THE CHOICE OF EXCHANGE RATE REGIMES: IMPLICATIONS FOR THE CENTRAL AND EASTERN EUROPEAN COUNTRIES

By

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Submitted to

Central European University

Department of Economics

In partial fulfillment of the requirements for the degree of Master of Arts

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Budapest, Hungary

2007

Acknowledgements

I would like to thank Professors Andri Chassamboulli and Julius Horvath for invaluable help while writing the thesis. Also I am grateful to Professor Gabor Kezdi, to Gabor Koltay and Kamran Mammadov for helpful comments and suggestions. The usual caveats apply.

Abstract

The thesis analyzes the impact of exchange rate regimes on inflation, output growth and fiscal discipline in ten Central and Eastern European countries. To this aim, a sample of ten Central and Eastern European countries for the 1994Q1 – 2006Q2 period, the system GMM methodology for dynamic panel data and various exchange rate classifications are employed. All macroeconomic and econometric aspects considered, the results suggest that flexible exchange rate regimes promote lower inflation rates although they may allow for greater fiscal discretion. The strong hold on inflation and/or a potential expansionary fiscal policy induces, under floating regimes, higher interest rates and exchange rate appreciation, thus nullifying the growth stimulus from a growth enhancing fiscal stance or from lower economic uncertainty due to price stability. Thus, the floats appear to be less effective in encouraging economic growth as compared to the more rigid currency arrangements.

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Introduction

The question of whether the choice of exchange rate regime matters or not has led to a considerable body of literature but little consensus. Theoretical approaches suggest such a diversity of feedback between currency regimes and macroeconomic performance that it is difficult if not impossible to establish a straightforward relationship. Empirical studies in turn have long been plagued by precarious data availability and a lack of adequate econometric tools to tackle the shortcomings of the data at hand. One important development in the recent literature on the costs and benefits of exchange rate flexibility is the increased prominence of de facto classifications of currency regimes as a result of marked difference between the actual country practice and the stated (de jure) exchange rate and monetary policy framework[1]. However, de facto measures vary considerably, depending on the methodology used to assess regimes.

I chose the comprehensive "natural" classification of Reinhart and Rogoff (2002) to explore the theoretical linkages between the exchange rate regimes and macroeconomic performance in ten Central and Eastern European countries over the 1994Q1 – 2006Q2 period. In the process of economic transformation these countries went through, there were not few the episodes of increased macroeconomic instability, characterized by very high inflation rates and considerable declines in output, which would only incorrectly be attributed to a particular exchange rate regime. Reinhart and Rogoff's classification distinguishes these episodes as the reflection of such macroeconomic imbalances as to overwhelm any possible effects of any currency regime.

[1] Various de facto regime classifications have been proposed, including those of Ghosh et. all (2002), Reinhart and Rogoff (2002) or Levy-Yeyati and Sturzenegger (2002, 2003).

Moreover, while most of the papers relating the exchange rate regime to macroeconomic success have generally addressed the potential simultaneity problems as well as the dynamic nature of the performance variables under investigation, they have used distinct cross–section or pooled regressions to estimate the relationship between either inflation, economic growth or fiscal stance, on the one hand, and exchange rate regimes, on the other hand. Two key problems of this approach have been the inability to take into account the unobserved heterogeneity and the foregone possibility of making use of the correlation in the disturbances from inflation, economic growth and fiscal discipline equations due to both common and/or country specific factors influencing all three variables.

System GMM estimation for dynamic panel data models helps tackle unobservable heterogeneity issues even when inertial behavior of the dependent variables is allowed for and it also efficiently exploits all additional information that might be contained in the residuals due to omitted factors that simultaneously influence all three variables. Yet, it implies a transformation of the variables in the system, therefore distorting the relation between the level of inflation, output growth and fiscal discipline, on the one hand, and the exchange rate regime, on the other hand. It particularly relates to the first–differenced currency regime dummies, which do not necessarily show the impact of a switch in the regime on the dependent variable, as they might reflect movements both to and away from a given currency arrangement.

That is why, based on the initial exchange rate indicators, dummies are generated for all possible types of shifts across regimes. First–differentiation of these dummies would then adequately reflect the relative impact of movements across exchange rate regimes on the

performance variables. The analysis then focuses on the inflation, output growth and fiscal discipline differential between increasing flexibility (a switch from intermediates to floats), limiting flexibility (a switch from floats to intermediates) and fully banning exchange rate flexibility (a switch either from intermediate to pegs or from floats to pegs)[2].

To summarize, the results suggest that flexible rates promote lower inflation rates although they may allow for greater fiscal discretion. The strong hold on inflation and/or a potential expansionary fiscal policy induces, under floating regimes, higher interest rates and exchange rate appreciation, thus nullifying the growth stimulus from a growth enhancing fiscal stance or from lower economic uncertainty due to price stability. Thus, the floats appear to be less effective in encouraging economic growth as compared to the more rigid currency systems.

The paper proceeds as follows. Chapter 2 reviews the standard theory of choice among exchange rate regimes. Although the literature on exchange rate arrangements is vast, much of it can be organized around several central themes reflecting the main trade-offs in the choice of exchange rate regime. In chapter 3, I take the analysis a step further and explore the influence of the exchange rate framework on the easiness with which countries committed to adopting the Euro can fulfill the convergence criteria. Chapter 4 describes the data and the econometrics used to examine the relationship between exchange rate regime and macroeconomic performance, especially inflation, fiscal discipline and output growth. Finally, chapter 5 presents the main empirical results and chapter 6 concludes the paper.

[2] There are no instances in my sample of switches away from pegs.

Chapter 2 - The Theory of Exchange Rate Regimes

In theory, the choice between fixed and flexible exchange rates is essentially a trade–off between reduced exchange rate volatility and an independent monetary policy (Ghosh, Gulde and Wolf, 2002)[3]. The various ways this trade–off is manifested have been extensively analyzed from numerous distinct approaches. The literature has evaluated currency regimes according to their shock absorbing properties, their role in fostering economic integration, in the context of stabilization programs or in light of the discipline in the macro-economic policy they promote. As opposed to seeing the exchange rate arrangement as a potential cause of the quality of macro-economic policy, another strand of literature investigates the range of structural characteristics that makes countries favor either of the regimes.

Thus, one early approach in the analysis of exchange rate regimes has looked at how effective they are in reducing the variance of the domestic output in the face of different kinds of disturbances. The key insight of this body of literature which was greatly influenced by the seminal papers of Fleming (1962) and Mundell (1963), following earlier work by James Meade, is that fixed exchange rates are superior to floating rates when nominal disturbances dominate, as they are able to accommodate a change in the money demand or supply with less output volatility.

For example, under fixed exchange rates, a monetary expansion lowers interest rates, leading to capital outflows; the resulting loss in reserves determines the monetary authorities to shrink the money supply. Under high capital mobility, the offset can be complete, causing the

[3] In practice, however, the difference between fixed and floating regimes is usually smaller as far as the autonomy of monetary policy is concerned. This is particularly valid for the developing countries where central banks cannot truly disregard exchange rate movements due to such considerations as external competitiveness, exchange rate pass-through to inflation or foreign exchange exposure arising from external debt.

monetary policy to be ineffective in stabilizing the output. In contrast, under a floating system, the capital flight induces the depreciation of the nominal exchange rate, which in turn stimulates output. If on the contrary, as a result of an increased money demand, domestic interest rate rises, this leads, under fixed exchange rates, to an increase in reserves[4] and a corresponding expansion of the money supply. To the limit, the increase in the money supply, perfectly matches the higher money demand, completely insulating output. Floating exchange rates, by contrast, would generate an appreciating response of the currency, reducing exports and thus adding to the negative impact of higher interest rate upon the output.

On the other hand, if shocks are real – shocks to productivity or to the terms of trade – exchange rate flexibility can be an advantage, as it allows the economy to respond to the change in equilibrium prices, through a speedy shift in the nominal exchange rate in addition to the adjustment in the national sticky money prices. Under floating exchange rates, a fiscal expansion increases the domestic interest rate, causing an appreciation of the local currency in response to capital inflows. This can negatively impact domestic output, as it makes it more expensive in foreign markets and also it becomes relatively cheaper for residents to consume imported goods. In a fixed exchange rate framework, the increase in reserves has to be accommodated through a corresponding increase in the money supply, which decreases interest rates, thus stimulating output even further. A negative real shock, on the other hand, generates a fall in the demand for domestic money, which the monetary authorities have to adjust by absorbing the excess money supply; the resulting rise in interest rates is likely to further contribute to the magnitude of the downturn.

[4] The accumulation of reserves can result either from lower imports, under low capital mobility, or because of larger capital inflows in response to the higher interest rates, under high capital mobility.

The benefits and costs of alternative currency regimes have also been analyzed in the framework of the optimal currency areas (OCA) debate. The key insight of the OCA literature, best represented by Mundell (1961) and McKinnon (1963) and Kenen (1969), is that the gain from adopting a common currency increases in the degree of symmetry in output shocks, factor mobility and trade openness between the respective countries. Here again, the direction of the relationships can go both ways. The assumption underlying, for instance, the push for greater intra European exchange rate stability, is that lower exchange rate volatility acts towards reducing uncertainty and risk premia, thus stimulating cross–border trade. Furthermore, given the now established positive relationship between trade and GDP growth[5], it is to be expected that countries sharing the same currency should experience higher output growth as well. However, greater trade integration enhances specialization and it therefore reduces the correlation of supply shocks and correspondingly, the case for pegging or forming a monetary union.

In addition to enhanced trade linkages as a result of reduced transaction costs (from currency conversion) and greater relative price predictability, other benefits of a common currency include insulation from monetary disturbances and speculative bubbles, as well as less political pressure for trade protection because of sharp shifts in real exchange rates. Conversely, the costs associated with sharing the same currency include losing monetary independence, which means that domestic authorities cannot use the monetary policy to deal with local macroeconomic shocks, nor use inflation to decrease the real burden of public debt, political difficulties related to the mechanism of splitting the seignorage revenues among the member countries and the nonzero probability of speculative attacks in the transition process from individual currencies to a common currency (Obstfeld and Rogoff, 1996).

[5] Edwards 1993b; Frankel and Rose 1999

A substantial literature explores the role of the exchange rate regime in the context of macroeconomic stabilization efforts. Most empirical studies on exchange rate–based stabilizations have focused on the higher inflation members of the European Monetary System[6], the hyperinflations in Israel (Bruno et al. 1988) and on the Southern Cone countries of Latin America. The experience of these countries is known in the literature as the "ERBS Syndrome". This essentially describes a case of unsuccessful stabilization coming as a result of a rapid fall in the domestic real interest rate, which triggers a consumption boom that in turn widens the current account deficit and depletes reserves, leading to the collapse of the peg and an upsurge of inflation.

Gosh, Gulde and Wolf (2002) also examine the differences in disinflation programs across regimes. They compare the behavior of two policy variables (money growth and fiscal deficit) and that of some other macroeconomic variables (real exchange rate, current account balance, output growth) and find that successful stabilizations lead to similar results under pegged and floating regimes. They show that inflation roughly halves under either fixed or floating regimes, with a rather more pronounced decline in the case of pegged regimes starting from high inflation. Similarly, the change in the level of output is comparable under the pegged and the floating regimes as well as the difference in real GDP growth rates before and after stabilization. A somewhat more visible distinction between regimes is found in the behavior of the policy variables, i.e. the fiscal adjustment is shown to be smaller and the current account deficit larger under pegged exchange rates, which may indicate that the confidence effects of pegging the exchange rate may grant countries some fiscal leeway. As for the costs of failed stabilization attempts, they are shown to be marginal under both regimes.

[6] Giavazzi and Giovannini (1989), Kremers (1990) and Rebelo (1993) among others.

Some interesting insights on the choice of currency regimes come from the literature on time inconsistency or the credibility problem**.** Barro and Gordon (1983) developed a model of close–economy game between wage setters and the central bank. In their model, wage contracts are formed before the central bank decides upon the monetary policy thus determining the inflation rate. Besides reducing inflation, the central bank also aims at minimizing the unemployment. It therefore can use surprise inflation to reduce real wages, thereby raising employment. The challenge here consists of credibly committing by the central bank to low inflation so that wage setters would build this belief into their nominal wage demands and shift the economy into a low–inflation equilibrium. In an open economy, the exchange rate peg is shown to provide a pre–commitment device, which, although it does not remove the incentive to create surprise inflation, it limits the ability of the central bank to give way to this incentive. The harder the peg, the larger are the costs of exiting the regime, thus outweighing the potential benefits of generating surprise inflation and making the pre–commitment device more credible.

Finally, the difference in the impact of currency regimes when de facto measures are used as compared to de jure measures (Reinhart and Rogoff, 2002; De Grauwe and Schnabl, 2004), as well as the lack of the micro-foundations needed for meaningful welfare analysis (Natalucci and Ravenna, 2002) are some caveats that the literature on exchange rate regimes has recently started to deal with. As a consequence, the performance of different regimes is now increasingly being assessed by using various de facto measures of currency arrangements and dynamic general equilibrium models to allow for an adequate welfare analysis through the introduction of a representative agent utility maximization function.

Chapter 3 - The Choice of Exchange Rate Regime in the Run–up to the EMU

The safest thing one can tell about choosing between exchange rate regimes is that there is always going to be a dimension that would not fit (Calvo and Mishkin, 2003). Both fixed and flexible currency regimes[7] have been found to promote various facets of economic activity, to work well for some countries and not that well for others. This, however, is no good news for the new EU member states[8] aspiring to enter in the European Monetary Union (EMU). The reason for this relates to the conditions imposed for entrance in the Euro zone, which need to be jointly fulfilled and, moreover, are potentially conflicting to a degree which is given by the chosen exchange rate regime.

These conditions envisage exchange rate, inflation and interest rate stability as well as budget deficit and public debt sustainability, thus indicating the degree of economic convergence (nominal convergence) new EU member states would have to achieve in order to be accepted to participate in the Euro area. The public finance criterion settles a 3% upper limit to the ratio of the annual government deficit to GDP, and also a 60% limit to that of the gross government debt to GDP. According to the interest rate criterion, the nominal long term interest rate should not exceed by more than 2 percents that of the three lowest inflation countries in the EU. In its turn, the exchange rate stability criterion requires at least two years' membership in the ERM II, the exchange rate arrangement between the Euro area and EU members outside it. ERM II successful participation means limiting the exchange rate movements within a ±15 percent band around a mutually agreed central parity against the Euro, given no devaluations have been made. Finally, the inflation criterion limits the annual inflation rate in EMU

[7] Although later in the analysis I will employ a broader range of exchange rate regimes, I will now use the bipolar view and focus on the main differentiating traits of the fixed and flexible exchange rate arrangements.
[8] I am referring to both the 2004 and 2007 EU entering countries from Central and Eastern Europe.

candidate countries to no more than 1.5 percent above the average of the three lowest inflation countries in the EU.

Most of the literature on the Maastricht criteria and the performance of Central and Eastern European Countries (CEECs) in fulfilling them points towards a potential conflict between the last two criteria mentioned above[9]. The root of the problem is considered to be the presence of a sizeable HBS effect, which implies a continuous real exchange rate appreciation. Real exchange rate appreciation can translate into nominal exchange rate appreciation, higher inflation, or a combination of both, according to each country's specific exchange rate framework. If this is the case, meeting both criteria can prove to be quite cumbersome for these countries in terms of aggregate welfare and growth, which ultimately define their performance as far as real convergence is concerned. Although real convergence is not required for the adoption of the Euro, this is a major objective of these countries local authorities cannot possibly ignore.

The HBS effect can be briefly defined as productivity driven appreciation of the exchange rate. In the catch-up process of the EMU candidate countries, the tradable sector, given its exposure to the world competition, experiences larger productivity growth than the non–tradable sector. The literature estimates with respect to productivity growth differential between the Euro area and the EU candidate countries' tradable sectors range from 1% to 4%, with most of the estimates above 2% (Natalucci and Ravenna, 2002). Higher productivity leads to higher wages in the tradable sector, but not exclusively, due to wage equalization resulting from labor mobility across sectors and trade unions' pressures. Therefore, wages in

[9] Buiter (2004) outlines the impossibility for countries experiencing high productivity increases to simultaneously achieve low inflation and a stable exchange rate. Balazs (2002), however, shows that achieving low inflation rates may not be such a difficult task as previously suggested because productivity increases do not

the non-tradable sector increase as well, in spite of lower productivity gains. This forces firms in the non-tradable sector to raise prices which push CPI inflation up[10]. The CPI inflation increase induced by the HBS effect has been found to be smaller under a flexible exchange rate than under a fixed exchange rate. The difference in outcomes between the fixed and flexible rates may lessen when the elasticity of substitution between tradable and non-tradable goods in consumption and investment is high, thus leading to a smaller increase in the non-tradable inflation and ultimately to a smaller CPI inflation rate (Halpern and Wyplosz, 2001).

Real exchange rate movements can be explained not only through the HBS effect, but also through another effect, first documented by Stockman (1980) and Lucas (1982), which links the productivity shocks to the changes in the ratio of foreign to domestic traded goods prices. A detailed presentation of the decomposition of real exchange rate movements in changes in the price ratio of traded goods (Lucas–Stockman effect) and changes in the ratio of non-tradable prices to tradable prices between the countries (HBS effect) is presented in the Appendix A. The decomposition is further on used to assess the magnitude of the HBS effect in the ten transition countries. As Figure 1 shows, real exchange rates and the internal relative price ratios are closely moving together in all countries, irrespective of the degree of exchange rate flexibility preferred by the monetary authorities.

The HBS effect is the supply side's reaction to the high relative productivity growth in the tradable sector. Increased productivity, however, implies increases in income and wealth, which fuel consumption. Thus, there is also a demand side effect, as it is mentioned by Rostowski (2006) and earlier by Halpern and Wyplosz (2001), putting pressure on the overall

fully translate into price increases due to the construction of the CPI index. As a result, real exchange rate movements are only partly explained by productivity developments.

[10] The decreasing cost of capital, assuming the tradable sector is more capital intensive, can lead to similar inflationary outcomes as shown by Buiter and Grafe (2002).

inflation rate, which can be further exacerbated by pro-cyclical public sector policies, as it was the case in Romania in 2005.

In addition to the potential trade-off between the exchange rate stability and inflation target that the choice of currency regime can mitigate, it is also interesting to see its effect on the effectiveness of the fiscal policy and thus on the easiness with which countries can fulfill the public finances criterion. There are several mechanisms through which the choice of the currency arrangement influences the fiscal performance of a government (Mateusz Szczurek, 2006).

The most important difference between exchange rate regimes is the commitment to tight fiscal policy. The advocates of hard exchange rate regimes argue that they improve budgetary management as the government can no longer recur to the central bank to monetize its spending. More and more studies, however, provide evidence of a diluted disciplinary effect of fixed regimes[11]. The potential explanations are found in an ineffective constraint on monetary financing as well as several offsetting effects of pegging.

Thus, the observed inability of fixed regimes in capping fiscal deficits has been attributed to the fact that, they do not prevent fiscal seignorage, a channel whereby monetary financing is possible in the short and medium run, even in an exchange rate peg (Alberola and Molina, 2002). Fiscal seignorage is defined as the revenues effectively accruing to the government from the central bank to finance public deficit, whereas monetary seignorage broadly refers to the process of money creation. Moreover, despite the fact that, in principle, fixed exchange

[11] Tornell and Velasco (1995), Alberola E. and Molina L. (2002)

rate regimes impose important restrictions on seignorage, they also may relax other financial constraints for the government.

Hard pegs may make it easier for governments to borrow foreign funds thus allowing them to delay necessary reforms to fix fiscal imbalances. For example, the currency risk premium on the debt may decrease by pegging the exchange rate, at least for the time while the peg is credible. Only after debts start to pile up and the costs begin to bite, the situation becomes unsustainable and the ill thought nature of the policies becomes widely visible. Tornell and Velasco (1995, 2000) as well as Duttagupta and Tolosa (2006) show that flexible rates, by contrast, allow the effects of irresponsible fiscal policies to immediately manifest themselves through movements in the exchange rate and the price level which are readily observable. By forcing the costs to be paid up-front, provided that exchange rate instability and inflation are costly for the fiscal authorities, flexible rates are thought to enforce more fiscal discipline on the government. Calvo and Mishkin (2003), however, do not find any particular positive impact of the conduct of monetary policy under floating exchange rate systems in promoting fiscal responsibility.

Revenue financing is considered another potential offsetting effect of pegging. The initial expansionary effect of fixing the exchange rate, documented in the exchange rate based stabilization literature (Calvo and Vegh, 1998), may increase revenues and relax the financial constraint. Similarly, exchange rate movements in the context of flexible regimes can also impact the level of economic activity, and thus the amount of fiscal revenues collected through the tax system. For instance, nominal appreciation under a flexible exchange rate arrangement, can negatively impact the profits, and therefore, the tax revenues from the tradable sector. On the other hand, real exchange rate appreciation increases wealth, imports

and consumption, leading to higher VAT intake, which, in turn, can compensate for the losses in the exporters' corporate income tax.

The third channel through which the exchange rate regime can influence the budget deficit is debt servicing. Under a floating exchange rate regime, the expectations of nominal appreciation as well as lower inflation act towards reducing the debt service cost. Such expectations can be, however, limited by the risk of a reversed depreciation just before the EMU entry, which can be used in order to wipe out the domestic currency denominated debt, stimulate the economy through real exchange rate depreciation and ease the burden of pending fiscal reforms. Attempts of late manipulations or "end–games" in the context of the EMU are analyzed at length in Fratianni and von Hagen (1992), Froot and Rogoff (1991).

Finally, nominal appreciation has an immediate public debt reducing impact as the local currency value of the foreign currency denominated debt falls. The overall influence of the exchange rate regime, however, depends on the currency structure of the public debt. Thus, nominal appreciation would have been negative for the Czech Republic in March 2006, as its public debt was almost entirely in domestic currency, whereas for Poland, the short–term impact of appreciation would have been positive, since 29% of the state treasury debt was in foreign currency (Mateusz Szczurek, 2006).

As far as the interest rate criterion is concerned, its fulfillment largely depends on the credibility of EMU accession, that is, on the ability to fulfill all the other criteria. This means that if investors expect the country to become an EMU member, then bond yields will converge. The presence of such a self–enforcing expectation of the markets makes the choice of the exchange rate regime somewhat irrelevant to the ability to fulfill the interest rate

criterion. In support to the above, the evidence on bond yields itself is mixed, indicating that long–term bond yields have not converged more in floating exchange rate countries than in the pegging ones.

A close objective to the fulfillment of the EMU entry conditions, in transition economies, is the achievement of sustainable economic growth which could help them catch up with the richer western European countries. The issue of economic growth, however, has long been somewhat outside the debate on the choice of exchange rate regime, as, given the economic theory, the exchange rate is an aspect of monetary policy and if money is neutral in the long run, it should not have an impact on long–run growth. The relationship has recently been deeper documented and several channels have been suggested through which exchange rates, in their either fixed or flexible form, can positively influence growth.

First, as posited by Dornbush (2001), pegging the currency eliminates currency risk and hence lowers interest rates, thus stimulating investment and growth. Another benefit associated with a common currency is the decrease in transaction costs in international trade. Given a positive impact of cross–country trade on economic growth, both channels indicate a beneficial role of fixed exchange rates in fostering growth. The empirical evidence is, however, mixed: Gosh, Gulde and Wolf (2003) find a positive significant impact of currency boards on growth, while Edwards and Magendzo (2003) find that economies which have experienced dollarization have had lower growth than those which have not. Floating rates, in turn, may indirectly raise the economic growth rate by lowering the volatility of economic aggregates, including that of the output. As far as the experience of the Central and Eastern European countries is concerned, the fixed exchange rate economies have had larger economic growth rates than the floating exchange rate economies. The fixed regime countries in the region had on average

7.83% real GDP per capita growth rate over the last three years, whereas the floats experienced only 5.16% real GDP per capita growth rate over the same period (EBRD Transition Report 2006).

These are the today's practical issues of economic policy that decision makers in the transition countries have to deal with. Macroeconomic stability is a key ingredient to success in this context, and the choice of currency regime is a central element to it. The requirement of jointly fulfilling the EMU entry criteria and, in addition to that, promoting sustainable high economic growth rates, were first to indicate the potential usefulness of estimating the impact of exchange rate regime on the above mentioned performance variables in a simultaneous framework. The analysis is suitable for a true simultaneous equations setting with numerous estimation– related advantages which I describe at length in the next section.

Chapter 4 - Data and Methodology

4.1 The Model

To identify the effect of the exchange rate arrangement on inflation, budget deficit, and in addition to these, on output growth, I specify three panel equations system for the period 1994Q1 – 2006Q2 in ten CEECs (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). Most of the primary data on which the interest variables were calculated are taken from Benczur and Ratfai (2005), including real GDP, investment, government consumption, exports and imports, money, CPI, net capital flows and real effective exchange rate. Data on nominal exchange rate and producer price index (PPI) for the Euro area are obtained from Eurostat, while data for individual country PPI were taken from UNECE's on-line database. The source of data for exchange rate regimes was the IMF Annual Report on Exchange Rate Arrangements and Exchange Restrictions for de jure classification and the Exchange Rate Classification Database of Reinhart and Rogoff (2001) for de facto exchange rate classification. All time series were seasonally adjusted using TRAMO/SEATS adjustment method and have been transformed into their natural log levels. Table 1 provides a detailed description of the data by listing the variables, presenting the way they were computed and also noting which of the following equations feature these variables.

The control variables have been drawn from the literature and, overall, are deemed to provide a suitable depiction of the direction and magnitude of the effects they were supposed to uncover. Some other control variables have also been considered along the way; however, they were left out whenever they produced results that highly varied across specifications. Each of the three equations in the system has the following form:

$$y_{it} = \alpha + \beta x_{it} + \delta z_{it} + v_{it}, \quad v_{it} = c_i + \varepsilon_{it}$$

where y_{it} is an indicator of economic performance, measured by either the inflation rate, the real GDP growth rate or the central government expenditures. In the simple system GMM estimation, x_{it} comprises alternative exchange rate regime indicators, including an observed exchange rate flexibility score and dummy variables corresponding to currency regimes as defined either in the IMF official classification or in Reinhart and Rogoff's natural classification scheme. Under the fixed effects regression, x_{it} includes the change in the observed exchange rate flexibility as well as dummy variables corresponding to the various potential shifts across as supported by the data. Z_{it} comprises a number of control variables for country i at time t, the description of which is given in Table 1. Finally, v_{it} is the composite error term in the regression, comprising the country specific, time invariant factors and the idiosyncratic error term.

There are two sources of endogeneity that have to be enabled. First, as shown in Table 1, the dynamic nature of the variables of interest was represented through a model containing lagged dependent variables among the regressors. Yet, the one lag period of the dependent variable is correlated with the country's unobservable factors which renders Ordinary Least Squares (OLS) estimator biased and inconsistent. Fixed Effects and First Difference transformations, although wiping out the individual effects, do not fully solve the problem of endogeneity because the transformed lagged variables are still correlated with the transformed error term. Enabling the individual effects introduces another problem, as it implies a transformation of the variables in the system, therefore distorting the relation between the level of inflation, output growth and fiscal discipline, on the one hand, and the exchange rate regime, on the other hand. Second, the exchange rate regime indicators are very likely to be subject to an endogeneity bias i.e. the observed relationship may in fact reflect the influence of the performance variables on the choice of the regime rather than the other way around. The

volatility of foreign reserves holdings as well as the ratio of international reserves to the money supply is used as instrumental variables to address the issue of reverse causality.

Given these considerations, an initial system GMM estimation is carried out without accounting for the inertial behavior of the three variables of interest in order to obtain the inflation, output growth and fiscal discipline differential between currency regimes. In a second step, I use first-differencing to eliminate country unobserved characteristics, and then apply the same system GMM estimation to account for the remaining endogeneity in the explanatory variables and the correlation in the disturbances. First–differencing implies that what is regressed is the change in the dependent variable on the change in the regime dummy. The transformed currency regime dummies, however, do not necessarily show the impact of a switch in the regime on the dependent variable, as they might reflect movements both to and away from a given exchange rate arrangement. Another problem in considering individual effects is that there would be no difference between the countries with only one type of regime in the whole sample, since the resulting variable would be in all cases equal to zero.

That is why, based on the initial exchange rate indicators, dummies are generated for all possible types of shifts among regimes. First–differentiation of these dummies would then adequately reflect the relative impact of movements across exchange rate regimes on the performance variables. The analysis will then focus on the inflation, output growth and fiscal discipline differential between increasing flexibility (a switch from intermediates to floats), limiting flexibility (a switch from floats to intermediates) and fully banning flexibility (a switch either from intermediate to pegs or from floats to pegs). There are no instances in my sample of switches away from pegs.

The analysis focuses on the coefficients on the exchange rate regime variables. The coefficients presented in the output tables are to be interpreted as measures of performance relative to the excluded floating regime/shift in the policy to pegs and conditional on the other control variables in the regressions.

4.2 Panel Unit Root Tests

As Canzoneri et al. notice in the case of long run real exchange rate analysis, there are two problems with time series studies on transition economies: on the one hand, there are typically at most ten to fifteen years of reliable data on any panel of these countries and on the other hand, unit root tests have low power in small samples, thus making it difficult for the researchers to distinguish between series that are stationary and series that are stationary but highly persistent. In order to alleviate these problems, a panel of ten new EU member countries[12] is employed over the 1994Q1–2006Q2 period. While increasing the sample size by only increasing the frequency of observation – moving from, say, yearly to quarterly data – may not increase the power[13], the addition of more countries should increase the power of the tests[14] (Crespo–Cuaresma, J., Fidrmuc, J. and MacDonald, R., 2003; Taylor, Alan M. and Mark P. Taylor, 2004).

There are two kinds of tests: the first type of tests imposes the same dynamics across all units under the alternative hypothesis which is both very restrictive and empirically not very interesting, i.e. the pooled t-test proposed by Levin, Lin and Chu (2002; LLC hereafter); the

[12] I am referring to both 2004 and 2007 EU entering countries.

[13] As argued in Shiller and Peroni's 1985 paper, "Testing the Random Walk Hypothesis: Power Versus Frequency of Observation", an increase in the frequency of observation does not bring an improvement in the statistical power of unit root tests because increasing the amount of detail concerning short run movements can only provide information about short run as opposed to long run behavior.

[14] However, it has been noticed that, let's say 1000 panel observations contain less information than 1000 observations from a single time-series. In the time series, the estimated autoregressive coefficient converges at rate T, whereas in the panel, it converges at rate $T\sqrt{N}$, where N is the number of cross-section units. Therefore, in terms of convergence toward the asymptotic distribution, it's better to get more time-series observations (Mark, 2001).

second kind of tests allow for different dynamics under H_1 and include the averaged t-test of Im, Pesaran and Shin (2003; IPS hereafter) and the combination tests of Maddala and Wu (1999; MW hereafter). These tests are based on the assumption of independent cross-sections. As in practice, panels from macroeconomics and international finance are seldom cross-sectionally independent, panel unit root tests that allow for cross-section correlation have been designed often in the form of extensions of the tests for independent panels.

The LLC test is based on Levin and Lin (1992) but improves on it as heterogeneity of cross-sectional units is allowed. It begins with the ADF regression: $\Delta y_{it} = \alpha_i + \delta_i t + \theta_t + \phi_i y_{it-1} + \varepsilon_{it}$ where $-2 < \phi_i \leq 0$, α_i is an individual–specific effect, θ_t is a single–factor common time effect and ε_{it} is a stationary but possibly serially correlated idiosyncratic effect which is independent across units. Y_{it} is a unit root process if $\phi_i = 0$ and $\delta_i = 0$. $\alpha_i = 0$ means that there is no drift in the unit root process, while the common effect θ_t is used to account for correlation across cross sectional units. As previously mentioned, LLC test has an important homogeneity restriction, namely the null assumes $\phi_i = \phi = 0$, against the alternative $\phi_i < 0$ for all individual units.

The resulting test equations are 1) $\Delta \tilde{y}_{it} = \alpha_i + \delta_i t + \phi_i \tilde{y}_{it-1} + \sum_{k=1}^{K_i} \gamma_{ik} \Delta \tilde{y}_{it-k} + \varepsilon_{it}$ where $\tilde{y}_{it} = y_{it} - (1/N) \sum_{i=1}^{N} y_{it}$ is the deviation from the cross-sectional average and is used to control for the time effect θ_t. Unlike the slope coefficient on $\tilde{y}_{it-1}$ which is constrained to be equal across panel units, the coefficients on the lagged differences as well as the number of lags k_i are free to vary[15]. Then two auxiliary regressions are estimated

[15] One way to solve for k_i is to make use of the AIC or the BIC.

2) $\Delta\tilde{y}_{it} = a_i + b_i t + \sum_{k=1}^{K_i} c_{ik}\Delta\tilde{y}_{it-k} + e_{it}$

3) $\tilde{y}_{it-1} = a_i^{'} + b_i^{'} t + \sum_{k=1}^{K_i} c_{ik}^{'}\Delta\tilde{y}_{it-k} + v_{it}$

The residuals from the above regressions, $\hat{e}_{it}$ and $\hat{v}_{it}$, are normalized by $\hat{\sigma}_{\varepsilon_{it}} = \sqrt{\text{var}(\hat{\varepsilon}_{it})}$ yielding: $\tilde{e}_{it} = \frac{\hat{e}_{it}}{\hat{\sigma}_{\varepsilon_{it}}}$ and $\hat{v}_{it} = \frac{\hat{v}_{it}}{\hat{\sigma}_{\varepsilon_{it}}}$. In the last step, these adjusted residuals are pooled and used to estimate the panel t–statistic as $\tilde{e}_{it} = \phi\tilde{v}_{it-1} + \tilde{\varepsilon}_{it}$. The conventional t statistic for the coefficient ϕ has a standard normal limiting distribution if the underlying model does not include fixed effects and individual trends. Otherwise, the statistic has to be corrected using adjustment factors tabulated in Levin et al., depending on the deterministic specification. The ensuing test statistic is distributed as $t_{\phi}^{*} \sim$ N(0,1).

IPS test addresses the homogeneity issue by allowing for a heterogeneous alternative based on the average of ADF tests computed for each panel unit in the model. The estimating equation is again $\Delta\tilde{y}_{it} = \alpha_i + \delta_i t + \phi_i\tilde{y}_{it-1} + \sum_{k=1}^{K_i}\gamma_{ki}\Delta\tilde{y}_{it-k} + \varepsilon_{it}$ where $E(\varepsilon_{it}\varepsilon_{js}) = 0$, I $\neq$ j, for all t, s. The null hypothesis of a unit root, $H_0: \phi_i = 0$, is tested using $\tilde{t}_{bar} = (1/N)\sum_{i=1}^{N} t_{\phi i}$ against the heterogeneous alternative: $H_1: \phi = 0$ for i = 1, …, N_1 and $\phi < 0$ for I = N_1+1, …, N. They show that normalization of this statistic using the first two moments of the $\tilde{t}$'s distribution leads to a standard normal statistic first as T→∞ followed by N→∞. One drawback of the IPS test is that its critical values are simulated only for common K_i = K and T_i = T which requires a balanced panel data set. The rejection of the panel unit root does not necessarily imply that the unit root is rejected for all cross-sectional units, but only for a non-zero share of the sample. The IPS does not say anything about the size of this subgroup.

Finally, Maddala and Wu propose a test with a heterogeneous H_1 based on an alternative aggregation function. In doing so, they apply the Fisher's idea of combining p–values from independent tests to construct a joint test. The Fisher's result is that the p–values from independent tests p_i are distributed as U[0,1] variables and $\lambda = -2\sum_{i=1}^{N} \ln p_i \sim \chi^2_{2N}$. It does not require a balanced panel and unlike the LLC and IPS tests, whose asymptotic distributions were established by allowing both N and T simultaneously to go to infinity and by sequential $T\to\infty$, $N\to\infty$ asymptotics, the distributional results of the MW (or Fisher) depend only on $T\to\infty$. The disadvantage is that p–values should be calculated numerically. Cross sectional dependence affects all these tests, but MW the least when T is large and N is small.

Results in Table 1 indicate that, for most variables in both samples we can reject the null of a unit root test in the levels which implies that all these series are I(0) according to the tests considered. Where the results of the tests differed, prominence was given to the tests allowing for a heterogeneous alternative hypothesis with time trends included to correct for cross–sectional dependence. The variables that were found I(1) are considered in the analysis in the differenced form.

Table 1. Panel Unit Root Tests 1994:1-2006:2

	LLC test	LLC^{TD} test	IPS test	IPS^{TD} test	MW test	MW^{TD} test
Real GDP Growth						
–whole sample	-10.081***	-8.170***	-11.486***	-10.096***	171.468***	138.781***
–small sample	-10.089***	-8.225***	-12.161***	-10.563***	162.331***	129.126***
Inflation						
–whole sample	-6.842***	-5.101***	-5.369***	-4.125***	72.630***	55.616***
– small sample	-7.458***	-5.658***	-9.460***	-6.776***	118.898***	77.377**
Money Growth						
–whole sample	-0.218	4.045	-3.714***	-1.395*	51.477***	37.594***
– small sample	0.204	4.814	-3.290***	-0.558	41.961***	27.111**
Exchange Rate						
Volatility	-10.777***	-10.792***	-10.590***	-9.651***	146.274***	120.313***
–whole sample	-6.803***	-8.419***	-7.033***	-6.631***	85.609***	72.142***
– small sample						
International Reserves						
–whole sample	-0.519	-0.491	2.273	-0.353	14.632	25.207
– small sample	-0.180	1.700	-3.259***	-2.807***	42.330***	41.046***
International						
Reserves/M2	-3.121***	-0.654	-2.430***	-0.352	35.599**	21.757
–whole sample	-0.115	2.087	-3.217***	-2.789***	41.717***	41.029***
– small sample						
International reserves						
Volatility	-8.507***	-9.373***	-9.859***	-9.557***	134.947***	121.062***
–whole sample	-8.064***	-8.369***	-8.155***	-7.680***	98.372***	86.686***
– small sample						
Government						
Consumption/GDP						
–whole sample	-1.857**	-6.633***	-3.528***	-7.902***	67.268***	123.272***
– small sample	-1.489*	-6.142***	-2.796***	-8.191***	53.407***	114.954***
Investment/GDP						
–whole sample	-6.054***	-6.783***	-3.865***	-4.764***	67.768***	65.791***
– small sample	-6.761***	-7.074***	-5.593***	-4.899***	67.485***	58.053***
Net Capital						
Flows/GDP	-3.305***	-3.049***	-4.854***	-4.243***	66.532***	56.478***
–whole sample	-2.839***	-3.067***	-5.191***	-4.617***	61.909***	52.526***
– small sample						
Openness						
–whole sample	-1.638*	-3.114***	-0.827	-4.950***	31.517**	63.362***
– small sample	-1.503*	-3.105***	-1.469***	-4.834***	30.589***	55.677***

Note: TD denotes the inclusion of time dummies. I consider the Eviews ADF-Fisher test for the MW test. ***, ** *and * denotes significance at 1% level, 5% level and 10% level, respectively.*

4.3 System Analysis

Most empirical studies relating the exchange rate regime to macroeconomic performance, i.e inflation, fiscal discipline and output growth, examine these relationships by means of separate regressions. There are, however, obvious interdependencies among these equations which if taken into account can better uncover the influence of exchange rate arrangement on macroeconomic success. For example, the disturbances in the inflation, growth and fiscal expenditure equations can include factors that are common to all countries, such as EU membership, as well as factors that are specific to the particular country. Since the disturbances are obviously correlated across the three equations it may be useful to estimate them jointly rather than ignore this connection.

Moreover, the exchange rate regime analysis is suitable for simultaneous equations framework as it satisfies the autonomy requirement i.e. the endogenous variables in the system are choice variables of different economic units. The inflation function describes monetary authorities' behavior; the government consumption function describes the fiscal authorities' behavior while the real growth function can be thought of as describing the firms' behavior. That is to say that each equation has an economic meaning independently from the other equations in the system. I therefore estimate the above mentioned equations simultaneously using the GMM-Time Series (HAC) which accounts for heteroskedasticity and autocorrelation of unknown form.

The presence of country's unobservable factors inducing endogeneity in the lagged dependent variables requires the use of different instruments for different equations. Arrelano and Bond (1991) suggest that, for each equation, lagged levels of the explanatory variables, including the lagged dependent variable, to be used as instruments. According to Blundell and Bond

(1998), however, "when the autoregressive parameter is moderately large and the number of time series observations is moderately small…levels of the series provide weak instruments for the series in this case". I follow Blundell and Bond (1998)'s suggestion and use lagged differences as instruments to eliminate the possibility of bias due to weak instruments.

The estimation strategy also assumes the absence of serial correlation in the levels of the error term ε_{it}. I therefore test the validity of the instruments being used by means of serial correlation tests of the first differenced residuals. I expect significant first order serial correlation but require zero second order serial correlation for the instruments to be valid. If there is significant second order correlation I drop the instruments back a further time. As additional robustness check, I also consider the J–statistic for model misspecification. A large J statistic is an indication of model misspecification.

There are however some limitations to the system GMM estimation technique. First, as already mentioned, it is very likely that the country's observed and unobserved heterogeneity terms will be correlated, for example, as a result of omitting important explanatory variables from the model. Such a correlation particularly in dynamic panel data setting adversely affects the GMM-type estimators as they explicitly rely on the assumption of no unobserved effects in the pursuit of asymptotic efficiency (Matyas et. all, 2001). Second, although the systems methods are asymptotically better, they have one problem i.e. any specification error in the structure of the model will be propagated throughout the system (Greene, 2006).

Chapter 5 - Empirical Results

There are three aspects driving the variation in the estimation results (Tables 2-7 in Appendix C): differentiation between de jure and de facto measures of exchange rate regimes, the consideration of unobservable heterogeneity problems and inertial behavior in the performance measures of interest and finally, the distinction between the first round accession countries and the late reformers, Bulgaria and Romania. However, accounting for all these considerations suggests that floats can help achieve financial stability through lower inflation rates and more fiscal responsibility as compared to the more rigid arrangements. The push for enhanced financial stability, however, comes at the cost of lower economic growth rates. Therefore, under floating exchange rate regimes, the real economy objective of economic growth appears to get crowded out by the financial objectives to a greater extent than under fixed or intermediate regimes.

5.1 Initial Estimation

The estimation results of the simple system GMM analysis i.e. without taking care of country specific factors and inertial behavior in the dependent variables, provides mixed results with respect to the influence of the exchange rate system on inflation, output growth and fiscal stance, according to the specific exchange rate indicator employed or whether all countries versus first round accession countries are considered. For the entire sample, with the standard IMF classification, floating exchange rate countries appear to promote lower inflation rates although they may allow for greater fiscal discretion. A strong hold on inflation as well as fiscal policy for growth in floating rate regimes induce higher interest rates and exchange rate appreciation which can nullify the growth stimulus from a potential expansionary fiscal policy or from lower economic uncertainty as a result of price stability. This may be an explanation

for the positive and statistically significant coefficient on the pegged regime dummy indicating that pegs are better in encouraging output growth than the floats.

When the observed exchange rate volatility is used as an indicator of the true monetary and exchange rate policy, the results on the floats' anti–inflationary benefits, their potential fiscal discretionary influence as well as their negative impact on output growth, remain. The estimation based on Reinhart and Rogoff's natural classification does not contradict the above results on the inflation and output growth relative performance of the floating rates systems. However, the estimates change when it comes to their disciplinary effect on the central government consumption indicating a potential role for the floats in enhancing fiscal responsibility.

Excluding Bulgaria and Romania from the sample produces mixed results. Thus, the analysis based on the IMF official classification indicates that the performance of floating exchange rate regimes relative to the pegged regimes differs as compared to their performance relative to the intermediate systems. The floats are shown to deter fiscal overspending and boost growth to a higher extent than the pegs; however, their ability to cap inflation is lower than that of the pegged regimes. The growth stimulating advantage of the floats is preserved against the intermediate regimes; in addition, the floats are shown to promote lower inflation rates than the intermediate arrangements. Nevertheless, results point to a greater disciplinary effect of the intermediate regimes than that of the flexible systems.

Estimations based on de facto measures of exchange rate regimes provide contrasting views on the relative inflation and fiscal discipline performance of the floating rates. However, they do agree on the fact that the floats or greater exchange rate flexibility stimulates output

growth to a lower degree than the more rigid arrangements. When the observed exchange rate volatility indicator is used, the results point towards a significant anti–inflationary and fiscal disciplining impact of greater exchange rate flexibility. In contrast, the estimates based on Reinhart and Rogoff's classification, indicate that pegged as well as intermediate regimes outperform the floats in terms of their ability to simultaneously reduce inflation and enhance output growth. As far as the fiscal discipline is concerned, the intermediate regimes are shown to have the most important influence on capping public spending. The floats follow close, however, providing a stronger hold on government spending than the fixed regimes.

5.2 First–Differencing Analysis

Once inertial behavior in the dependent variables and unobserved country effects are taken into account, results are driven only by the distinction between first round accession countries and the later comers, Bulgaria and Romania.

Estimation results for the entire sample, using the standard IMF classification, suggest that pegging the exchange rate can substantially improve inflation performance and promote greater fiscal discipline. Allowing for increased flexibility in the exchange rate policy, as compared to limiting or fully banning it, has an ambiguous, albeit statistically insignificant, impact on economic growth. When the observed exchange rate volatility is used to properly depict the actual exchange rate arrangement, the results indicate that increasing exchange rate flexibility can help boost output and deter fiscal authorities from unsound spending. The inflation result is robust, however, to the use of the observed exchange rate volatility as a de facto measure of the underlying monetary and exchange rate policy. I also estimated a system with Reinhart and Rogoff's classification, but unfortunately, I could not accept the null of no second order autocorrelation at 1% significance level in the fiscal discipline equation, and thus the results are not likely reliable. However, it can be noted that when fixed effects were

allowed for, the shift in the exchange rate policy no longer exerted a significant effect. Nevertheless, since the null of no second order autocorrelation was rejected, the results to consider remain those of the estimation using other measures of exchange rate regimes or those which do not account for fixed effects.

The results for the smaller sample, based on the IMF's official classification, indicate that countries allowing for greater exchange rate flexibility can achieve greater financial stability through lower inflation rates and higher fiscal responsibility. This seems to come in exchange of a lower growth rate of real GDP. The results on the floats' anti–inflationary benefits, on the one hand, and the lower output enhancing ability, on the other hand, are robust to replacing the IMF standard exchange rate regime indicators with the observed exchange rate flexibility score. However, they suggest that exchange rate stability can impose a greater constraint on the public spending. When Reinhart and Rogoff's classification is employed, the results indicate a positive, statistically significant impact of pegging on fiscal discipline indicating that exchange rate stability would induce better management of public finances. Although they are not statistically significant, the inflation and output growth differentials seem to suggest lower inflation and output growth rates resulting from a shift towards greater flexibility in the exchange rate.

Conclusions

The thesis explores the impact of exchange rate arrangements on inflation, economic growth and fiscal discipline. While most of the papers relating the exchange rate regime to macroeconomic success have generally addressed the potential simultaneity problems as well as the dynamic nature of the performance variables under investigation, they have used distinct cross–section or pooled regressions to estimate the relationship between either inflation, economic growth or fiscal stance, on the one hand, and exchange rate regimes, on the other hand. The weaknesses of this approach have been the inability to take into account the unobserved heterogeneity and the foregone possibility of making use of the correlation in the disturbances from inflation, economic growth and fiscal discipline equations due to both common and/or country specific factors influencing all three variables.

Dynamic panel data analysis within the system GMM estimation framework helps tackle unobservable heterogeneity issues even when inertial behavior of the dependent variables is allowed for and it also efficiently exploits all additional information that might be contained in the residuals due to omitted factors that simultaneously influence all three variables. There are three aspects driving the variation in the estimation results: differentiation between de jure and de facto measures of exchange rate regimes, the consideration of unobservable heterogeneity problems and inertial behavior in the performance measures of interest and finally, the distinction between the first round accession countries and the late reformers, Bulgaria and Romania. All things considered, the analysis, based on a sample of ten Central and Eastern European during 1994Q1 and 2006Q2, suggests that that flexible rates promote lower inflation rates although they may allow for greater fiscal discretion. The strong hold on inflation and/or a potential expansionary fiscal policy induces, under floating regimes, higher interest rates and exchange rate appreciation, thus nullifying the growth stimulus from a

growth enhancing fiscal stance or from lower economic uncertainty due to price stability. Thus, the floats appear to be less effective in encouraging economic growth as compared to the more rigid currency systems.

As Tornell and Velasco (2000) rightfully point out, there is no exchange rate arrangement that could ultimately act as a substitute for sound macroeconomic policies. That is why the currency regime should not be regarded as an end in itself but as a facilitating mechanism for a country's major economic objectives by setting the framework for macroeconomic policy mix with a smaller or larger scope for either of the policy tools at hand.

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APPENDIX A - Decomposition of Real Exchange Rate Movements

This section presents the decomposition of real exchange rate changes. Real exchange rate movements can be driven by changes in the price ratio of traded goods between countries (Lucas–Stockman view) as well as changes in the ratio of non-tradable prices to tradable prices between the countries (HBS theory). As previously explained in the paper, provided that PPP holds in the traded goods sector, the HBS hypothesis implies that stronger productivity growth in the tradable sector relative to the non-traded sector leads to an increase in the relative prices of non-traded goods. Then a stronger HBS effect in the home country translates into a real appreciation of the domestic currency. In contrast, Lucas (1982) and Stockman (1980) suggest an alternative transmission mechanism for domestic productivity shocks to relative prices. They show that increased productivity in the home country leads to an increase in the supply of domestic relative to foreign traded goods, thus lowering the domestic prices relative to foreign traded goods prices (which is equal to a worsening of the terms of trade) and resulting in a long-real depreciation.

In a two country framework, the real exchange rate q_t is defined as the price of foreign goods (measured in domestic currency) relative to the price of the domestically produced goods:

$$q_t = (e_t + p_t^*) - p_t$$

where q_t is the real exchange rate, e_t is the nominal exchange rate expressed in units of national currency per foreign currency, and the variables p and p^* refer to the domestic and the foreign consumer price indices (CPI), respectively. Further on, each CPI can be written as a geometric average of the tradable and non-tradable goods price indices:

$$p_t = \alpha p_t^{NT} + (1-\alpha)\, p_t^T$$

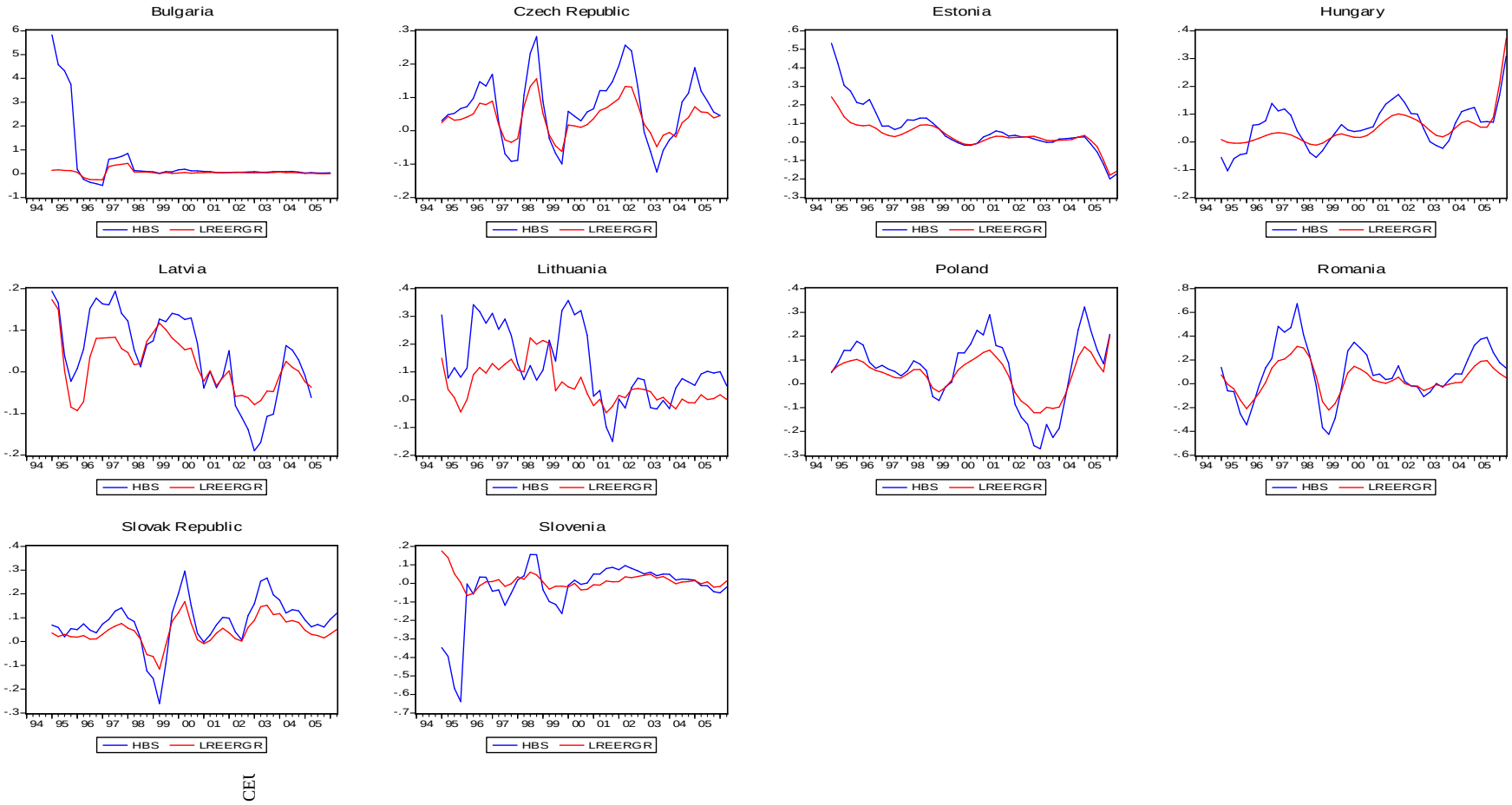
$$p_t^* = \alpha^* p_t^{*NT} + (1-\alpha^*)\, p_t^{*T}$$

where α is the weight of the non-tradable goods price index in the aggregate CPI. Assuming the weights of non–tradables are the same in both countries, the real exchange rate can be decomposed into:

$$q_t = x_t + y_t = [e_t + (p_t^{T*} - p_t^T)] + \{\alpha[(p_t^{NT*} - p^{T*}_t) - (p_t^{NT} - p_t^T)$$

where x_t measures the relative price of traded goods (also called the external exchange rate or the terms of trade and may thus be seen as an indicator of competitiveness, while the y_t represents the ratio of non-tradable prices to tradable prices in the foreign country relative to the home country and is usually referred to as the internal relative price ratio. The above decomposition allows me to determine whether the exchange rate movements are due to changes in the external exchange rate x_t or in the internal price ratio y_t. When applied to the countries in the studied sample, it allows me to assess the magnitude of the HBS effect in the real exchange rate movements.

Figure 1. The Change in REER (based on CPI) and the Change in the Internal Relative Price Ratio



APPENDIX B -Variable Description

	VARIABLE	DESCRIPTION
IMF de jure regime dummies	Pegged (peg) Intermediate (int) Floating (float)	Pegged regimes (IMF classification: 1, 2) Intermediate regimes (IMF classification: 3–6) Floating regimes (IMF classification: 7, 8)
De Grauwe and Schnabl de facto regime measure	Observed Exchange Rate volatility (ERVOL)	Z score as proposed by Gosh, Gulde and Wolf (2002)
Reinhart and Rogoff de facto regime dummies	Pegged (RR1) Limited Flexibility (RR2) Managed Floating (RR3) Freely Floating (RR4) Freely Falling (RR5)	Pegged regimes (fine classification 1–4) Limited flexibility regimes (fine classification 5–9) Managed floating regimes (fine classification 10–12) Freely floating regimes (fine classification 13) – no data in my sample Freely falling (fine clasification 14)
Policy Shifts Dummies	Banning Flexibility Limiting Flexibility Increasing Flexibility	Switch from 1. Either intermediate to pegs or from floats to pegs 2. Managed floating to pegged regimes Switch from 1. Floats to intermediate regimes 2. Managed floating to limited flexibility arrangements Switch from 1. Intermediate regimes to floats 2. Limited flexibility regimes to managed floats
Dependent Variable	Control Variables	
Government Consumption to GDP	Lagged Government Consumption to GDP (GovGDP(-1)) Real GDP Growth (Δy) Change in Terms of Trade (ΔToT) Money Growth (Δm) Openness (Open)	The lagged ratio of real central government consumption to GDP Real GDP Growth – quarterly change in log of real GDP The quarterly change in log of the relative PPI between the Euro area and individual countries. Growth Rate of M2 (quarterly change in log of M2) The sum of imports and exports over GDP

Dependent Variable	**Control Variables**	**Description**
Inflation	Lagged Inflation $\pi(-1)$ Money Growth (Δm) Real GDP Growth (Δy) Government Consumption (GovGDP) Net Capital Flows to GDP (NcfGDP) Change in Terms of Trade (ΔToT) Openness (Open)	Lagged inflation (quarterly change in log of CPI) Growth Rate of M2 (quarterly change in log of M2) Real GDP Growth (quarterly change in log of real GDP) The ratio of real central government expenditures to GDP The ratio of net capital flows to GDP The quarterly change in log of the relative PPI between the Euro area and individual countries. The sum of imports and exports over GDP
Real GDP Growth	Lagged Real GDP Growth ($\Delta y(-1)$) Investment Ratio (InvGDP) Lagged Government Consumption (GovGDP(-1)) Net Capital Flows to GDP (NcfGDP) Lagged Inflation $\pi(-1)$ Change in Terms of Trade (ΔToT) Openness (Open)	Lagged Real GDP Growth The ratio of real gross fixed capital formation to GDP The lagged ratio of real central government consumption to GDP The ratio of net capital flows to GDP Lagged inflation (quarterly change in log of CPI) The quarterly change in log of the relative PPI between the Euro area and individual countries. The sum of imports and exports over GDP
Instruments	International Reserves (Res) The Ratio of International Reserves to Money Supply (ResM2) The Volatility of International Reserves (Resvol) Inflation Targeting (Target) Lags of endogenous and exogenous variables	IFS series of Total Reserves minus Gold The Ratio of International Reserves to Money Supply Z' score for international reserves Dummy variable

APPENDIX C - Output Tables

Table 2 Inflation Performance – Initial Estimation

	All Countries			First Round Accession Countries		
	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme
Pegged (peg)	-0.003	-	-	-0.029***	-	-
Intermediate	0.007**	-	-	0.027***	-	-
Exchange Rate Volatility	-	-0.002**	-	-	-0.008***	-
Pegged (RR1)	-	-	-0.007***	-	-	-0.015***
Limited Flexibility (RR2)	-	-	0.005	-	-	-0.008***
Money Growth	0.054***	0.045***	0.068***	0.312***	0.128***	0.020***
Real GDP Growth	0.124***	0.031	0.130***	0.118***	0.181***	0.445***
GovGDP	0.005***	0.010***	0.002	0.071***	0.018***	0.009***
NcfGDP	-0.001**	-0.02***	0.002**	-0.006***	-0.006***	-0.001***
Δ ToT	-1.025***	-1.043***	-1.014***	-0.299***	-0.426***	-0.210***
Openness	0.005*	-0.002	0.006**	0.032***	-0.001	-0.005***
Constant	0.006**	0.014***	0.021***	0.116***	0.032***	0.028***
Observations	400	355	240	108	101	85

Table 3 Growth Performance – Initial Estimation

	All Countries			First Round Accession Countries		
	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme
Pegged (peg)	0.009***	-	-	-0.021***	-	-
Intermediate	0.001	-	-	-0.010***	-	-
Exchange Rate Volatility	-	-0.005***	-	-	0.009***	-
Pegged (RR1)	-	-	0.001	-	-	0.009***
Limited Flexibility (RR2)	-	-	0.020***	-	-	0.010***
InvGDP	0.016***	0.006**	-0.008**	-0.017***	-0.009*	-0.007***
GovGDP(-1)	0.000	0.005***	0.009***	-0.037***	-0.026***	0.011***
NcfGDP	0.001***	0.001***	0.003***	0.003***	0.005***	-0.001*
Lagged Inflation	0.078***	0.073***	0.070***	0.208***	0.127***	0.251***
Δ ToT	0.101***	0.071***	0.082***	0.177***	0.167***	0.164***
Openness	0.000	-0.003**	0.002	-0.031***	0.003	-0.012
Constant	0.034***	0.031***	0.022***	-0.012**	0.013	0.005***
Observations	406	331	242	99	101	85

Table 4 Fiscal Performance – Initial Estimation

	All Countries			First Round Accession Countries		
	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme
Pegged (peg)	-0.235***	-	-	0.105***	-	-
Intermediate	-0.492***	-	-	-0.035**	-	-
Exchange Rate Volatility	-	0.400***	-	-	-0.066***	-
Pegged (RR1)	-	-	0.205***	-	-	0.043***
Limited Flexibility (RR2)	-	-	-0.095	-	-	-0.155***
Real GDP Growth	3.096***	11.151***	5.835***	-0.641***	-1.092***	0.691***
Δ ToT	1.886***	3.483***	1.420***	-0.131	-0.688***	-0.574***
Openness	-0.345***	0.175***	-0.190***	-0.086***	-0.117***	0.049**
Money Growth	0.916***	1.514***	1.292***	0.546***	0.603***	-0.140***
Constant	-1.54***	-1.858***	-1.813***	-1.586***	-1.572***	-1.559***
Observations	430	362	264	100	114	81

Table 5 Inflation Performance – First–Differencing Analysis

	All Countries			First Round Accession Countries		
	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme
Increasing Flexibility 1	0.179**	-	-	-0.104***	-	-
Limiting Flexibility 1	-0.180	-	-	-	-	-
Exchange Rate Volatility	-	0.031***	-	-	-0.002*	-
Increasing Flexibility 2	-	-	-0.209	-	-	-0.003
Lagged Inflation	-0.075***	0.181***	0.123***	0.763***	-0.181***	0.89***
Money Growth	0.039*	0.068*	-0.075	-0.023***	0.012	-0.02***
Real GDP Growth	0.068	-0.298**	0.448*	-0.115***	-0.096***	0.19**
GovGDP	-0.165***	-0.104	-0.209	-0.135***	-0.09***	-0.07
NcfGDP	-0.012	-0.049***	0.005	-0.005***	-0.003***	0.008
Δ ToT	-1.031***	-0.748***	-0.919***	0.098***	0.05***	-0.08
Openness	0.084	1.720***	1.682***	-0.056**	-0.07***	-0.11
Constant	0.003***	-0.024***	-0.020***	0.001	-0.000	0.001
Observations	410	318	233	126	112	100

Table 6. Growth Performance - First–Differencing Analysis

	All Countries			First Round Accession Countries		
	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme
Increasing Flexibility 1	-0.113*	-	-	-0.354***	-	-
Limiting Flexibility 1	-0.090					
Exchange Rate Volatility	-	0.002	-	-	-0.003***	-
Increasing Flexibility 2	-	-	-0.91	-	-	-0.02
Real GDP Growth (-1)	-0.012	0.482***	0.356***	0.556***	-0.213**	0.18*
InvGDP	-0.017	-0.050**	-0.177***	-0.133**	-0.08***	-0.296***
GovGDP(-1)	0.091*	-0.037	0.001	0.910***	0.32***	-0.33***
NcfGDP	-0.003	0.012***	-0.013	-0.030***	-0.005***	-0.000
Lagged Inflation	0.088***	0.080***	0.083***	-0.018	-0.006	-0.19
Δ ToT	-0.026***	-0.039***	0.074***	0.229***	-0.03	0.31***
Openness	-0.680***	-0.437***	-0.309***	-0.517***	-0.21***	0.06
Constant	0.010***	0.007***	0.007***	0.014***	0.006***	-0.002
Observations	410	318	233	126	112	100

Table 7. Fiscal Performance – First–Differencing Analysis

	All Countries			First Round Accession Countries		
	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme	IMF de jure classification	De Facto DGS e/r measure	"Natural" classification scheme
Increased Flexibility 1	0.465**	-	-	-0.447***	-	-
Limiting Flexibility 1	0.209					
Exchange Rate Volatility	-	-0.006**	-	-	0.001	-
Increased Flexibility 2	-	-	-0.031	-	-	0.15**
GovGDP (-1)	0.682***	0.402***	0.440***	-0.029	0.16**	0.43***
Real GDP Growth	-0.124	0.218***	0.095	-0.320***	-0.32***	0.28**
∆ ToT	-0.009	-0.027***	-0.013	-0.026	0.25***	-0.22*
Openness	0.626***	0.540***	0.641***	0.259***	0.11**	0.65***
Money Growth	0.053*	-0.034**	-0.020	-0.033***	-0.05***	-0.06
Constant	-0.013***	-0.010***	-0.009***	-0.007***	-0.009***	-0.01***
Observations	426	334	244	133	112	105