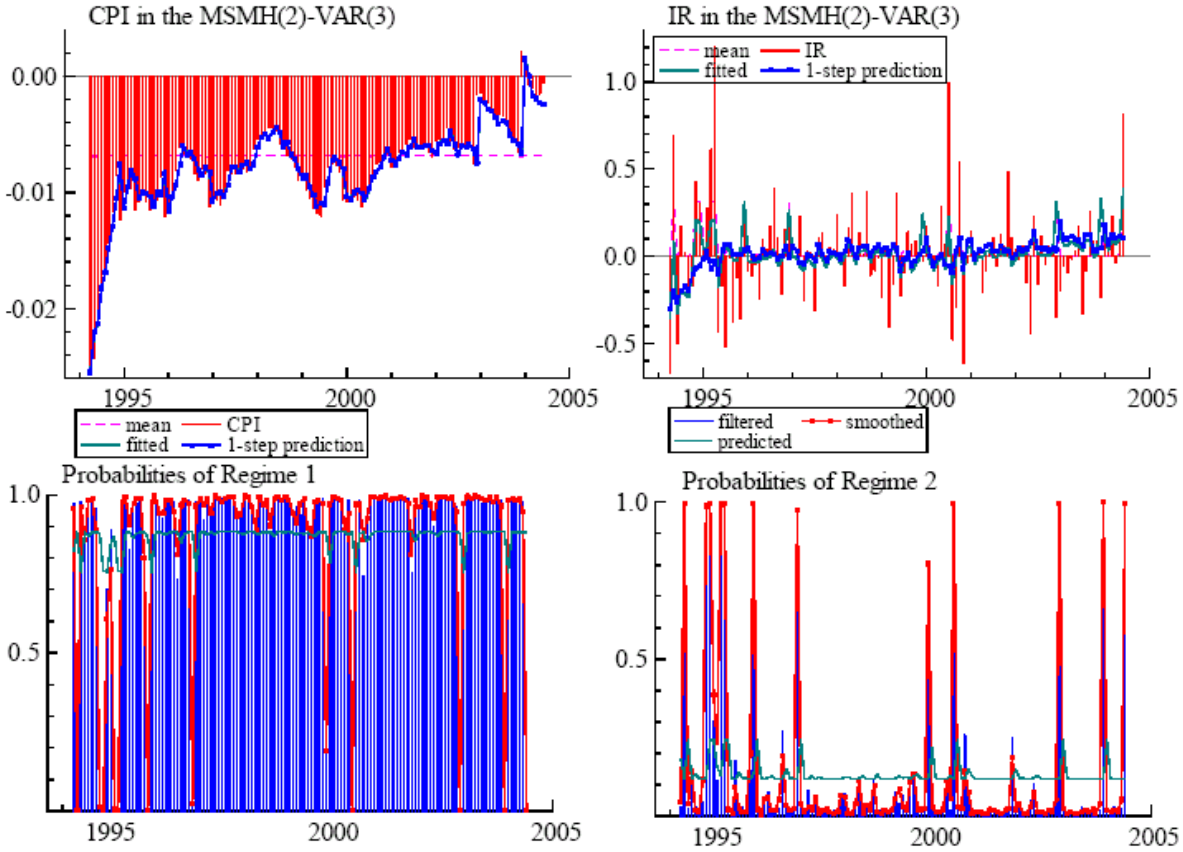
2.1.4 Lithuania



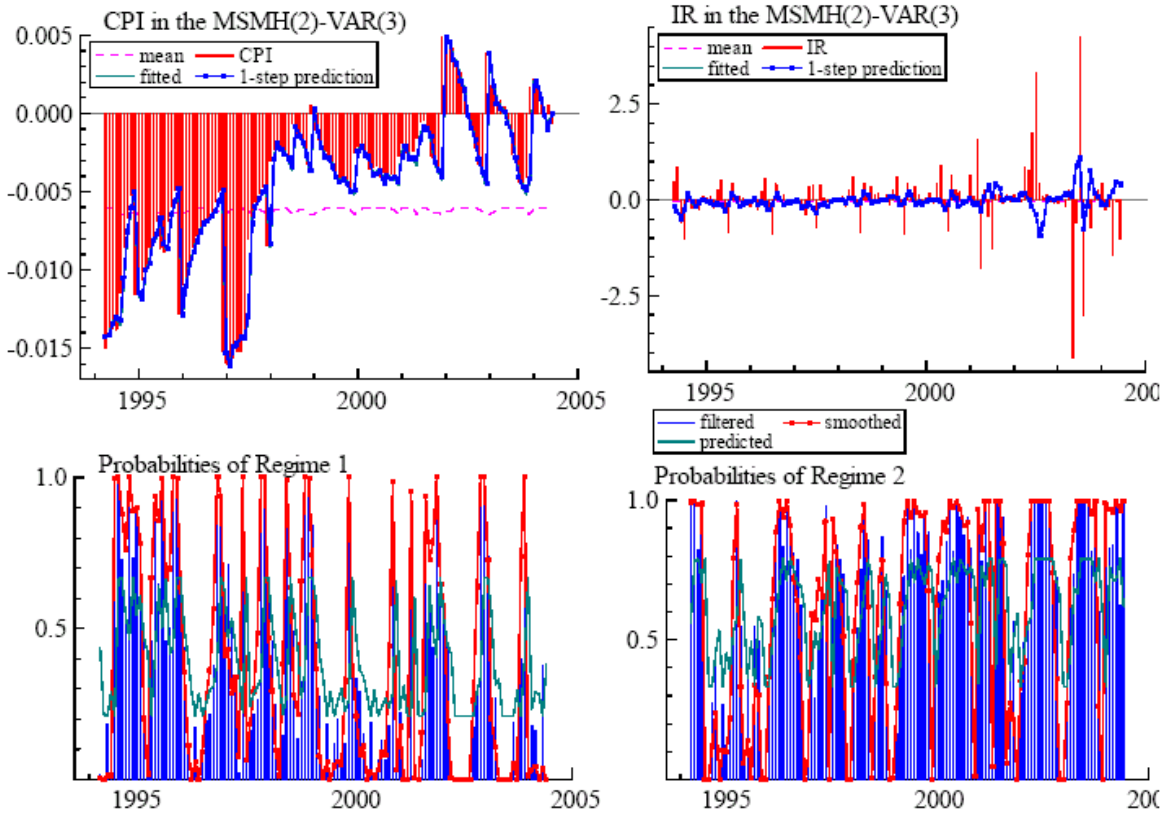
2.1.5 Slovakia



2.1.6 Slovenia



2.1.7 Czech Republic



2.1.8 Poland

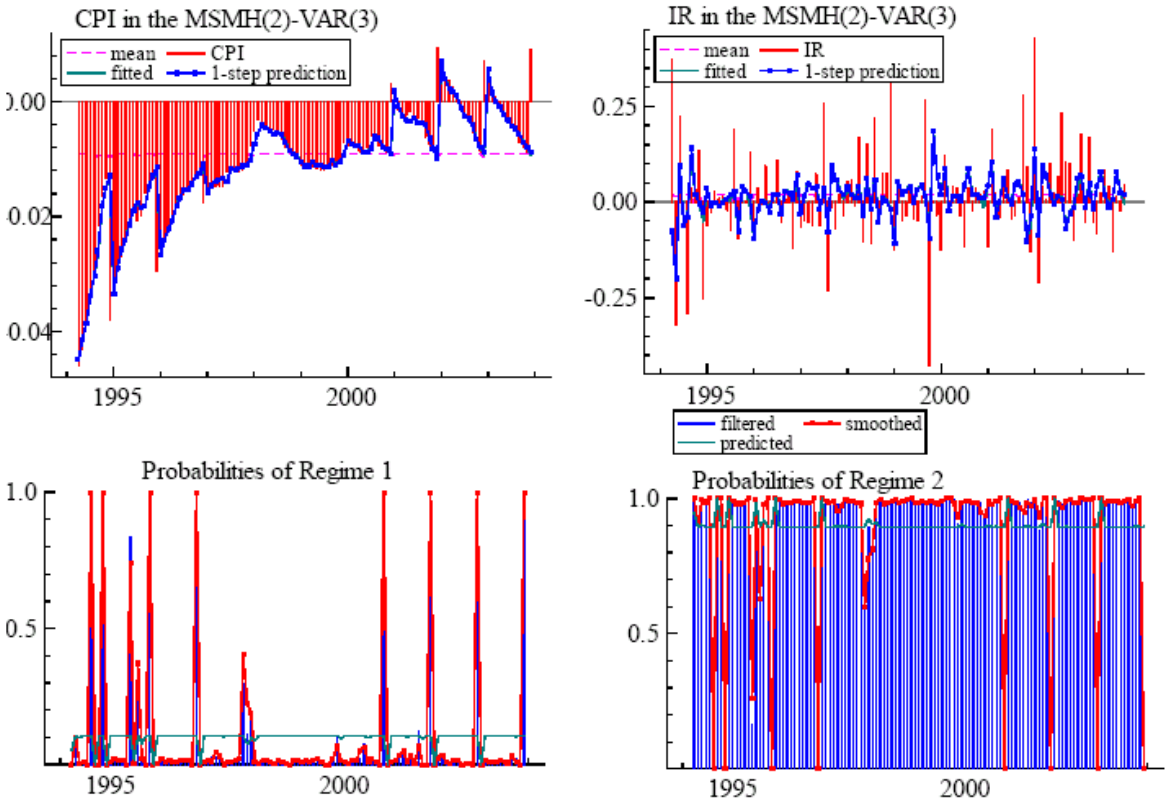


Figure 3.1 Russia: Real GDP Growth and Urals Oil Price

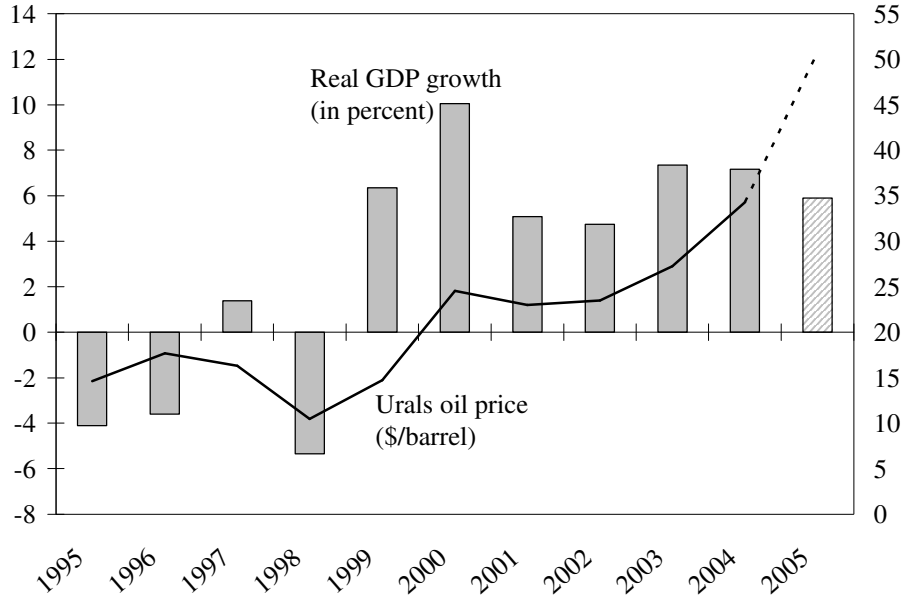
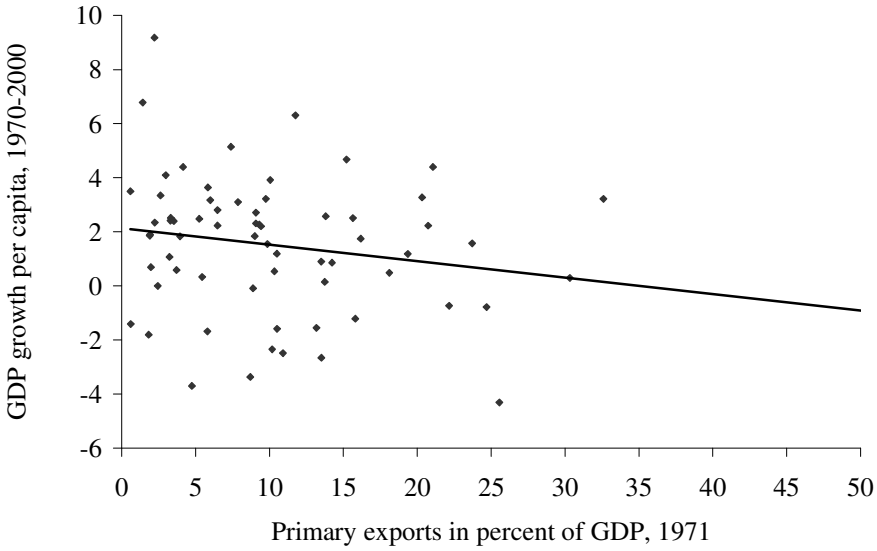
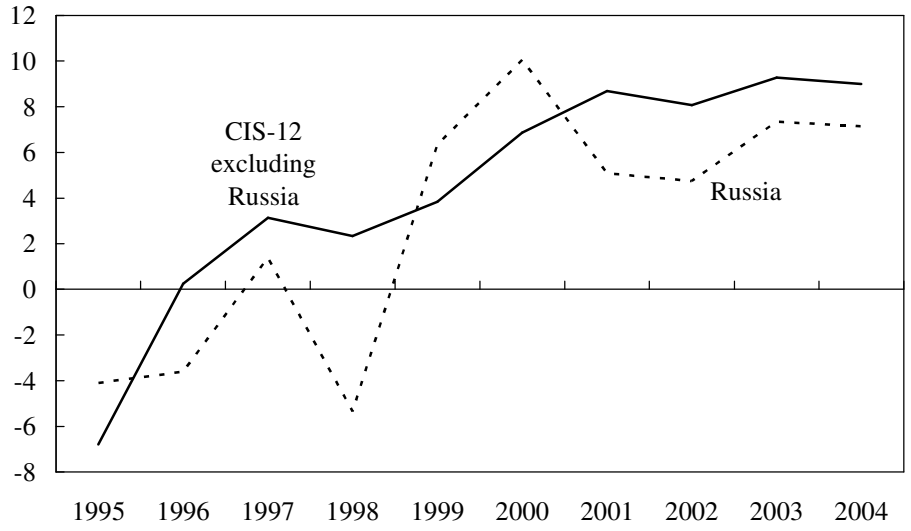


Figure 3.2 Primary Exports and GDP Growth per Capita



Sources: Penn World Tables, International Financial Statistics, and U.N. Comtrade database.

Figure 3.3 GDP Growth in Russia and the CIS, 1995-2004



Source: International Monetary Fund, World Economic Outlook.

Figure 3.4 Russia: Sectoral Economic Indicators

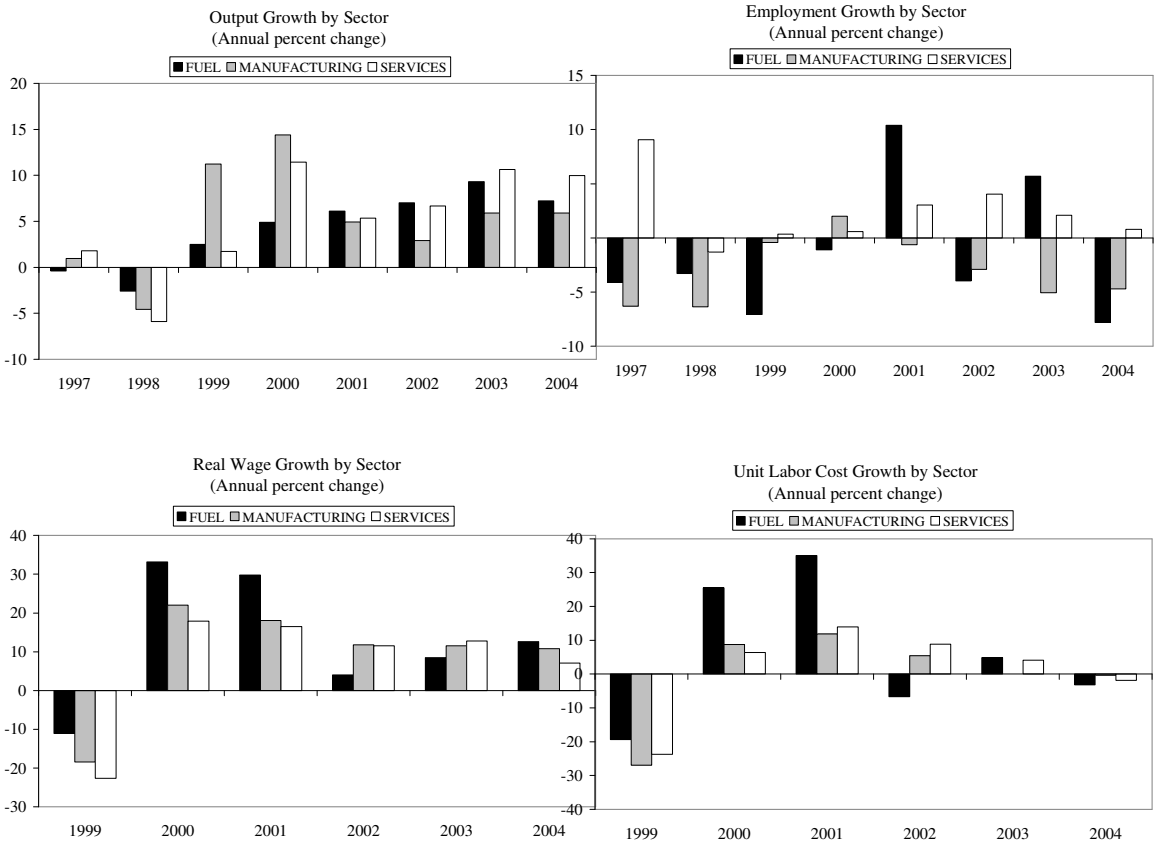
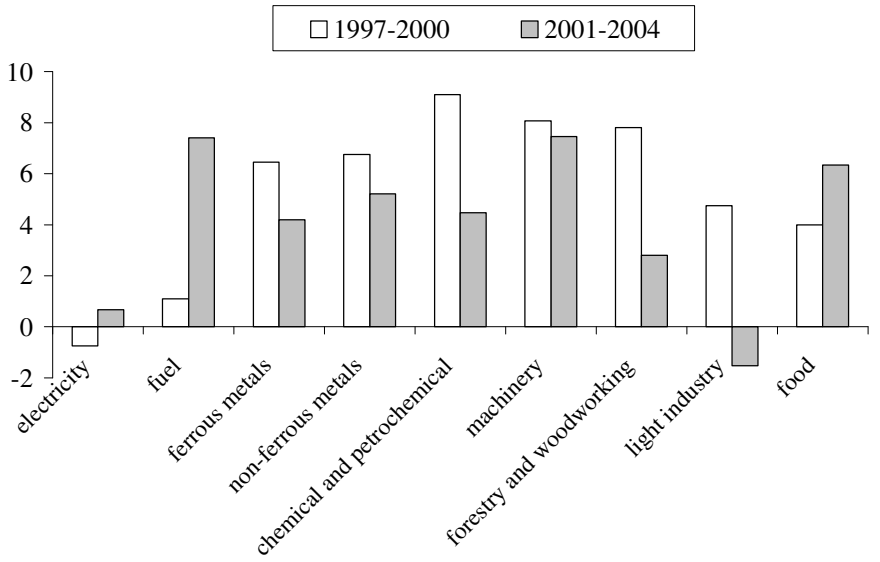
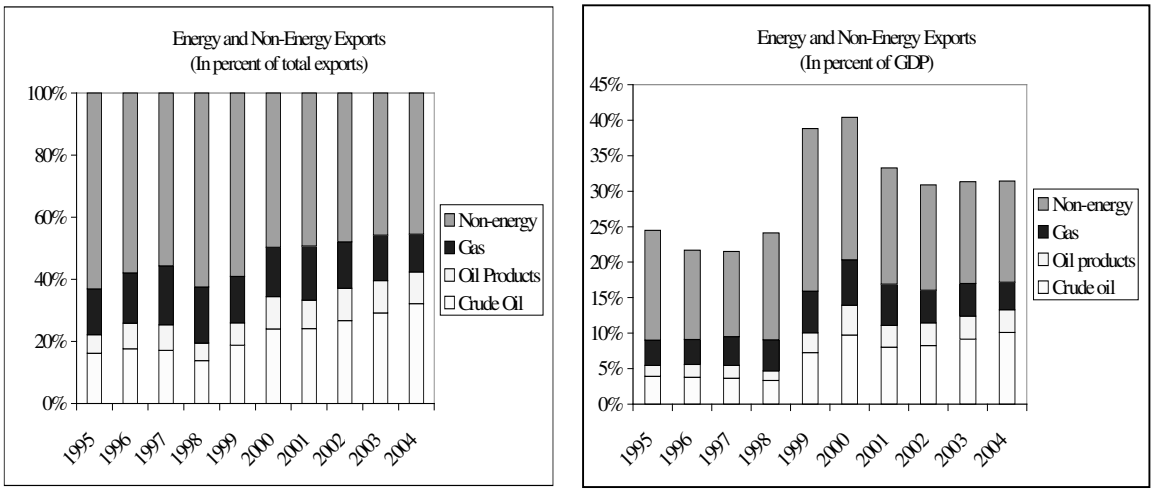


Figure 3.5 Russia: Industrial Growth Rates By Sector (in percent)



Source: Russian Federal State Statistics Service

Figure 3.6 Russia: energy exports



Source: IMF (2005)

Figure 3.7: Russia: Real Effective Exchange Rate and Its Determinants

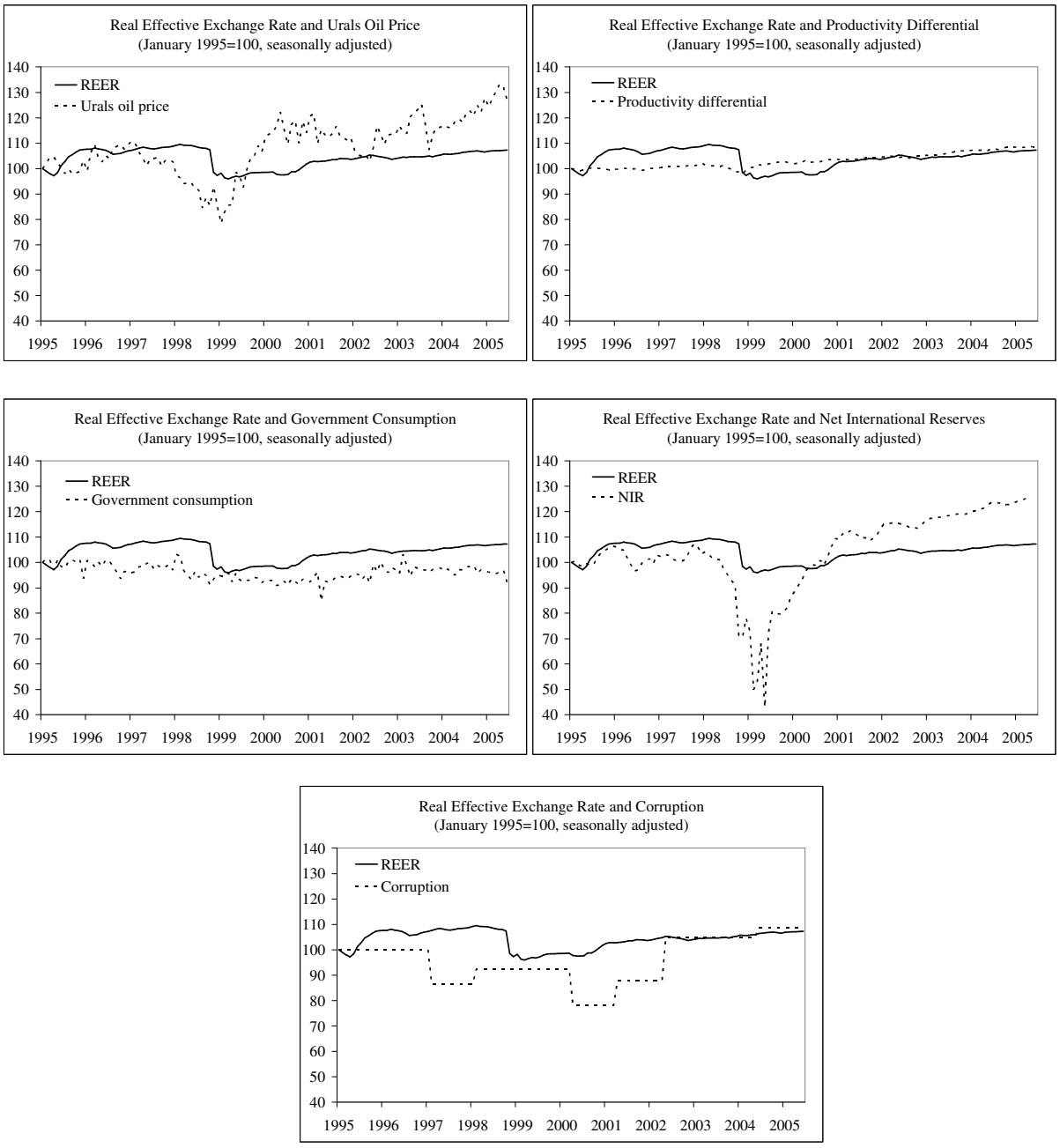
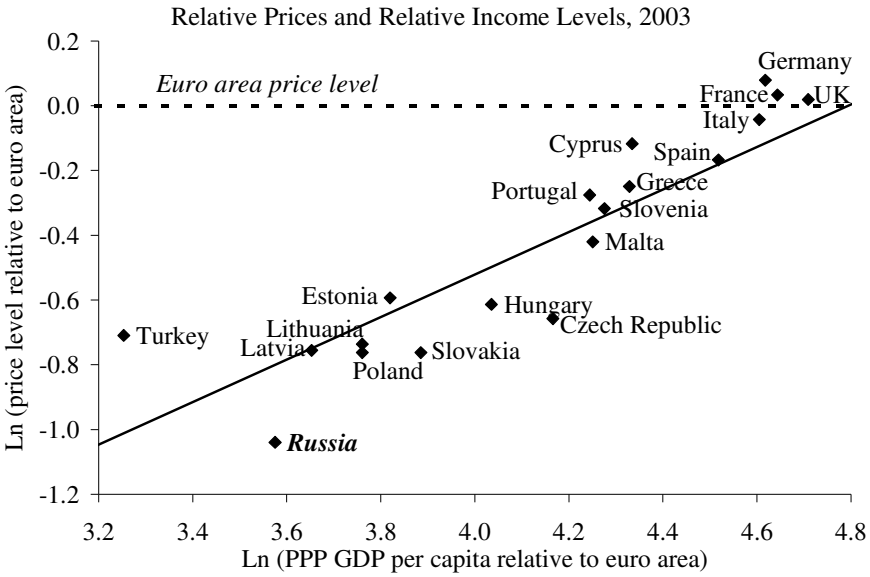
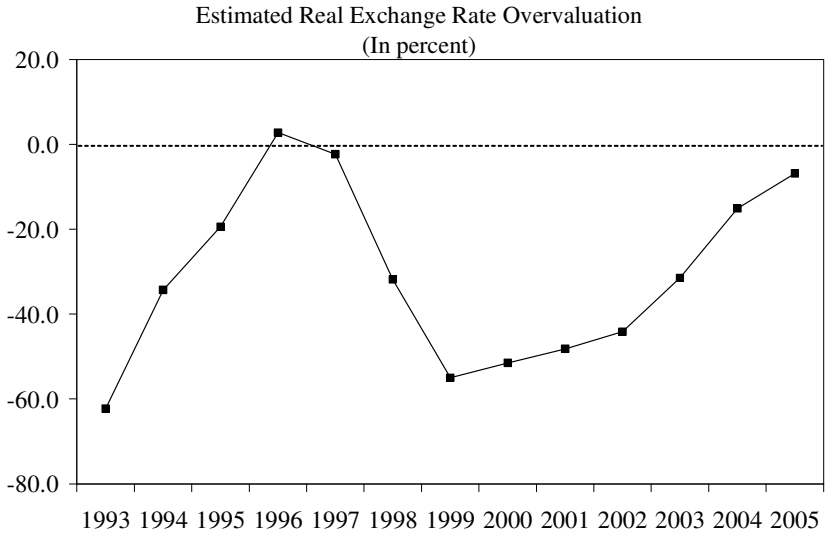


Figure 3.8 Relative prices and relative income levels



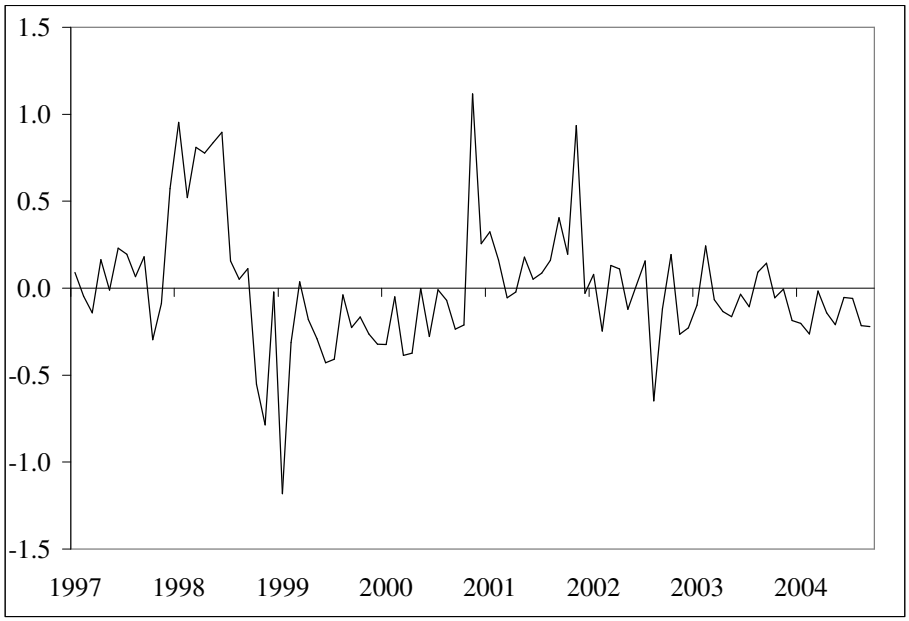
Source: IMF (2005)

Figure 3.9 Estimated real exchange rate overvaluation



Source: IMF (2005)

Figure 3.10 Russia: Estimated Real Exchange Rate Misalignment



Curriculum Vitae

Katerina Kalcheva

geboren in Sofia, Bulgarien

Ausbildung:

· Promotion, Universität München, Deutschland

· Forschungsaufenthalt, London School of Economics

· Aufbaustudium der Institut für Weltwirtschaft, Kiel, Deutschland

· M.A., University of National and World Economics, Sofia, Bulgarien

Forschungsinteressen:

· Empirischeökonomie, Analyse Transformationsländers, Geldökonomie

Berufliche Erfahrungen:

· Praktikant, IMF, Washington, USA

· Praktikant, Europäische Kommission, Brussels, Belgien

· Ökonom, Bulgarishe Zentralbank

Stipendien:

· Bank of Finland (BOFIT)

· Deutsche Forschungsgemeinschaft (DFG)

· Marie Curie Fellowsip (Europäische Kommission)

Eidesstattliche Versicherung

Ich versichere hiermit eidesstattlich, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sowie mir gegebenen Anregungen sind als solche kenntlich gemacht. Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

München, 07. October 2005

Katerina Kalcheva