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Exchange Rate Stability, Inflation, and Growth in (South) Eastern and Central Europe

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Abstract

The authors analyze the impact of the exchange rate regime on inflation and output in (South) Eastern and Central Europe. For the whole observation period the estimations reveal a significant impact of exchange rate stability on low inflation as well as a highly significant positive impact of exchange stability on real growth. When subdividing the period into a "high-inflation" period (1994–97) and a "low-inflation period" (1998–2004), and when removing outliers from the sample, the evidence in favor of a positive association between exchange rate stability and inflation disappears. The association of exchange rate stability with higher real growth remains robust. These findings suggest that membership of the (South) Eastern and Central European countries in the European Monetary Union would have a positive impact on these countries' growth rates.

1. Introduction

In May, 2004, ten (mostly) Central and Eastern European countries joined the European Union (EU). Bulgaria and Romania followed in January, 2007. A third group of countries—namely Albania, Bosnia-Herzegovina, Croatia, the FYR of Macedonia, Serbia-Montenegro, and Turkey—have been granted candidate or potential candidate status to the European Union.[1]

The gradual past and potential future eastern enlargement of the European Union has been accompanied by the redirection of the exchange rate policies. While in the early 1990s most (South) Eastern and Central European countries had pegged their currencies to the dollar or currency baskets which contained both dollar and European currencies, exchange rate strategies have been gradually redirected towards the euro (ECB, 2005). This gradual rise of the euro as a regional anchor currency may well herald an enlargement of the European Monetary Union (EMU). Within a few years, the EMU could include up to 27 member states, and may further grow to 33 over the long term.

The growing role of the euro as a regional anchor currency and the prospect of further EMU enlargement raise the question of the costs and benefits of exchange rate stabilization against the euro and EMU membership. Is a growing European Union an optimum currency area (OCA)? The traditional theoretical framework of OCAs as developed by Mundell (1961) leads to skepticism. Because heterogeneity will increase, the probability of asymmetric shocks will rise. The (South) Eastern and Central European countries in the economic catch-up are likely to follow different business cycles than the mature welfare states at the center of the European Union. This may imply that it is not in the interest of the enlarged EU to embark on a monetary union.

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Nevertheless, several new member states had expressed their strong intention to join the EMU as soon as possible. After Estonia, Cyprus, Latvia, Lithuania, Malta, and Slovenia had joined the Exchange Rate Mechanism II, a new wave of EMU enlargement was expected soon after Slovenia joined in January, 2007. The rationale in favor of an early EMU membership is to be found outside the traditional OCA framework. As stressed in some of Mundell's (1973a, 1973b) later works, in a world of nonstationary expectations, exchange rate movements do not function as stabilizing instruments in the face of asymmetric shocks. Instead, they are likely to be an independent source of volatility which can be eliminated by an early EMU membership.

Which framework applies for the (South) Eastern and Central European countries? Should the independence in monetary policymaking be maintained as long as possible to cope with asymmetric shocks during their economic catch-up process? Or should they peg tightly to the euro and join the EMU quickly to reap the benefits of irrevocably fixed exchange rates?

Updating and enlarging the sample of De Grauwe and Schnabl (2004), this paper adds to the discussion by measuring the impact of exchange rate stability on inflation and output growth in 18 (South) Eastern and Central European (mostly transition) countries. If fixed exchange rates contribute to low inflation and high growth, EMU enlargement could be seen as providing a source of benefits for the EMU's prospective members. We will use a panel data approach to perform this analysis.

2. Costs and Benefits of Exchange Rate Stabilization and EMU Membership

The decision of the (South) Eastern and Central European countries to enter the EMU will depend on the perceived costs and benefits. The traditional theory of OCAs as put forward by Mundell (1961) and McKinnon (1963) has relied on three criteria to make an assessment about the costs and benefits of a monetary union: asymmetry, flexibility, and openness (integration).

The seminal paper by Mundell (1961) on OCAs focused on asymmetric shocks and the flexibility of labor markets. Assuming sticky prices and wages, Mundell analyzed the macroeconomic adjustment mechanisms of demand shifts among regions (countries). Within this Keynesian framework, he concluded that countries that face large asymmetric shocks would find it costly to abandon their monetary and exchange rate policies when entering a monetary union. These costs, however, would be reduced if these countries were characterized by wage flexibility and labor mobility. All in all, Mundell was led to skepticism about the desirability of forming a monetary union among countries that experience large asymmetric shocks and that lack flexibility.

McKinnon (1963) introduced the degree of openness as a determinant of the costs and benefits of a monetary union. He assumed that small and (therefore) open countries are price takers on the world market. Fluctuating exchange rates would imply a highly volatile price level. It can be shown that as the degree of openness increases, the benefits of a monetary union also increase. Not surprisingly most smaller (South) Eastern and Central European countries such as the Baltics, Bulgaria, Bosnia-Herzegovina, Croatia, and the FYR of Macedonia have adopted tight pegs to the euro, partially in the form of currency board arrangements. In countries with a history of high or (even hyper) inflation (such as the former Yugoslav countries), exchange rate stability against the euro has contributed substantially to macroeconomic stability. The benefits arise from the fact that the elimination of exchange rate variability reduces transaction costs and the volatility of domestic prices.

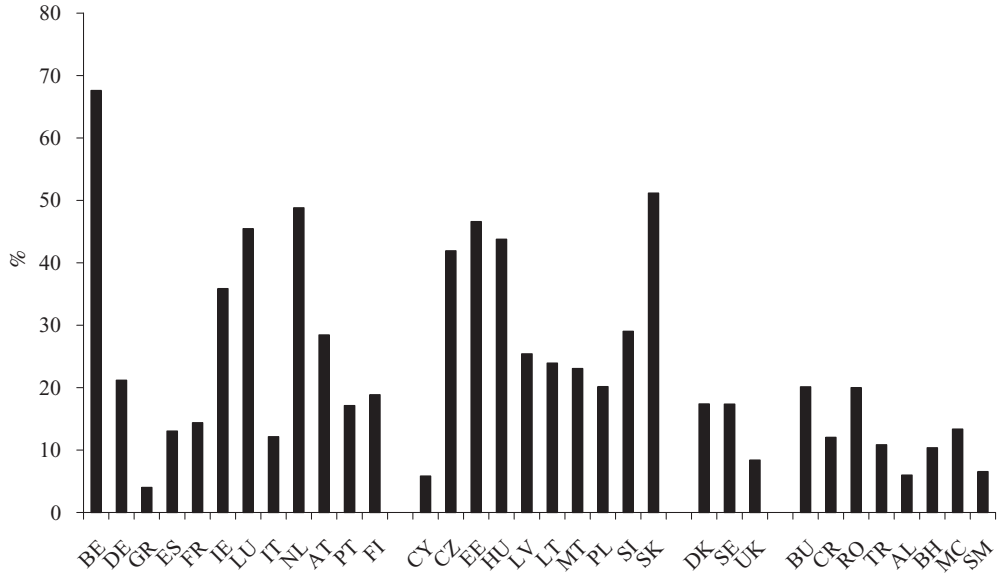

Figure 1. Exports to EU25 as Percent of GDP (2004)

Source: IMF: Direction of Trade Statistics.

Is a growing EMU an optimum currency area—that is, one which would gradually include all new member states, the present "outs" (Denmark, Sweden, and the United Kingdom) as well as the members of the third group of candidate and potential candidate EU countries? In the spirit of Mundell (1961) and McKinnon (1963) we will look at a number of OCA-criteria. We start with openness. Figure 1 shows the exports to the EU25 as a percentage of GDP for four groups of countries: the 12 present EMU members, the ten new member states, the three EMU "outs," and the group of candidate and potential candidate countries.

In 2004, exports to the EU25, as a percentage of GDP, were higher for the new member states (an arithmetic average of 31.1%) than for the present EMU members (27.2%). Based on McKinnon's (1963) openness criterion, the new member states should have a strong interest in joining the EMU as soon as possible. This is even more the case, as prospective membership of the EMU can be expected to further increase trade integration among members (Frankel and Rose, 1998).[2]

In contrast, exports to the EU25 as a percent of GDP remains on average considerably lower for the group of EMU outs (14.4%) and the group of the candidate and potential candidate countries (12.4%). While the first group has already decided to postpone EMU membership, many members of the second group have pursued tight exchange rate stability against the euro and have shown strong interest in an early euro adoption, even considering unilateral euroization.

The degree of asymmetric shocks is more difficult to quantify. Bayoumi and Eichengreen (1993) used a Vector Auto Regression methodology, as proposed by Blanchard and Quah (1989), to measure asymmetric shocks in the potential first wave of EMU members. Based on the assumption that demand shocks are temporary and supply shocks are persistent, Bayoumi and Eichengreen (1993: 221–2) concluded that "a strong distinction emerges between supply shocks affecting the countries at the center of the European Community—Germany, France, Belgium, the Netherlands, and Denmark—

and the very different supply shocks affecting other EC members—the United Kingdom, Italy, Spain, Portugal, Ireland, and Greece."

What is the evidence for the degree of asymmetry in the (South) Eastern and Central European countries? Recently most research on this topic has been done with respect to the new member states.[3] Buiter and Grafe (2002), who analyzed the heterogeneity of national income structures and co-movements of inventory cycles, found evidence that Central and Eastern European business cycles are by no means synchronized with the EU15. Fidrmuc and Korhonen (2001) used the VAR framework by Blanchard and Quah (1989) to show that the shocks are significantly more idiosyncratic with regard to the EU25 than for the EU15.

The flexibility of labor markets in the EU25 is known about the least. Iara and Traistaru (2004) analyzed wage flexibility in four Central and Eastern European countries during the 1990s based on the estimation of static and dynamic wage curves. They concluded that labor market flexibility is rather high in Bulgaria, but for Hungary and Poland it is lower. The Romanian labor market was found to be very rigid. A panel study by Alvarez-Plata et al. (2003) of the potential migration from Eastern and Central European countries into the EU15 predicted considerable movement of labor force from these countries into Germany and other EU15 member states. For the candidate and potential candidate countries it is likely that the degree of asymmetry and labor market flexibility is lower than for the new member states, as (trade) integration with the EU15 is less advanced and official unemployment rates remain at very high levels.

All in all, the empirical evidence seems to be mixed. Albeit at different stages, trade integration of all countries at the (South) Eastern EMU periphery with the rest of the union advances well. However, the degree of asymmetry of shocks appears to be relatively high, while flexibility is not particularly strong. All this suggests that the growing European Union would not at this moment constitute an OCA. In this view, the (South) Eastern and Central European countries would be well advised to allow for more exchange rate flexibility against the euro and postpone EMU membership—at least if the traditional OCA criteria are considered.

Nevertheless, as suggested by Mundell in later works (1973a, 1973b), factors outside the original Keynesian framework (assuming fixed prices and wages) might provide arguments in favor of an early EMU membership (McKinnon, 2004). In Mundell (1973a, 1973b) exchange rate movements do not stabilize the economy in the face of asymmetric shocks. Instead, they are independent sources of volatility because foreign exchange markets are not efficient. They are dominated by speculative dynamics that lead to exchange rate movements unconnected to movements in the fundamentals.

As a result, exchange rates exhibit excess volatility and are a source of great macroeconomic volatility, especially in small, open economies. In this world it is beneficial for small, open economies that allow the free movement of capital to fix their exchange rates as a way to avoid the disruptive macroeconomic effects of floating exchange rates. This is even more the case as capital controls have to be abolished as a condition for E(M)U membership. Because pegged exchange rates are fragile and subject to crises, these countries will find it advantageous to join a monetary union so as to permanently fix their exchange rates.

In the following sections we take up the issue raised by Mundell (1973a, 1973b) and McKinnon (2004) and analyze the extent to which the (South) Eastern and Central European countries have created a better environment for trade, capital flows, and growth by stabilizing exchange rates. This will allow us to shed light on the question of

whether Mundell (1961) or Mundell (1973a, 1973b) is the appropriate framework for the (South) Eastern and Central European countries to decide about exchange rate stabilization against the euro and (later on) EMU membership.

3. Sample Selection, Volatility Measures, and Subperiods

We use a panel of 18 (South) Eastern and Central European countries to analyze how inflation and economic growth have been affected by the exchange rate regime. Given the relatively short observation period available for the transition economies, country-specific regressions would not provide enough degrees of freedom. Even for a panel of 18 countries, an 11-year sample period with a maximum of 198 observations could be criticized as being too short. Nevertheless, it can give us valuable insight into the cost and benefits of exchange rate stability against the euro and EMU membership of the (South) Eastern and Central European countries by exploring both the time dimension and the country dimension of the panel.

3.1 Sample

Our sample consists of the (South) Eastern and Central European (potential) EU accession countries: the new member states of Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic, and Slovenia; the EU candidate countries of Bulgaria, Croatia, the FYR of Macedonia, Romania, and Turkey; as well as the potential candidate countries of Albania and Bosnia-Herzegovina. Serbia and Montenegro are excluded from the sample due to very limited data availability. Because the macroeconomic data for the cross-country panel are very fragmented prior to 1993, the observation period starts in 1994 and ends in 2004. This choice of the sample period also excludes the turbulent macroeconomic circumstances of the early transformation years.

3.2 Volatility Measures

When the impact of the exchange rate regime on inflation and growth is measured, one of the most important decisions to be made is the underlying definition of exchange rate stability. In practice, exchange rate arrangements can seldom be subdivided into fully pegged or fully flexible regimes; they cover a broad variety of "intermediate" regimes ranging from currency board arrangements as in Bulgaria and Bosnia-Herzegovina to independent floats as in Turkey and Albania. In addition—as stressed by a growing literature that includes those such as Reinhart and Rogoff (2004), Calvo and Reinhart (2002), and McKinnon and Schnabl (2004)—the official announcements of (*de jure*) exchange rate arrangements might differ from *de facto* exchange rate policies.

Official (IMF) classifications of exchange rate arrangements as published in the IMF *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* provide a measure of the commitment by the monetary authorities in favor of specified exchange rate targets. The IMF classifies *de jure* exchange rate arrangements into eight groups with a rising degree of exchange rate flexibility. As shown in Table 1, the official IMF classifications range from exchange rate arrangements without separate legal tender (dollarization or euroization) up to independent floating. These eight classifications are generally subdivided into fixed exchange rate arrangements (1 and 2), intermediate

Table 1. De jure Exchange Rate Arrangements in (South) Eastern and Central Europe

	90	*91*	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*	*00*	*01*	*02*	*03*	*04*
CY	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
CZ	3	3	3	3	3	3	6	7	7	7	7	8	8	8	8
EE	n.a.	n.a.	2	2	2	2	2	2	2	2	2	2	2	2	2
HU	3	3	3	3	3	6	6	6	6	6	6	4	4	4	4
LV	n.a.	n.a.	8	8	3	3	3	3	3	3	3	3	3	3	3
LT	n.a.	n.a.	8	8	2	2	2	2	2	2	2	2	2	2	2
MT	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PL	3	5	5	5	5	6	6	6	6	6	8	8	8	8	8
SI	3	3	3	3	3	3	6	6	7	7	7	7	7	7	7
SK	n.a.	n.a.	7	7	7	7	7	7	7	7	7	7	7	7	7
BU	3	8	8	8	8	8	8	2	2	2	2	2	2	2	2
CR	n.a.	n.a.	n.a.	n.a.	n.a.	7	7	7	7	7	7	7	7	7	7
RO	3	7	7	7	7	7	7	7	7	7	7	6	6	6	6
TR	7	7	7	7	7	7	7	7	7	6	6	8	8	8	8
AL	n.a.	n.a.	8	8	8	8	8	8	8	8	8	8	8	8	8
BH	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3	3	3	2	2	2	2	2	2
MC	n.a.	n.a.	n.a.	n.a.	n.a.	7	7	7	7	3	3	3	3	3	3
SM	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	7	7	7

Source: IMF (various issues): *Annual Report on Exchange Rate Arrangements and Exchange Rate Restrictions*.
Notes: 1 = exchange rate arrangements with no separate legal tender; 2 = currency board arrangements; 3 = other conventional fixed peg arrangements (within a band of at most ±1 %); 4 = pegged exchange rate arrangements within horizontal bands (at least ±1 %); 5 = crawling pegs (with small, preannounced adjustment); 6 = exchange rates with crawling bands; 7 = managed floating with no preannounced path for the exchange rate; 8 = independent floating (market-determined exchange rate and independent monetary policy). n.a. = not available.

exchange rate arrangements (3 to 6), and flexible exchange rate arrangements (7 and 8) (Fischer, 2001:3–4). In our sample of 18 South (Eastern) and Central European countries all official IMF exchange rate arrangements are represented except euroization.[4]

While *de jure* exchange rate classifications emphasize the "signaling effect for expectations," they depend on the country's *ex ante* self-assessment of the exchange rate regime.[5] As a result, they might fail to control for a possible discrepancy between *de jure* and *de facto* regimes. Such a discrepancy often arises from "fear of floating," leading countries to pursue exchange rate stabilization even when they declare their exchange rate regime to be flexible. In this case, exchange rate flexibility will be less than that suggested by official classifications. In this respect, *de facto* measures for exchange rate volatility provide useful information with respect to the impact of exchange rate stability on macroeconomic stability.

The methodologies used to identify *de facto* exchange rate regimes use a combination of several indicators: the observed nominal exchange rate volatility, the percentage changes in foreign reserves, and the absolute changes in nominal interest rates (Calvo and Reinhart, 2002). We focus on observed nominal exchange rate volatility as an indicator for exchange rate stabilization because foreign reserves and interest rate changes as indicators for exchange rate stabilization suffer from several shortcomings. Percentage changes of foreign reserves tend to be biased by the stock of foreign reserves. Given the same absolute change in foreign reserves, countries with a large stock of these reserves exhibit low percentage changes, while countries with a small stock of foreign reserves exhibit high percentage changes.[6]

Interest rate changes may not reflect exchange rate policies because in many emerging markets financial and money markets are highly underdeveloped, fragmented, and isolated from international financial markets by capital controls. For this reason interest rate changes may not reflect market conditions. Nominal exchange rate volatility is chosen instead of real exchange rate volatility because it represents official exchange rate policies which target nominal volatility because (*inter alia*) real volatility is unknown at the day of intervention.[7]

Furthermore, in countries other than those with tight pegs, nominal and real exchange rate volatilities tend to be highly correlated. During the 1990s, the Deutsche mark (DM) and the US dollar competed as anchor currencies in (South) Eastern and Central Europe. Some countries pegged their currencies to the dollar, others to the DM or to currency baskets with a broad variety of (European) currencies. With the introduction of the euro in 1999 and the approaching EU accession of most of the (South) Eastern and Central European countries, the euro has become the dominant anchor currency in the region with an increasing number of countries choosing the euro as a reference currency for foreign exchange intervention (ECB 2005).

To take into account the role of the euro (DM) and the dollar as anchor currencies in the (South) Eastern and Central European countries, we proceed in two steps. First, we calculate a measure for nominal exchange rate volatility against the euro (DM) and the dollar, respectively.[8] The z scores ($z_t = \sqrt{\mu_t^2 + \sigma_t^2}$) as proposed by Ghosh et al. (2003) incorporate both exchange rate fluctuations around a constant level and exchange rate fluctuations around a gradual depreciation path. The parameter μ corresponds to the arithmetic average of month-to-month percentage exchange rate changes of the year t, while σ corresponds to the standard deviation of the month-to-month percentage exchange rate changes of the year t. The z scores are calculated using yearly observations between 1994 and 2004.

Second, to compute a measure of both euro (DM) and dollar pegging in (South) Eastern and Central Europe, we calculate a measure of exchange rate stabilization by averaging the z scores of dollar and euro pegging. This provides us with a rough measure of nominal effective exchange rate stability (NOMEFF) in (South) Eastern and Central Europe. We observe that the Latvian currency basket which was pursued until December, 2004 now achieves a higher degree of exchange rate stabilization than under the two single-currency indicators. The rigid pegs of all Baltic countries maintain the highest z scores for exchange rate stabilization.

3.3 Subperiods

The sample period from 1994 to 2004 covers roughly two different institutional environments for exchange rate stabilization. Up to 1997, in (South) Eastern and Central Europe, exchange rate strategies were quite heterogeneous and did not follow a consistent formal or informal common guideline. While one group of countries—notably, Cyprus, Malta, Croatia, and the Baltic countries—pursued tight pegs to the Deutsche mark, the dollar, or currency baskets, a second group (Bosnia-Herzegovina, Bulgaria, Hungary, the FYR of Macedonia, Poland, Romania, Serbia-Montenegro, Slovenia, and Turkey) experienced persistent depreciations. Albania as well as the Czech and the Slovak republics exhibited considerable exchange rate fluctuations, but without a clear trend.

During 1997–98 the political circumstances for exchange rate policies in (South) Eastern and Central Europe changed in two respects. First, the 1997–98 financial crises in East Asia, South America, and Central and Eastern Europe suggested that the

so-called intermediate exchange rate regimes (Fischer, 2001) could be fragile. Following IMF recommendations, many emerging countries adopted inflation-targeting frameworks. Inflation targeting was officially introduced in the Czech Republic (1998), Poland (1999), Hungary (2001), Slovenia (2002), Romania (2005), and Turkey (2006), which partially coincided with the official shift toward flexible exchange rate arrangements.[9]

Second, in March, 1998, the EU started the official negotiations on EU accession with the Luxembourg group (Estonia, the Czech Republic, Hungary, Poland, and Slovenia), and, in October, 1999, with the Helsinki group (Bulgaria, Latvia, Lithuania, Romania, and the Slovak Republic). The adoption of the *acquis communautaire* by the accession countries incorporated the coordination of macroeconomic policies (art. 103, 1 EC Treaty), the prohibition of central bank loans to the government (art. 104), and the control of government deficits (art. 104c). The approaching EU accession provided an informal framework for macroeconomic stabilization that is unique in the group of emerging markets. Although EU accession did not impose any direct restrictions on the exchange rate strategies, the coordination of macroeconomic policies required low inflation. The gradual depreciations in Bulgaria, Hungary, Poland, and Slovenia abated, or at least slowed down.

Similarly, those of the remaining candidate and potential candidate countries, including the FYR of Macedonia (1998) and Bosnia-Herzegovina (1997), who decided to peg their exchange rates tightly to the euro, have contributed to macroeconomic stabilization starting around 1998. Thus, although macroeconomic stabilization in Turkey and Romania is more recent and inflation and depreciation remains high up to the present in Serbia, 1998 constitutes an important break point for macroeconomic stabilization in most (South) Eastern and Central European countries.

Furthermore, with EU membership anticipated, and due to a high degree of euroization, in the former Yugoslav republics, exchange rate stabilization against the euro gained a more prominent weight for the (South) Eastern and Central European countries. Bosnia-Herzegovina, Bulgaria, and the FYR of Macedonia adopted tight pegs to the DM (later euro) in 1997; and Hungary changed the weight of the euro in its currency basket to 100% in January, 2002. The Lithuanian currency board switched the reference currency from the dollar to the euro in early 2002, and Latvia adopted the euro as the sole exchange rate target in January, 2005. Other (South) Eastern and Central European countries, such as the Czech and the Slovak republics, and Romania, announced the euro would become their official intervention currency.

4. Exchange Rate Regime and Inflation

The predominant view of the relationship between the exchange regime and inflation is that pegged exchange rates contribute to lower and more stable inflation. For (developing and emerging) countries with (comparatively) weak institutional frameworks, pegged exchange rates provide an important tool to control inflation via both a commitment toward exchange rate stability and a disciplining effect on monetary growth (Crockett and Goldstein, 1976). For small, open economies, pegging the nominal exchange rate helps minimize fluctuations of the domestic price level and thereby contributes to macroeconomic stability (McKinnon, 1963).

In contrast, in countries with strong institutional frameworks (based on central bank independence and developed money markets), low inflation can be achieved without any specific commitment to an explicit exchange rate target (Calvo and Mishkin, 2003). Recently, inflation-targeting frameworks have become a widely used tool to achieve price stability in both industrial countries and emerging markets. In large (closed)

economies, inflation targets—which imply freely floating exchange rates—will not affect the volatility of inflation, because the fraction of traded goods on the aggregate price level is comparatively small. In contrast, in smaller (more open) economies, exchange rate fluctuations might impair price stability, and therefore (informal) exchange stabilization might persist.

To provide first evidence on the impact of exchange rate volatility on inflation, the countries are ranked according to their z score for monthly exchange rate stability against both euro (DM) and dollar. Averages are calculated for a group with (relatively) fixed exchange rates (group 1) and for a group with (relatively) flexible exchange rates (group 2) for the two subperiods 1994–97 and 1998–2004.

At first glance, for 1994–97, inflation in the pegged exchange rate group is considerably lower than in the more flexible group for both consumer and wholesale prices. But if the high-inflation countries Romania, Bulgaria, and Turkey are removed from the sample, this distinction gets weaker. Similarly, for the second subperiod, there is less clear indication that stable exchange rates contribute to lower inflation if the outliers Romania, Turkey, and Serbia-Montenegro are removed from the sample.

Given the complex interdependence among all macroeconomic aggregates, such as prices, money, interest rates, and real growth, this finding is not surprising. Fixed exchange rates might contribute to price stability, but other determinants of inflation —such as the dismantling of price controls in the transition economies—might compensate for this effect.

4.1 Model Specification

To identify the effect of exchange rate policies and inflation targeting on the level of inflation, we specify a cross-country panel model for the period 1994–2004. The basic framework for the analysis is a monetary model of inflation, in which inflation is determined by the growth rates of money (*MON*) and output (*GDP*). We include in this model the indicators for *de jure* exchange rate stability (*PEG* (*de jure* hard peg), *IMD* (*de jure* intermediate regime)) and *de facto* exchange rate stability (*EUVOL*, *NOMEFF* (exchange rate volatility against the euro (DM) and both euro and dollar)) and introduce dummies for inflation targeting (*TARGET*).

Starting from this baseline model, we add control variables that can influence the impact of the exchange rate stability on inflation. These control variables can be subdivided into domestic and external variables. The domestic control variables are central bank independence (*INDEP*), short-term capital inflows as a percentage of *GDP* (*CAPGAP*), and current budget deficits as a percentage of *GDP* (*DEF*). The external control variables are a dummy for the 1998 wave of financial crisis (*CRISIS*), the EMU consumer price inflation[10] (*CPIEMU*), and the EU real growth (*GDPEU*). Control variables that remained insignificant for all estimations and robustness checks were removed to save degrees of freedom.[11] This yields the following specification:

$$y_{it} = \alpha_i + x'_{it}\beta_i + \varepsilon_{it}, \tag{1}$$

where y_{it} is the vector of cross-country inflation rates over the period 1994–2004. The regressors are denoted by x_{it} and include the indicators of exchange rate stability, domestic control variables, and external control variables; ε_{it} is the error term.

A major issue concerning the specification of equation (1) is the possible endogeneity bias. As it stands, equation (1) assumes that the causality runs from the exchange rate regime to the rate of inflation. There is, however, also a potential reverse causality;

that is, countries with low inflation are more likely to adopt pegged exchange rates. Conversely, in countries with high inflation, the probability of adopting fixed exchange rates is low.

We address the endogeneity issue by estimating a General Method of Moments (GMM) model as proposed by Arellano and Bond (1991). This GMM model uses the lags of all endogenous and exogenous variables as instruments. The exchange rate stability indicators, the dummy for inflation targeting, money supply, real growth, and absolute interest rates changes are assumed to be subject to an endogeneity bias. Real EU growth and the dummy for the 1998 crisis[12] are assumed to be exogenous. In addition, we introduce openness,[13] export concentration to the EU15, and volatility of foreign reserves as instrumental variables, which are assumed to be correlated with exchange rate volatility but not with inflation.

4.2 Estimation Results

Following Ghosh et al. (2003:75–106), we first estimate equation (1) based on *de jure* exchange rate classifications. It includes dummies for pegged (*PEG*) and intermediate (*IMD*) exchange rate regimes, with floating regimes as the excluded category. In this specification, negative coefficients of the dummies indicate lower average inflation in comparison with flexible regimes. Positive coefficients indicate higher inflation. In a second and third step, the dummies for *de jure* exchange rate stability are substituted by the *z* scores for *de facto* exchange rate stability. "De Facto I" indicates exchange rate stability against the euro (DM) (*EUVOL*). "De Facto II" indicates exchange rate stability against both the euro (DM) and the dollar, which can be interpreted as a simple measure of (*NOMEFF*). Positive coefficients indicate that pegged exchange rates (lower volatility) are associated with less inflation.

The results are reported in Table 2. For the whole observation period (1994–2004) we find that the coefficient for *de jure* intermediate regimes is highly significant, albeit that this result has to be treated with caution as *de jure* and *de facto* exchange rate regimes may diverge. The dummy for inflation targeting is negative for the *de jure* specification, suggesting that inflation targeting may contribute to lower inflation. Indeed, the inflation targeters of Central and Eastern Europe have allowed for considerable appreciations of their currencies which contributed to lower inflation. The other coefficients have the expected sign. *GDP* growth which is assumed to lead to higher money demand is found to contribute to lower inflation. The coefficient is highly significant. Real growth in the euro area (which contributes to higher demand for imports from the small neighboring countries) contributes to higher inflation (significant at the 1% level). Crisis is associated with deflation very significantly. Money remains insignificant, however.

The results of the estimations based on *de facto* exchange rate variability against the euro (DM) and against an average of the euro and the dollar are presented in the De Facto I and De Facto II areas of Table 2. We find that these two measures of *de facto* exchange rate stability have the expected sign and are significant at the 5% level for the nominal effective exchange rate. Exchange rate stability against the euro (DM) and the dollar seems to contribute to a lower level of inflation. The other coefficients keep the expected signs. Thus, the first step of our estimation suggests that in (South) Eastern and Central Europe exchange rate pegs contributed significantly to lower inflation from 1994 to 2004.

For reasons discussed in the previous section, we check for structural breaks in the estimated equation. The change in the political environment that occurred for most

Table 2. Arellano-Bond Panel Estimation for Inflation—All Countries

17 countries	*De jure*		*De Facto I*		*De Facto II*	
One-period model	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*
CPI (lags)	0.000*	1.85	0.000***	2.61	0.000***	2.73
PEG	(dropped)					
IMD	–0.063***	–4.17				
EUVOL			0.597	1.54		
NOMEFF					0.937**	2.29
TARGET	–0.044**	–2.29	–0.019	–1.07	–0.021	–1.19
GDP	–0.466***	–3.74	–0.461***	–3.30	–0.401***	–2.81
MON	0.005	0.26	0.001	0.06	–0.002	–0.09
GDPEU	1.595***	4.10	1.527***	3.95	1.521***	3.91
CRISIS	–0.163***	–10.84	–0.156***	–10.09	–0.158***	–10.15
C	–0.041***	–4.63	–0.039***	–4.42	–0.039***	–4.40
Observations	127		127		127	
Sargan, AR(2)	0.84	0.87	0.02	0.97	0.04	0.83
Two-periods model	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*
CPI (lags)	0.000*	1.89	0.000*	2.58	0.000***	2.71
PEG 94–97	0.040	1.42				
PEG 98–04	(dropped)					
IMD 94–97	–0.062***	–3.07				
IMD 98–04	–0.055***	–3.43				
EUVOL 94–97			0.975**	2.05		
EUVOL 98–04			0.281	0.62		
NOMEFF 94–97					0.961**	2.06
NOMEFF 98–04					0.909*	1.87
TARGET	–0.046**	–2.36	–0.017	–0.96	–0.021	–1.18
GDP	–0.472***	–3.74	–0.046***	–3.25	–0.402***	–2.79
MON	0.001	0.09	–0.003	–0.16	–0.002	–0.10
GDPEU	1.544***	3.73	1.665***	4.11	1.535***	3.73
CRISIS	–0.150***	–7.58	–0.148***	–8.97	–0.157***	–9.17
C	–0.040***	–4.38	–0.042***	–4.55	–0.040***	–4.28
Observations	127		127		127	
Sargan, AR(2)	1.00	0.91	0.68	0.86	0.65	0.84

Source: IMF: International Financial Statistics.
Notes: Yearly data. Coeff. = coefficient; stat. = statistic; CPI = consumer price index; *PEG* = *de jure* hard peg; *IMD* = *de jure* intermediate regime; *EUVOL* = exchange rate volatility against the euro (DM); *NOMEFF* = exchange rate volatility against euro (DM) and dollar (arithmetic average); *TARGET* = dummy for inflation targeting; *GDP* = growth rate of real GDP; *MON* = money; *GDPEU* = real growth rate of the EU countries; *CRISIS* = dummy for crisis; C = constant; Sargan = Sargan test of over-identifying restrictions (*p* value); AR(2) = Arellano-Bond test that average covariance in residuals of order 2 is zero (*p* value).
* significant at 10%; ** significant at 5%; *** significant at 1%.

countries in the sample around 1998 may cause shifts in the coefficients of the indicators of exchange rate stability. In particular, since 1998, with inflation converging toward the EMU level, the correlation between exchange rate stability and inflation may be less evident.

To control for different impacts of the exchange rate regime on the level of inflation in different time periods, we introduce dummies for the pre–EU accession period (*PERIOD1*) from 1994 to 1997 and the EU accession period from 1998 to 2004 (*PERIOD2*). In the new model the variables of exchange rate stability are multiplied by these two period dummies. For the inflation targeting this distinction is not made because it emerged only during the second subperiod.

The results are reported in the lower panel of Table 2 (two-periods model). We observe that for the *de jure* hard pegs dummies the estimation is not robust; for intermediate regimes there is evidence for lower inflation with the respective caveats. For the *de facto* measures of exchange rate volatility, we observe a structural break. While in the pre-EU accession period the coefficients of exchange rate stability have the right sign and are highly significant, in the second period the level of significance declines substantially and ceases to be statistically significant for the exchange rate stability against the euro.

The explanation for this phenomenon could be related to macroeconomic stabilization and the Balassa-Samuelson effect. If in an environment of high inflation the exchange rate peg serves as an instrument of macroeconomic stabilization, exchange rate stability is clearly correlated with lower inflation. For instance, in the first subperiod the rigid exchange rate pegs in the Baltic countries can be clearly associated with lower inflation in comparison to countries such as Romania, Bulgaria, and Turkey, which allowed for higher inflation and secular depreciations of their currencies and therefore experienced higher exchange rate volatility.

In the second subperiod this distinction is less evident, as most countries in the region achieved low rates of inflation, which were based either on tight exchange rate pegs (e.g. Estonia, Latvia, Lithuania, Bulgaria, Croatia, and Bosnia-Herzegovina) or on exchange rate appreciation (e.g. Albania, Poland, the Czech and Slovak Republics). Assuming that all (South) Eastern and Central European countries are still in the economic catch-up process the Balassa-Samuelson effect (and other effects reinforcing) would imply higher (but controlled) inflation for countries with tight pegs to the euro (De Grauwe and Schnabl, 2005).

In contrast, in countries with more exchange rate flexibility (and inflation targeting frameworks) the Balassa-Samuelson effect would lead to nominal appreciation and thereby lower inflation than in the euro area. Both assumptions find support in our estimations, as the signs for *de jure* hard pegs[14] are positive and for inflation targeting are negative.

We also tested the robustness of our results by eliminating the outliers. As found by Ghosh et al. (2003), the impact of the exchange rate regime on inflation is very significant for high-inflation countries, but for low-inflation countries the evidence is weak. In our sample, during the first subperiod, Bulgaria, Romania, and Turkey, specifically, experienced very high (hyper) inflation that coincided with the fast depreciation of the respective currencies. While in the second subperiod most countries (including Bulgaria) achieved macroeconomic stabilization, in Romania and Turkey considerable inflation and strong depreciations persisted until recently. In such high inflation countries the correlation between inflation and exchange rate volatility is naturally strong.

To control for possible bias caused by the three outliers, we eliminated Bulgaria, Romania, and Turkey from our panel and re-estimated the model. We present the results in Table 3. One of the more striking results is that for the whole period we fail to find a significant effect of exchange rate stability on inflation for both the *de jure* and the *de facto* measures,[15] while the evidence in favor of the Balassa-Samuelson effect

Table 3. Arellano-Bond Panel Estimation for Inflation—Bulgaria, Romania, and Turkey Excluded

14 countries	*De jure*		*De Facto I*		*De Facto II*	
One-period model	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*
CPI (lags)	0.000***	3.07	0.000***	3.24	0.000***	3.30
PEG	(dropped)					
IMD	–0.004	–0.28				
EUVOL			0.276	0.66		
NOMEFF					0.268	0.60
TARGET	–0.038**	–2.36	–0.33**	–2.27	–0.033**	–2.29
GDP	–0.527***	–4.43	–0.498***	–3.28	–0.477***	–3.71
MON	–0.010	–0.59	–0.013	–0.76	–0.018	–1.06
GDPEU	0.735**	2.04	0.758**	2.11	0.714**	2.01
CRISIS	–0.126***	–9.31	–0.130***	–9.53	–0.126***	–9.31
C	–0.020**	–2.40	–0.02**	–2.42	–0.019**	–2.39
Observations	111		111		111	
Sargan, AR(2)	1.00	0.90	0.99	0.82	0.99	0.84
Two-periods model	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*	*Coeff.*	*z stat.*
CPI (lags)	0.000***	3.22	0.000***	3.24	0.000***	3.32
PEG 94–97	0.166***	6.15				
PEG 98–04	(dropped)					
IMD 94–97	0.043**	2.30				
IMD 98–04	–0.002	–0.12				
EUVOL 94–97			0.345	0.78		
EUVOL 98–04			0.075	0.13		
NOMEFF 94–97					0.212	0.47
NOMEFF 98–04					1.155	1.58
TARGET	–0.051***	–3.13	–0.032**	–2.15	–0.365**	–2.48
GDP	–0.625***	–5.15	–0.489***	–3.69	–0.489***	–3.78
MON	–0.019	–1.07	–0.015	–0.83	–0.015	–0.89
GDPEU	0.881**	2.33	0.807**	2.15	0.491	1.27
CRISIS	–0.039*	–1.93	–0.127***	–8.80	–0.132***	–9.28
C	–0.021***	–2.54	–0.021**	–2.45	–0.016*	–1.84
Observations	111		111		111	
Sargan, AR(2)	1.00	0.62	1.00	0.80	1.00	0.97

Source: IMF: International Financial Statistics.
Notes: Sargan = Sargan test of over-identifying restrictions (p value); AR(2) = Arellano-Bond test that average covariance in residuals of order 2 is zero (p value).
* significant at 10%; ** significant at 5%; *** significant at 1%.

(higher inflation for hard pegs and lower inflation for inflation targeting countries) becomes even more robust.

All in all, our findings are in-line with Ghosh et al. (2003). Both from a time and cross-country perspective, comparing high with low inflation periods (country) exchange rate stabilization is associated with lower inflation. Once a moderate level of inflation is achieved, the impact of the exchange rate regime on inflation is weak and insignificant.

5. Exchange Rate Regime and Output Growth

There is an important literature on the effect of the exchange rate regime on economic growth. On the whole, this literature is inconclusive, mainly because there are theoretical channels highlighting a positive effect of exchange rate stability on growth and others that stress the negative repercussions of exchange rate pegs on output expansion.

Proponents of fixed exchange rates have argued that stable exchange rates foster economic growth by promoting macroeconomic stability, in particular in small, open economies. McKinnon and Schnabl (2004) have argued for East Asia that the Asian crisis exchange rate stability against the US dollar contributed to low and stable inflation as well as to sound government finance. The resulting stable expectations in turn promoted investment and long-term growth (the "East Asian miracle").

One can identify two reasons why exchange rate stability promotes higher economic growth. First, the elimination of foreign exchange risk stimulates international trade and thereby the international division of labor. While the evidence for the positive impact of exchange rate stability on trade has remained mixed (IMF, 1984; European Commission, 1990), Frankel and Rose (2002) have found a strong positive impact of irrevocably fixed exchange rates on trade and income in the context of a monetary union.

Second, credible fixed exchange rate regimes create an environment of macroeconomic stability, thereby reducing the risk premium embedded in the real interest rate. The resulting lower long-term interest rates stimulate investment, consumption, and growth (Dornbusch, 2001). Indeed, the Baltic countries, Bulgaria, and Bosnia-Herzegovina regard their tight exchange rate arrangements as crucial for macroeconomic stability and therefore growth in their countries.

In contrast to this view, Meade (1951) and Friedman (1953) argued that under flexible exchange rates, countries can adjust to real shocks more easily. Under fixed exchange rate regimes, real exchange rate adjustments must be carried out through relative price changes, which in a world of price rigidities is slow and costly. This may create an excessive burden on the economy, leading to low economic growth.

Furthermore, the recent experience of currency crises has highlighted the costs of maintaining exchange rate pegs under free capital mobility (Fischer, 2001). Less than fully credible pegs can become victims of speculative attacks and painful recessions when the pegs collapse. Even if the peg can be defended in times of crisis, the costs in terms of rising interest rates are high as experienced in Estonia during the 1998 wave of speculative attacks in Central and Eastern Europe. As a result, flexible exchange rates would constitute a more appropriate regime to avoid crises and to achieve stable long-term growth.

Because economic theory does not allow us to make precise predictions, the question of whether exchange rate stability leads to more or less economic growth is essentially an empirical matter. Not surprisingly, because the theory is inconclusive, empirical studies have also come to different conclusions. Comparing growth in industrial countries during and after the Bretton-Woods System, Mundell (1995) found faster growth in times of exchange rate stability. Bailliu et al. (2003) have argued that intermediate and flexible exchange rates are detrimental for growth. The GLS estimation by Ghosh et al. (2003) yields a weak relationship between the exchange rate regime and growth.

In contrast, the panel estimation by Edwards and Levy-Yeyati (2003) found evidence that countries with more flexible exchange rates grow faster. Eichengreen and Leblang (2003) revealed a strong negative relationship between the exchange rate stability and growth for 12 countries over 120 years. They concluded that the results of such estimations strongly depend on the time period and the sample.

We are interested in the impact of the exchange regime on the growth rates of the (South) Eastern and Central European countries during their transition toward the EU. To get first evidence on the impact of exchange rate stability on growth in these countries, as in section 4, the sample is subdivided into two groups, one with relatively fixed and one with relatively flexible exchange rates. We use the z score of average exchange rate volatility against both euro (DM) and dollar. Both periods (1994–97 and 1998–2004) suggest that (on average) growth is higher in countries with stable exchange rates.

5.1 Model Specification

To provide more evidence of the impact of the exchange rate regime on growth in (South) Eastern and Central Europe, we use a panel data model that explains economic growth by standard variables from the growth literature, to which we add the measures of exchange rate stability.[16] This yields the following regression equation:

$$w_{it} = \gamma_i + v'_{it}\delta_i + \varepsilon_{it} \tag{2}$$

where w_{it} is the vector of yearly real growth rates from 1994 to 2004. The explanatory variable v_{it} consists of the indicators of exchange rate stability and a set of control variables. These control variables are the ratio of investment to *GDP* (*INVGDP*), the growth rate of dollar exports (*EXPGR*), the budget deficit as a percentage of *GDP* (*DEF*), short-term capital inflows as a percentage of *GDP* (*CAPGDP*), and real growth of the EU15. Furthermore, we include dummies for the 1998 crisis and inflation targeting.[17]

5.2 Estimation Results

We use a general least-squares estimation to trace the impact of exchange rate volatility on growth. A fixed effects specification allows us to cope with the heterogeneity of the cross-country sample. The results of estimating the growth equation (2) are reported in Table 4. We find that the *de jure* exchange rate stability variables do not yield any significant effect on economic growth. This contrasts with the results obtained with the *de facto* exchange rate stability variables. The coefficients of the *de facto* exchange rate measures have negative signs and are highly significant at the 1% level. This result holds for the whole period and for the two subperiods, albeit the significance levels declines in the second subperiod. Thus, we cannot reject the hypothesis that exchange rate stability promotes economic growth in the (South) Eastern and Central European countries.

Our findings for the (South) Eastern European countries appear to be stronger than in the all-country sample of Ghosh et al. (2003) and are in contrast to the findings of Edwards and Levy-Yeyati (2003). Our results provide strong evidence in favor of macroeconomic stabilization based on stable exchange rates, which provides a favorable environment for international trade and payment flows. As the coefficients for both exchange rate volatility against the euro and both the euro and the dollar are significant there does not seem to be a specific preference for the euro or the dollar as an anchor currency.

We do not find evidence that inflation targeting contributed to more growth in the (South) Eastern and Central European countries. The other control variables have the expected signs and are statistically significant. On the whole, our main

Table 4. Panel GLS Estimation for Growth—All Countries

17 countries	*De jure*		*De Facto I*		*De Facto II*	
One-period model	*Coeff.*	*t stat.*	*Coeff.*	*t stat.*	*Coeff.*	*t stat.*
C	–0.011	–0.47	0.020	0.99	0.020	1.01
PEG	0.040	1.53				
IMD	0.017	1.39				
EUVOL			–0.182***	–3.84		
NOMEFF					–0.180***	–3.87
INVGDP	0.148*	1.71	0.100	1.23	0.102	1.25
EXPGR	0.064***	3.00	0.057***	2.81	0.056***	2.76
DEF	0.309**	2.52	0.356***	3.49	0.358***	3.52
CAPGDP	–0.28	–0.42	0.001	0.02	–0.002	–0.03
TARGET	–0.001	–0.10	–0.007	–0.58	–0.006	–0.54
CRISIS	–0.021*	–1.68	–0.018	–1.56	–0.019	–1.64
GDPEU	0.0273	0.67	0.253	0.65	0.262	0.68
Observations	137		138		138	
R^2 within	0.28		0.34		0.34	
R^2 between	0.00		0.01		0.01	
R^2 overall	0.08		0.20		0.20	
Two-periods model	*Coeff.*	*t stat.*	*Coeff.*	*t stat.*	*Coeff.*	*t stat.*
C	–0.013	–0.56	0.023	1.09	0.024	1.16
PEG 94–97	0.000	0.01				
PEG 98–04	0.053**	2.08				
IMD 94–97	0.010	0.76				
IMD 98–04	0.018	1.45				
EUVOL 94–97			–0.183***	–3.86		
EUVOL 98–04			–0.328	–1.34		
NOMEFF 94–97					–0.185***	–3.95
NOMEFF 98–04					–0.388	–1.65
INVGDP	0.127	1.53	0.096	1.17	0.098	1.20
EXPGR	0.089***	4.11	0.055***	2.65	0.053**	2.57
DEF	0.242**	2.03	0.346***	3.35	0.346***	3.38
CAPGDP	0.016	0.24	–0.003	–0.05	–0.009	–0.15
TARGET	–0.004	–0.29	–0.005	–0.46	–0.003	–0.28
CRISIS	–0.026**	–2.16	–0.016	–1.29	–0.016	–1.36
GDPEU	0.363	0.92	0.230	0.59	0.247	0.64
Observations	137		138		138	
R^2 within	0.35		0.34		0.34	
R^2 between	0.00		0.02		0.02	
R^2 overall	0.15		0.20		0.21	

Source: IMF, International Financial Statistics.

Notes: Yearly data. White heteroskedasticity-consistent standard errors and covariance. *GLS* = general least–squares; *PEG* = *de jure* hard peg; *IMD* = *de jure* intermediate regime; *EUVOL* = exchange rate volatility against euro (DM); *NOMEFF* = exchange rate volatility against euro (DM) and dollar (arithmetic average); *INVGDP* = ratio of investment to *GDP*; *EXPGR* = growth rate of dollar exports; *DEF* = budget deficit as a percentage of *GDP*; *CAPGDP* = short-term capital inflows as a percentage of *GDP*; *TARGET* = dummy for inflation targeting; *CRISIS* = dummy for crisis; *GDPEU* = real growth rate of the EU countries.

* significant at 10%; ** significant at 5%; *** significant at 1%.

conclusion that exchange rate stability (measured by *de facto* stability) has promoted economic growth in the (South) Eastern and Central European countries is maintained. This conclusion seems to be rather robust.

6. Conclusion

What is the implication of our findings for the new EU member states and for the countries which are working to achieve E(M)U membership? Our estimations of the impact of the exchange rate regime on economic growth suggest that exchange rate fixity does not reduce economic growth in the (South) Eastern and Central European countries. On the contrary, by fixing exchange rates to the euro, the countries at the EMU periphery can reap the benefits of more trade (Frankel and Rose, 2002) and lower interest rates (Dornbusch, 2001). The view that entry into the euro area will constrain the growth potential is not warranted. The evidence also shows that for these small, open economies stabilizing exchange rates has been a source of macroeconomic stability. The Mundell (1973a, 1973b) framework seems to be the right one to use in thinking about the desirability of joining the euro area.

This does not mean that the Mundell (1961) framework has become irrelevant. There are still risks involved for the (South) Eastern and Central European countries when they join the EMU. These risks arise because of the possibility of future large asymmetric shocks. This risk will be particularly strong if labor market flexibility is low. Our results, however, suggest that against these risks there is the high growth potential that the new EMU members are likely to enjoy. All this leads to optimism about the benefits of monetary union for the new member states.

Appendix: Data

Macroeconomic data on exchange rates, consumer price inflation, whole sale price inflation, foreign reserves, monetary base, money, nominal interest rates, dollar exports, foreign reserves, and short-term capital flows are monthly data from IMF International Financial Statistics and World Economic Outlook databases. Real GDP are quarterly data from the same source. Volatilities are computed as yearly standard deviations of month-to-month percentage changes. By calculating yearly standard deviations, we obtain considerably fewer observations than if we relied on quarterly or monthly data, but we avoid possible bias caused by computing moving standard deviations of overlapping monthly or quarterly percentage change rates.

Openness is calculated as the nominal exports divided by the nominal GDP (yearly values). A dummy for inflation targeting (*TARGET*) is computed according to the official statements about the adoption of inflation-targeting frameworks by the respective central banks. The dummy for central bank independence (*INDEP*) is constructed based on the day when the respective central banks became officially independent. An alternative measure of central bank independence is taken from Cukierman et al. (2002). The dummy for the speculative crisis that hit Central and Eastern Europe in the aftermath of the Asian crisis is introduced for the year 1998 for the countries affected by speculative attacks.

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Notes

1. Croatia and Turkey received the status of an EU candidate country in 2004. Albania, Bosnia-Herzegovina, the FYR of Macedonia, and Serbia-Montenegro became potential EU candidate countries by the authority of the EU Presidency at the European Council of Feira in June, 2000.
2. Micco et al. (2003) argue that EMU membership has increased bilateral trade among the present members considerably when compared to trade with the non-EMU countries.
3. For a meta-analysis, see Fidrmuc and Korhonen (2006).
4. Note that within Serbia-Montenegro Kosovo and Montenegro have adopted the euro as their official legal tender. Neither are included in the sample due to very limited data.
5. As *de jure* exchange rate classifications might be closer to an *ex ante* declaration of the exchange rate regime, they may be less vulnerable to the possible endogeneity bias, as discussed below.
6. Nevertheless, percentage changes of foreign reserves tend to be highly negatively correlated with exchange rate volatility against the anchor currency.
7. In addition, nominal and real exchange rate volatility tends to be highly correlated in countries with soft and more flexible exchange rate regimes.
8. We use nominal exchange rate volatility instead of real exchange rate volatility as official exchange rate policies target nominal (and not real) exchange rates.
9. Because in small, open economies the pass-through of exchange rate fluctuations to prices is high, *de facto* exchange rate stabilization persisted (but without any specified target).
10. Alternatively, inflation in the United States.
11. These were central bank independence, short-term capital inflows, budget deficits, and EMU inflation.
12. We interpret the crisis as contagion from other crisis regions in East Asia and Latin America.
13. Openness also includes country size, which can be assumed to correlate with exchange rate stability but not inflation.

14. Official hard pegs arrangements correspond to dollarization (euroization) and currency board arrangements which can be assumed to correspond well with the *de facto* regimes in contrast to other *de jure* regimes.
15. In addition, the estimation process for the *de jure* regimes becomes unstable, dropping the coefficient for pegged regimes.
16. See Ghosh et al. (2003) and Edwards and Levy-Yeyati (2003) for a similar approach.
17. Control variables that represent workers' education are less important for our sample, because they can be assumed to be by and large the same for the observation period and all countries.