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Abstract:
Since the introduction of the euro in January 1999, exchange rate stability at the periphery of the euro area is growing. The paper investigates the impact of exchange rate stability on growth for a sample of 41 mostly small open economies at the EMU periphery. It identifies international trade, international capital flows and macroeconomic stability as important transmission channels from exchange rate stability to more growth. It is argued that fixed exchange rates provide a more stable framework for the adjustment of asset and labour markets of countries in the economic catch-up process thereby accelerating growth. Panel estimations reveal a robust negative relationship between exchange rate volatility and growth for countries in the economic catch-up process with open capital accounts.

Keywords: *Exchange Rate Regimes, Exchange Rate Volatility, Growth, EMU Periphery, International Role of the Euro.*

JEL classification: F43, F31, E42.

Non-Technical Summary

The international role of the euro is growing. An increasing number of private and public agents in the countries at the periphery of the European Monetary Union (EMU) are using the euro as an invoicing, vehicle, banking, pegging, intervention and reserve currency. For the official exchange rate policies the role of the euro has not only increased in the countries associated with the European integration process, but also beyond the EU27, for instance in Russia and East Asia.

The growing role of the euro as an anchor currency for the countries in the EMU periphery poses the question about the pros-and-cons of exchange rate stabilization against the euro. While after the Asian crisis a strong argument has been made in favour of more flexible exchange rates, many countries have de facto continued exchange rate stabilization. In particular, at the EMU periphery exchange rate volatility (against the euro) has steadily decreased. This paper scrutinizes theoretically and empirically the impact of exchange rate stability on economic growth for this region.

Theoretical evidence concerning the impact of exchange rate stability on growth is mixed. The theoretical arguments in favour of flexible exchange rates are mainly of macroeconomic nature, as flexible exchange rates allow for an easier adjustment in response to asymmetric country specific real shocks. From a microeconomic perspective low exchange rate volatility can be associated with lower transaction costs for international trade and capital flows thereby contributing to higher growth. There are also macroeconomic benefits of fixed exchange rates as they contribute to macroeconomic stability and help to avoid "beggar-thy-neighbour" depreciations in highly integrated economic regions.

Furthermore it is argued that for small open countries in the economic catch-up process fixed exchange rates provide a more stable environment for the adjustment of asset and labour markets. Small open economies with flexible exchange rate regimes are argued to have higher risk premiums on interest rates as uncertainty in asset markets is increasing. Based on the Scandinavian model of wage adjustment it is shown that under flexible exchange rates there is additional uncertainty with respect to the wage bargaining process which leads to lower wage increases.

Panel GLS and GMM estimations trace the impact of exchange rate volatility on growth for 41 countries at the EMU periphery from 1994 to 2005. The panel estimations for the overall sample reveal a significant negative impact of exchange rate volatility on growth.

The positive impact of exchange rate stability on growth is particularly strong for Emerging Europe, i.e., the central, eastern and south-eastern European countries, and the countries which belong to the Commonwealth of Independent States. For the industrialized non-EMU countries where capital markets are more developed the negative impact of exchange rate volatility on growth is less pronounced. The non-European countries which border the Mediterranean Sea do not show a significant impact of exchange rate stability on growth. This could be due to the fact that in this region the exchange rate pegs are often supported by tight capital account and interest rate controls.

1. Introduction

The international role of the euro is growing. An increasing number of private and public agents in the countries at the periphery of the European Monetary Union (EMU) are using the euro as an invoicing, vehicle, banking, pegging, intervention and reserve currency (ECB 2006, Kamps 2006). For the official exchange rate policies the role of the euro has not only increased in countries associated with the European integration process, but also beyond the EU27, for instance in Russia (Schnabl 2006a) and (possibly) East Asia (Schnabl 2006b, Kawai 2006).

The growing role of the euro as an anchor currency for the countries in the EMU periphery poses the question about the pros-and-cons of exchange rate stabilization against the euro. With the 1997/98 Asian crisis, the downsides of (softly) fixed exchange rates which are suspected to encourage speculative capital inflows, moral hazard, and overinvestment have become visible (Fischer 2001). Proponents of flexible exchange rates have also emphasized the need for macroeconomic flexibility in the face of real asymmetric shocks. In contrast, proponents of fixed exchange rates have stressed the (microeconomic) benefits of low transaction costs for international trade (Frankel and Rose 2002) as well as the impact of trade integration on the probability of asymmetric economic developments (Frankel and Rose 1998).

While asymmetric shocks and trade integration have remained the most important criteria in the academic discussion about the pros-and-cons of (irrevocably) fixed exchange rates, we will argue that also capital markets and macroeconomic stability matter. For countries in the economic catch-up process where capital markets remain underdeveloped and macroeconomic instability tends to be high, fixed exchange rates are an important anchor for macroeconomic policies and private expectations. In particular they provide an important anchor for the adjustment of asset and labour markets.

Previous research on the impact of exchange stability on growth has tended to find weak evidence in favour of a positive impact of exchange rate stability on growth. For large country samples such as by Ghosh, Gulde and Wolf (2003) there is weak evidence that exchange rate stability affects growth in a positive or negative way. The panel estimations for more than 180 countries by Edwards and Levy-Yeyati (2003) find evidence that countries with more flexible exchange rates grow faster. Eichengreen and Leblang (2003) reveal a strong negative relationship between ex-

change rate stability and growth for 12 countries over a period of 120 years. They conclude that the results of such estimations strongly depend on the time period and the sample.

While many previous studies have chosen very large samples to the increase the robustness of the estimation process the question is approached from a different angle. We test for the impact of the exchange rate stability on growth for the EMU periphery, i.e. a smaller region where an increasing number of emerging market economies in the economic catch-up process has dismantled capital controls. As capital controls can be regarded as an important impediment to growth - as they disconnect domestic capital markets from the liquid global capital markets - we can test for the impact of exchange rate stability on growth under the condition of free capital movements.

Building upon De Grauwe and Schnabl (2005a), we perform GLS and GMM panel estimations for 41 countries in the EMU periphery. The results provide evidence in favour of a robust negative relationship between exchange rate volatility and growth.

2. Empirical and Theoretical Evidence

At the borders of the euro area exchange rate stability is growing. An increasing number of countries peg their exchange rates (more) tightly to the euro. Compared to the mid 1990s exchange volatility of the countries bordering the euro area has decreased considerably. The role of the euro as an anchor currency is growing steadily at the cost of the US dollar. While in central, eastern, and south-eastern Europe the growing exchange rate stability against the euro can be associated with the EU enlargement process, also beyond the (potential) EU candidate countries inter alia Norway, Morocco, Tunisia, and Russia are stabilizing their exchange rates against the euro.

Figure 1 compares the standard deviations of the monthly percent exchange rate changes of 41 EMU periphery currencies against the euro[1] in the years 1994 to 2006 with the standard deviations of the nine East Asian currencies against the US dollar (unweighted averages). East Asia is used as a benchmark because exchange rate stability against the US dollar has been – except for the Asian crisis – regarded as exceptionally tight (McKinnon and Schnabl 2004a).

In the mid 1990s, exchange volatility against the German mark in the EMU periphery has been considerably higher than East Asian exchange rate volatility against the US dollar. Yet, around

[1] The German mark represents the euro before January 1999.

1996 exchange volatility against the German mark declined considerably and remained by and large constant until the year 2001, significantly above the East Asian level against the dollar (except for the Asian crisis period). Since then, exchange rate volatility at the EMU periphery is steadily declining approaching the East Asian level.[2] In short, Europe and its periphery are moving towards an unprecedented degree of intra-regional exchange rate stability.

Figure 2 shows the different degrees of exchange rate volatility for several sub-groups of countries both against the euro and the dollar (unweighted averages). The upper left panel depicts exchange rate volatility for the whole EMU periphery sample. For the period up to the year 2004, exchange rate volatility against the euro (German mark) and against the dollar is similar. Since then, exchange rate stability against the euro is significantly less. The trend is pointing further downwards.

The sub-samples[3] show different developments depending on the country group. Emerging Europe, i.e. the central, eastern and south-eastern European countries experienced very high exchange rate volatility before 1997. Since then it has declined considerably, significantly more against the euro than against the dollar. In non-EMU industrialized Europe (Denmark, Iceland, Norway, Sweden, Switzerland, and UK) the exchange rate volatility has been significantly lower against the euro than against the dollar and widely unchanged since the mid 1990s. In contrast, in the CIS and the Mediterranean countries – like in East Asia – exchange rate stabilization against the dollar persists.

The increasing degree of exchange rate stability in the region poses the question of what are the motivations to stabilize exchange rates in general and to the peg to the euro in specific. This paper focuses on the effects of the exchange rate regime on economic growth which can be seen as a comprehensive measure of the benefits of exchange rate stabilization. The following section surveys the role of asymmetric shocks, international trade and international capital markets as the most important transmission channels from stable exchange rates to more growth.

2.1 Asymmetric shocks

Flexible exchange rates have been regarded as an important tool to cope with asymmetric (real) shocks (Meade 1951, Friedman 1953). The reason is that under fixed exchange rate regimes real

[2] Note that exchange rate volatility against the euro in the EMU periphery sample is biased upwards by countries which maintain tight exchange rate stability against the dollar such as Jordan, Egypt or Lebanon.

[3] The composition of the respective sub-samples is shown in Table 1.

exchange rate adjustments must be carried out through relative price and productivity changes which in a world of price and wage rigidities are slow and costly. The outcome is a lower growth performance.

Mundell's (1961) seminal paper on optimum currency areas extended the argument to a monetary union. Interpreting monetary and exchange rate policies as Keynesian instruments of adjustment, Mundell (1961) argued that shock absorption within a heterogeneous group of countries is easier if monetary and exchange rate policies remain independent. In particular for countries with rigid labour markets and low international labour mobility, monetary autonomy was regarded as important. Today, Mundell's (1961) OCA framework remains the most important theoretical tool to analyse the pro-and-cons of EMU enlargement (Fidrmuc and Korhonen 2006).

In contrast, McKinnon (1963) emphasized the benefits of fixed exchange rate regimes for small open economies in the face of nominal shocks. Assuming that for small open economies the international price level is given and traded goods make up a high share of the domestically consumed goods, exchange rate stability ensures domestic price stability. The welfare effect of stable exchange rates originates in macroeconomic stability which provides a favourable environment for investment and consumption. From this perspective, as acknowledged by Mundell (1973a, 1973b) in later works, monetary and exchange rate policies are regarded as a source of uncertainty and volatility in small open economies. Growth is enhanced when exchange rate fluctuations are smoothed.

2.2 International Trade

Building upon Ricardo, the welfare gains from the international partition of labour are widely acknowledged. The economic policy implication is to remove exchange rate volatility to foster trade and growth.

The impact of exchange rate volatility on trade among two or a group of countries has both a micro- and macroeconomic dimension. From a microeconomic perspective exchange rate volatility – for instance measured as day-to-day or week-to-week exchange rate fluctuations – is associated with higher transactions costs because uncertainty is high and hedging foreign exchange risk is

costly. Indirectly, fixed exchange rates enhance international price transparency as consumers can compare prices in different countries more easily. If exchange rate volatility is eliminated, international arbitrage enhances efficiency, productivity and welfare. These microeconomic benefits of exchange rate stabilization have been a detrimental motivation of the European (monetary) integration process (European Commission 1990).

The macroeconomic dimension arises from the fact that long-term exchange rate fluctuations – for instance measured as monthly or yearly changes of the exchange rate level – affect the competitiveness of domestic export and import competing industries. In specific in small open economies the growth performance is strongly influenced by long-term fluctuations of the exchange rate level. Even large, comparatively closed economies such as the euro area and Japan are sensitive to large exchange rate swings, in particular in the case of appreciation. McKinnon and Ohno (1997) show for Japan that since the early 1970s when the yen became flexible against the dollar growth has been strongly influenced by the appreciation of the Japanese currency.

McKinnon and Schnabl (2003) argue for the small open East Asian economies, that the fluctuations of the Japanese yen against the US dollar strongly affected the growth performance of the whole region. They identify trade with Japan and competition in third markets (US) as crucial transmission channels. Before 1995 the appreciation of the Japanese yen against the dollar enhanced the competitiveness of the smaller East Asian economies who kept their exchange rate pegged to the dollar. Economic growth in the region accelerated. The strong deprecation of the yen against the dollar from 1995 into 1997 slowed down growth, contributing to the 1997/98 Asian crisis.

Although the short-term and long-term swings of exchange rates can strongly affect the growth performance of open economies through the trade channel the empirical evidence in favour of a systematic positive (or negative) effect of exchange rate stability on trade (and thereby growth) has remained mixed (IMF 1984, European Commission 1990). Bacchetta and van Wincoop (2000) find based on a general equilibrium framework that exchange rate stability is not necessarily associated with more trade. Gravity models have been used as frameworks to quantify the impact of exchange rate stability on trade and growth, in particular in the context of a monetary union. While the size of the coefficient by Frankel and Rose (2002) seems to exaggerate the trade effects of a monetary union, Micco, Stein and Ordoñez (2003) find that in its early years the European Monetary Union has increased intra-EMU trade by up to 16%.

2.3 Capital Markets

Capital markets have played an increasing role in the discussion about exchange rate stabilization and growth (McKinnon and Schnabl 2004a, De Grauwe and Schnabl 2005a, Aghion et al. 2006). The impact on economic growth has both a short-term (microeconomic) and a long-term (macroeconomic) perspective.

From a short-term perspective, fixed exchange rates can foster economic growth by a more efficient international allocation of capital when transaction costs for capital flows are removed (McKinnon 1973). If international capital market segmentations are dismantled debtors in high yield emerging market economies benefit from a substantial decline in interest rates due to investment from low yield developed capital markets (Dornbusch 2001). The authorities in the emerging market debtor countries have an incentive to maintain these capital inflows by providing an efficient financial supervision.

From a more long-term perspective, fluctuations in the exchange rate level constitute a risk for growth in emerging markets economies as they affect the balance sheets of banks and enterprises where foreign debt tends to be denominated in foreign currency (Eichengreen and Hausmann 1999).[4] Sharp depreciations inflate the liabilities in terms of domestic currency thereby increasing the probability of default and crisis. In debtor countries with highly euroized (dollarized) financial sectors, the incentive to avoid sharp exchange rate fluctuations is even stronger (Chmelarova and Schnabl 2006). Maintaining the exchange rate at a constant level, in particular preventing sharp depreciations, is equivalent to maintaining growth (McKinnon and Schnabl 2004a).

Although, fixed exchange rates can support growth in small open economies by encouraging international capital inflows, excessive capital inflows into countries with shallow capital markets can contribute to excess volatility (Fratzscher and Bussiere 2004). Fast credit growth, asset price bubbles and overinvestment may emerge which can cumulate in a fast reversal of international capital flows and sharp depreciations. The short-term gains in economic growth are eroded by crisis and recession leaving the long-term growth effect of fixed exchange rate regimes indeterminate. From this perspective, flexible exchange rates are seen as the appropriate policy choice to

[4] The impact of exchange rate fluctuations in the case of asset dollarization is explored by McKinnon and Schnabl (2004b).

avoid boom-and-bust cycles and to achieve a steadier and higher long-term growth performance (Fischer 2001).

If more exchange rate flexibility will indeed lead to less speculative capital inflows may hinge on exchange rate expectations. If the exchange rate follows a random walk, exchange rate flexibility is likely to discourage speculation. If, however, like in emerging market economies in the economic catch-up process, the exchange rate follows a predictable appreciation path (as shown in section 3), flexible exchange rates can encourage one way bets on the appreciation of the emerging market currency. The consequence would be more instead of less speculative capital inflows and increased volatility.

3. Adjustment on the Real Appreciation Path

As shown above, the theoretical evidence on the impact of the exchange rate stability on economic growth remains mixed. While the academic research has focused on asymmetric shocks and the impact of fixed exchange rates on trade, here we focus on the impact of exchange rate uncertainty on the adjustment of labour and asset markets in countries in the economic catch-up process.

Building upon Balassa (1964) and Samuelson (1964) the industrial catch-up (of emerging market economies) leads to two (alternative) economic policy outcomes (De Grauwe and Schnabl 2005b). (1) If exchange rates are fixed, the relative productivity gains drive up wages and prices. (2) Under a flexible exchange rate regime (and inflation targeting)[5] the relative productivity gains lead to nominal appreciation. Although both monetary frameworks can be seen as equal policy choices to engineer the real appreciation which is the natural outcome of the industrial catch-up, exchange rate flexibility and sustained appreciation expectations may increase uncertainty in labour and asset markets.

3.1. Adjustment of Labour Markets

Traditional models of international adjustment as by Meade (1951), Friedman (1953) and Mundell (1961) interpret flexible exchange rates as a substitute for wage flexibility in the face of ex-

[5] It is assumed that the inflation target is close to the level of inflation in the anchor country.

ogenous shocks.[6] In contrast, the Scandinavian model of wage adjustment (Linbeck 1979) suggests that the fixed exchange rates provide a stable, growth enhancing framework for the wage bargaining process. Lindbeck's (1979) dynamic extension of the Balassa-Samuelson model is based on the assumption that the relative purchasing power parity holds for tradable goods. Arbitrage in the international tradable goods markets is assumed to ensure price convergence in the tradable sectors of two countries: Domestic price inflation in tradables ($\hat{p}_T^D$) is equal to the world (dollar) rate of inflation ($\hat{p}_T^W$) plus the rate of depreciation $\hat{e}$.

$$\hat{p}_T^D = \hat{p}_T^W + \hat{e} \tag{1}$$

The wage bargaining process under a fixed exchange rate regime is initiated in the (industrial) tradable goods sector, where labour productivity tends to grow faster than in the non-tradables (service) sector. The trade unions in the "unsheltered" tradables sector capture the productivity gains $\hat{q}_T^A$ plus eventual price increases of tradable goods $\hat{p}_T^D$ by nominal wage increases $\hat{w}_T^D$:

$$\hat{w}_T^D = \hat{p}_T^D + \hat{q}_T^D \tag{2}$$

In small open economies the wage bargaining process in the manufacturing sector is constrained by the fixed exchange rate. If unions bargain for a nominal wage larger than $\hat{w}_T^D$ in equation (2), manufacturing goods are rendered uncompetitive in world markets with a respective rise in unemployment.

Like in the Balassa-Samuelson-framework labour "solidarity" and labour mobility across domestic sectors transmit the manufacturing wage increases ($\hat{w}_T^D$) to wage increases in the non-tradable sectors ($\hat{w}_{NT}^D$) implying $\hat{w}_{NT}^D = \hat{w}_T^D$. Because the non-tradable sectors are widely shielded from world markets, prices ($\hat{p}_{NT}^D$) are not constrained by international competition but driven by wage increases ($\hat{w}_{NT}^D$) minus the productivity gains in the non-traded goods sector ($\hat{q}_{NT}^D$). Productivity increases in the non-tradable (service) sector are assumed to be smaller than in the manufacturing sector.

6 Given rigid wages a negative (positive) domestic productivity shock is offset by currency depreciation (appreciation). Real wages are reduced (increased) by higher (lower) domestic prices of tradable goods.

$$\hat{p}_{NT}^{D} = \hat{w}_{NT}^{D} - \hat{q}_{NT}^{D} \text{ with } \hat{q}_{NT}^{D} < \hat{q}_{T}^{D} \quad (3)$$

The wage bargaining and price adjustment process in the traded and non-traded goods sectors determine overall inflation ($\hat{p}^{D}$) which is defined as a composite of traded goods price inflation and non-traded goods price inflation given the respective weights α and (1-α):

$$\hat{p}^{D} = \alpha\hat{p}_{T}^{D} + (1-\alpha)\hat{p}_{NT}^{D} \quad (4)$$

Equations (1), (2), (3) and (4) yield equation (5) which is a measure for supply driven inflation:

$$\hat{p}^{D} = (\hat{p}_{T}^{W} + \hat{e}) + (1-\alpha)(\hat{q}_{T}^{D} - \hat{q}_{NT}^{D}) \quad (5)$$

The term $\hat{p}_{T}^{W} + \hat{e}$ captures imported inflation which driven by rising traded goods world market prices and the depreciation (appreciation) of the domestic currency (exchange rate induced inflation (deflation)). The term $\hat{q}_{T}^{D} - \hat{q}_{NT}^{D}$ is equivalent to the structural component of overall inflation (Balassa-Samuelson-effekt). Productivity gains in the traded goods sector – which are both higher than in the non-traded goods sector and higher than abroad – are transmitted via the wage bargaining process into inflation.

The upshot is that under fixed exchange rates the bidding of trade unions for higher wages is constrained by the fixed exchange rate. Trade unions reap the full benefits of productivity gains and equilibrate the international competitiveness of the domestic manufacturing industry. But they do not bit for wage increases above the domestic productivity gains as this would damage the country's international competitiveness.[7]

The fixed exchange rate regime provides a stable, welfare enhancing framework for wage adjustment during the economic catch-up process for the following reason. Based on the simplifying assumption that productivity and prices are constant in the anchor country, the wage bargaining process is determined by the expected domestic productivity increases and the expected exchange rate change as in equation (6). The term ψ captures the exchange rate uncertainty which is as-

[7] This assumption is debatable in the short-run. Mighty labor unions may by able to bid for wages above the productivity gains. Yet such wage hikes may further increase the uncertainty concerning the future growth performance of the respective economy and therefore the risk premium. In the longer-run the wage increases above the productivity increases would not be sustainable.

sumed to be a positive function of exchange rate volatility. The term E is the expectation operator.

$$\hat{w}^D = E(q_T^D) + E(\hat{e}) + \psi \qquad (6)$$

In countries with credibly fixed exchange rates as for instance Bulgaria and Estonia the term $E(\hat{e})+\psi$ is equal (or close) to zero. Trade unions and enterprises solely have to predict the future productivity gains which tend to be less volatile than exchange rate changes.

If the exchange rate is allowed to float – for instance like currently in Poland – the currency tends to appreciate because of the Balassa-Samuelson-effect ($\hat{e}<0$). In addition, the exchange rate uncertainty implies a negative risk premium on wages ($\psi < 0$), because workers (and enterprises) have to predict both future productivity growth and exchange rate movements. Enterprises would be less eager to increase wages due to higher uncertainty with respect to future export earnings. With ψ taking a negative value wage growth is smaller when exchange rates fluctuate. An expected appreciation of the domestic currency makes enterprises even more reluctant to commit to wage increases as export revenues may decline. In average real wage increases will tend to be less than under fixed exchange rate regimes.[8]

3.2. Adjustment of Asset Markets

In a world of perfect capital mobility and perfect foresight the open interest rate parity holds. The domestic interest rate i^D is equal to the foreign interest rate i^W under consideration of the expected exchange rate change. In a two-country-model which comprises a large country with highly developed capital markets and a small country with underdeveloped capital markets the interest rate of the large country (world interest rate) i^W can be regarded as given. The interest rate of the small country i^D adjusts endogenously given the exchange rate expectations $E(\hat{e})$. In addition it is assumed that a risk premium φ exists which represents the uncertainty associated with the future exchange rate path:[9]

$$i^D = i^W + E(\hat{e}) + \varphi \qquad (7)$$

8 McKinnon and Schnabl (2006) show for Japan, that when country moved from fixed to flexible exchange rates in the early 1970s, wage increases substantially declined.

9 For simplification the country risk is assumed zero.

The risk premium φ of countries with a (sustained) current account deficit can be assumed to be positive because a rising stock of (mostly short-term) foreign currency denominated debt represents an inherent depreciation threat. Foreign creditors see investment in the emerging market riskier than investment in their domestic economy. They ask for a risk premium φ which reflects all kind of uncertainty associated with international borrowing. The risk premium φ is positively correlated with the volatility of the exchange rate and the size of the foreign liabilities.

Suppose the exchange rate is credibly pegged to the euro as it is the case for the Estonian krona. Then both $E(\hat{e})$ and φ are (close to) zero and short-term (money market) interest rates in Estonia converge towards the euro area level. By contrast – if as in the case of Poland or the Czech Republic – the exchange rate is widely allowed to float, then a positive premium φ may exist. For portfolio equilibrium, the interest rate on Polish or Czech assets must be higher than on euro assets by $|E(\hat{e}) + \varphi|$. The term $|E(\hat{e}) + \varphi|$ reflects the size of any expected exchange rate change, the probability that it will occur and how distant is the event.

The sign of the term $|E(\hat{e}) + \varphi|$ is indeterminate, if (in the long-term) a (productivity driven) appreciation of emerging market currency is expected ($E(\hat{e})<0$) and the risk premium ($\varphi>0$) is positive. If, for any reason, a temporary depreciation of the emerging market currency is expected, the term $|E(\hat{e}) + \varphi|$ is clearly positive. Figure 3 shows an attempt to approximate the average risk premium φ for the new EU member states[10] for the years 2001 to 2005. The approximation is based on the assumption that deviations from the open interest rate parity are a proxy for the risk associated with exchange rate instability.[11] The (ex post) risk premium φ is defined as the interest rate differential versus the euro area (per annum) minus the exchange rate change over the previous year.

Figure 3 suggests a correlation between the exchange rate volatility and the risk premium φ both based on short-term and long-term interest rates. The countries are ranked depending on their exchange rate variability – measured in standard deviations – against the euro (or the respective announced currency basket as in the case of Latvia before 2004). On the left hand side there are

[10] The new EU member states provide a good case study as capital controls which are another important reason for interest rate differentials were widely dismantled.

[11] The country and default risk (which tends to be positively correlated with exchange rate volatility) is assumed to be zero.

the countries with tight pegs (mostly) to the euro. The Baltic countries and Bulgaria pursue the most rigid exchange rate regimes. The countries with comparatively flexible exchange rates are listed on the right hand side.

Between 2001 and 2005 Hungary, Romania, the Czech Republic, the Slovak Republic, and Poland have exhibited the highest degree of exchange rate variability. If short-term interest rates are used for the calculation, the risk premiums seem high. In contrast, for the countries with tight pegs (to the euro) interest rates have converged towards the euro area level. The risk premiums seem very small. If alternatively long-term interest rates are used for the calculation (lower panel of Figure 3), the difference between the countries with low and high exchange rate variability is less, but still substantial. More exchange rate flexibility is associated with higher risk which implies a negative impact of exchange rate volatility on growth.

4. Empirical Investigation

In the section 2 and 3 we have argued that from a theoretical point of view, exchange rate volatility (flexibility) may affect growth positively or negatively. To this end the impact of exchange rate volatility on growth remains an empirical matter that is scrutinized in the following section for the EMU periphery for the time period from 1994 to 2005. The transmission channels which were identified in section 2 and section 3 are represented in the control variables of the following investigation.

4.1. Sample, Observation Period, and Volatility Measures

To identify the effect of exchange rate volatility on growth, we specify a fragmented cross-country panel model for 41 EMU periphery countries (Table 1 provides an overview). Compared to De Grauwe and Schnabl (2005a) we use a substantially larger country sample of 41 countries which can be subdivided into four sub-groups. First, we include 17 central, eastern and south-eastern European countries which have already joined the European Union or are associated with the EU enlargement process as candidate or potential candidate countries. Serbia and Montenegro are excluded because of insufficient data. Most central, eastern and south-eastern European countries have redirected their exchange rate policies towards the euro.

Second, we include six non-euro area industrialized economies, which (partially) tend to stabilize their exchange rate against the euro, namely the UK, Iceland, Norway, Denmark, Sweden and

Switzerland. Also this second group exhibits tighter exchange rate stability against the euro than against the dollar (Figure 2). Third, we include 10 CIS countries, which have traditionally been stabilizing exchange rates against the US dollar. Tajikistan, Turkmenistan and Uzbekistan are excluded due to insufficient data. Finally, the sample comprises nine Mediterranean countries which maintain close economic linkages with the European Union, i.e. Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Syria, Morocco, and Tunisia. The Mediterranean countries have traditionally pursued (tight) exchange rate stability against the dollar, but some countries such as Morocco, Tunisia and Libya are using the euro as an anchor in currency baskets.

The data sources are IMF International Financial Statistics, IMF World Economic Outlook and the national central banks. We use yearly data, as for some countries data are only available on a yearly basis. The volatility measures are calculated as yearly averages of monthly percent exchange rate changes. The sample period starts in 1994, as a substantial part of the sample consists of (former) transition economies and therefore the data are unstable and very fragmented before 1994. The time period is up to the present (2005).

To test for the impact of the exchange rate regimes on economic growth, we use de facto volatility measures, because de jure volatility measures have proved to be flawed by "*fear of floating*" (Calvo and Reinhart 2002, McKinnon and Schnabl 2004a, De Grauwe and Schnabl 2005a). Exchange rate volatility can be measured in four ways. First, oscillations around a constant level as measured by the standard deviation of percent exchange rate changes (σ) can be seen as a proxy for uncertainty and transactions costs for international trade and short-term capital flows.

Second, the arithmetic average of percent exchange rate changes (μ) can be seen as a measure for changes in the exchange rate level, i.e. for "beggar-thy-neighbour" depreciations (positive sign) or a sustained appreciation pressure (negative sign) for the respective economy. Both measures are summarized by the z-score ($z_t = \sqrt{\mu_t^2 + \sigma_t^2}$) as proposed by Ghosh, Gulde and Wolf (2003). Fourth, sustained appreciation or depreciation can be captured by the yearly relative exchange rate change (τ) comparing January with December. Appreciations would exhibit a negative sign, depreciations a positive sign.

All four volatility measures are calculated against the euro and the dollar. Following Danne (2006) we compute a minimum measure for exchange rate volatility which includes the smaller volatility either against the euro or the dollar.

4.2. Model Specification and Estimation Framework

We use a cross-country panel data model that explains economic growth by exchange rate volatility and a set of control variables:[12]

$$w_{it} = \gamma_i + v'_{it}\,\delta_i + \varepsilon_{it}\ , \qquad (3)$$

where w_{it} is the vector of yearly real growth rates from 1994 to 2005. The explanatory variable v_{it} consists of the indicators of exchange rate volatility (σ, μ, z, τ) and the control variables.

Standard deviations of monthly exchange rate changes (σ) and January over December percent exchange rate changes (τ) measure exchange rate volatility. Alternatively, the z-score as a comprehensive measure of both is used.[13] As discussed in section 2 there are three main transmission channels from exchange rate stability to growth: interest rates (as influenced by the international assets market equilibrium), trade and macroeconomic stability (as influenced by the wage bargaining process). All three measures are highly correlated with the exchange rate regime. Exchange rate stability is expected to be linked with lower interest rates, more trade and lower inflation. We use short-term money market interest rates as a proxy for the interest rate channel.[14] Yearly percent changes of exports in terms of US dollar are used as a proxy for the trade channel. Yearly CPI inflation is used as a proxy for macroeconomic stability.

We also include a dummy for crisis in emerging markets such as for the 1997/98 Asian crisis and the 1998 Russian crisis as well as a dummy for inflation targeting regimes which are associated with exchange rate flexibility.

There are a large number of other macroeconomic variables which affect growth and therefore may be considered as control variables such as investment, consumption and government spending (divided by GDP). Including these variables into the specification increases the fit of the model, but also decreases the degrees of freedom. For this reason the model is restricted to the volatility measures and the transmission channels as specified above.

[12] See Ghosh, Gulde, and Wolf (2003) and Edwards and Levy-Yeyati (2003) for similar approaches.

[13] Yearly percent exchange rate changes are assumed to be strongly correlated with the means of monthly percent exchange rate changes.

As estimation frameworks we use both a generalized least square fixed effect model[15] and a dynamic panel estimation model We use a GLS model as baseline framework because the concern with the respect to endogeneity between exchange rate volatility and growth is low. Basically, there is no evidence that fast (slowly) growing countries are more prone to adopt either a fixed or a flexible exchange rate regime. In contrast to dynamic models the GLS framework provides information with respect to the fit of the model, in particular with respect to the cross section and time dimension. In addition, the GLS approach is more robust to a smaller sample size and allows for robustness checks based on sub-groups of the panel.

However, the GLS estimation is likely to suffer from endogeneity bias with the respect to the control variables. For instance, inflation is likely to affect the growth performance and growth is likely to affect inflation. To cope with distortions caused by endogeneity following Aghion et al. (2006) we use a dynamic panel estimations with robust two-step standard errors model as proposed by Arellano and Bond (1991) and Arellano and Bover (1995).[16] In this way we cope with endogeneity linked to the explanatory variables and possible bias due to country specific effects. Country size is used as an instrument variable.

There are variables, for instance the degree of institutional reforms, which affect both exchange rate volatility and growth. We regard inflation as a proxy for institutional reforms, as emerging market economies with a lower level of reforms tend to exhibit higher inflation. The interdependence between institutional reforms, macroeconomic stability, exchange rate stability and growth is further discussed in the conclusion.

4.3. Estimation Results

The estimation results for the whole EMU periphery sample for the period from 1994 to 2005 provide evidence in favor of a negative correlation between exchange rate volatility and growth. The baseline GLS specification for the whole sample with all control variables provides evidence that exchange rate volatility against the euro has a clearly negative impact on growth (Table 2).

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[14] Note that official interest rates might not reflect de facto liquidity conditions in countries with tight capital controls and repressed financial markets such as in some Mediterranean or CIS countries.

[15] Random effect models lead to by and large the same results.

[16] Aghion et al. (2006) transform the data into five year averages to cancel out business cycle fluctuations. For our short sample period this approach would not yield enough observations. In addition, the likelihood is small that exchange rate volatility follows similar cycles like real growth.

Both the standard deviation and the z-score are negative and significant at the 1%-level. The yearly change rate has a positive sign suggesting a negative (positive) impact of appreciation (depreciation) on growth. The proxies for the transmission channels have the expected signs and are all significant at the 1% level.

In particular, the dummy for inflation targeting has a negative sign and is significant suggesting that countries with inflation targeting frameworks experience lower growth.[17] Different specifications show a stable negative relationship between the z-score and growth. Also the negative sign for the standard deviations is robust. In contrast, without controlling for interest rates, export growth and inflation, the coefficient for the yearly exchange rate changes the sign. Now appreciation (depreciation) is significantly associated with higher (lower) growth.

An alternative specification traces the impact of exchange rate volatility on growth for volatility measures which use the lowest volatility either against the euro or the dollar (Min) (Table 3). The minimum volatility measure can be regarded as a more precise proxy for exchange rate volatility in the region as some countries in the EMU periphery peg their exchange rates to the dollar or had pegged their exchange rates to the dollar in the early part of the observation period. The fit of this specification is slightly better than for the previous model. The estimation results are very similar suggesting a robust negative relationship between exchange rate volatility and growth. Inflation targeting frameworks seem to have a clearly negative impact on growth.

To control for possible endogeneity bias we re-estimate the model based on the framework as proposed by Arellano and Bond (1991) and Arellano and Bover (1995). The results are presented in Table 4 and Table 5. The results are mainly in line with the GLS estimations. The z-scores and standard deviations show in most specifications a robust negative relationship between exchange rate volatility and growth at highly significant levels. For the yearly change rates the evidence is mixed depending on the model specification. The transmission channels have the expected signs and are mostly highly significant. These findings apply for both exchange rate stability against the euro and the min-specification.

This suggests that at the EMU periphery exchange rate stability can be associated with higher growth. The role of interest rates, trade and macroeconomic stability as transmission channels is

[17] Lower growth in countries with inflation targeting regimes is in line with findings that inflation targeting is associated with lower output volatility because a lower level of growth is linked to less output volatility.

confirmed. The anchor currency does not seem to matter for the impact of the exchange rate regime on growth.

4.4. Sensitivity Analysis

The results as shown in Table 2 to Table 5 may be driven by certain country groups or certain time periods. To isolate such effects and to check for the robustness of the results we built single country groups and re-estimate the panel. Then, we estimate the panel for two different time sub-periods. Although degrees of freedom are lost by this exercise, more information about the behavior of the overall sample is gained. As the number of observations for every sub-sample declines significantly, stable GMM estimations are only possible for the (largest) Emerging Europe sample. Note that the other sub-samples which are estimated with GLS remain subject to possible endogeneity bias and have to be treated with the respective caution.

Boosted by the European integration process Emerging Europe has become one of the most dynamic regions in the world experiencing substantial capital inflows and high growth. While in most countries of Emerging Europe exchange rates are tightly pegged to the euro, some countries in the region – such as Poland and the Czech Republic – have adopted flexible exchange rates in combination with inflation targeting frameworks. To obtain more information about the impact of exchange rate volatility on growth in this region we re-estimate the panel for this group of countries using the minimum volatility measure. This sub-sample provides evidence about the impact of the exchange rate regime on growth for countries with open capital accounts.

Both the GLS and GMM results (Table 6 and Table 7) are similar to the results of the whole sample. The negative sign for standard deviations and z-scores is very robust and in most specifications highly significant. For the yearly exchange rate changes the evidence in mixed. For two specifications the standard deviations have a positive sign and are insignificant. When the transmission channels are excluded the sign is negative and highly significant. The transmission channels have the expected sign. Inflation targeting turns out to be associated with less growth.

The results are less robust for the GLS estimations of the other country groups. For the non-EMU industrialized European countries there is no systematic effect concerning the impact of the exchange rate volatility on growth. The measures of exchange rate volatility have in most cases the expected signs, but are insignificant. The estimation results for the transmission channels are

mixed. This could be due to three reasons. First, the small sample size. Second the fact that the degree of exchange rate stability has not changed over time and therefore few information can be extracted from the time dimension of the panel.[18] Third, a lower degree of vulnerability to exchange rate fluctuations, because of higher developed capital markets (which allow hedging foreign exchange risk).

As argued by McKinnon and Schnabl (2004a, 2004b) and Chmelarova and Schnabl (2006) and as found by Aghion et al. (2006) countries with underdeveloped capital markets are particularly vulnerable to exchange rate fluctuations, because they lack the instruments to hedge foreign exchange risk (section 2). In specific, depreciations inflate the value of international liabilities in terms of domestic currencies because foreign debt tends to be denominated in international currencies. This implies a strong inclination to smooth exchange rate fluctuations. In contrast, in economies with developed financial markets such as Switzerland and the United Kingdom financial markets provide sufficient instruments to hedge foreign exchange risk. The vulnerability to exchange rate fluctuations is less.

The nine CIS countries are widely in line with Emerging Europe (GLS estimations). The signs of the standard deviations and z-scores are negative and mostly significant at the common levels. The coefficients of the yearly changes are mostly positive indicating that appreciations have a negative impact on growth in the CIS, but the coefficients are not significant at the common levels. Although the Mediterranean countries sample has the expected signs for all volatility measures, all coefficients remain insignificant. This can be due to two reasons: First, the small sample size. Second, the high degree of regulation and financial repression in this group of countries makes it generally difficult to extract valuable information from this sample.

The second set of sensitivity tests subdivides the whole sample into two sub-periods. Before 1998 Emerging Europe and the CIS experienced a rather high degree of macroeconomic instability which was mainly due to domestic macroeconomic instability and international financial crisis in East Asia and Russia. Since 1999, an increasing number of central, eastern and south-eastern European countries started (continued) EU accession negotiations which required an increasing degree of macroeconomic discipline. Furthermore, in the new millennium unprecedented low interest rates in the US (and other large developed economies) led to strong capital inflows into most emerging market economies which contributed to macroeconomic stability.

[18] Compared to the Emerging Europe sample few (more) information is extracted from the time (cross country) dimension.

Splitting the sample into two sub-periods is equivalent to testing for structural breaks due to different macroeconomic environments. In the first sub-sample from 1994-1998 the signs of the standard deviations and the z-score are negative and (mostly) highly significant. This supports the view that exchange rate stability contributes significantly to growth as fixed exchange rates contribute to macroeconomic stability. The results for the yearly exchange rate changes are less robust. The transmission channels have mostly the appropriate signs. In particular, during this period macroeconomic instability (inflation) is clearly associated with less growth.

Also in the second sub-sample the picture remains widely unchanged. The z-score is negative and significant at the one percent level for all specifications. The mean now has clearly a negative sign associating depreciation (appreciation) with less (more) growth. The results for the standard deviations are now insignificant with varying signs. One major difference for this low inflation period is that inflation is positively associated with more growth at significant levels. This implies that once emerging market economics have reached a moderate level of inflation, inflation is less detrimental for growth and positively linked to the business cycle.

5. Conclusion

The paper scrutinizes the impact of exchange rate volatility on economic growth for 41 EMU periphery countries. It is argued that for countries in the economic catch-up process there is a positive impact of exchange rate stability on growth as exchange rate stability contributes to more trade, capital inflows and macroeconomic stability. Furthermore, exchange rate stability is associated with a more stable adjustment process in labour and asset markets.

The panel estimations on the impact of the exchange rate volatility on growth in the EMU periphery provide rather robust evidence that the exchange rate stability is associated with more growth. The evidence is strong for Emerging Europe which has moved from an environment of high macroeconomic instability to macroeconomic stability during the observation period. The central, eastern and south-eastern European countries reap the benefits of intra-European trade, low interest rates as well as macroeconomic stabilization. For the group of industrialized non-EMU European countries where capital markets are more developed the benefits of stable exchange rates

seem weaker. No valuable information can be drawn from the Mediterranean country sample where the financial sectors (and the whole economies) remain strongly repressed.

While the econometric exercise yields rather robust evidence in favor of a positive relationship between exchange rate stability and growth, the interdependence between exchange rate stability, macroeconomic stability, institutional reforms and growth can not be fully disentangled. To maintain a fixed exchange rate, institutional reforms are necessary to ensure a sufficient degree of macroeconomic stability which is necessary to maintain the peg. All three interdependent factors are likely to encourage capital inflows which boost growth in the respective economy. To this end it remains unclear if the positive growth effect should be directly attributed to the exchange rate peg or is achieved via institutional reforms and macroeconomic stability which are necessary to maintain the peg.

Finally, although this investigation suggests fixed exchange rate regimes for countries in the economic catch-up process, the relationship between fixed exchange rates and growth may not be a linear one. As fixed exchange rates encourage capital inflows falling interest rates may encourage asset price bubbles and overinvestment which finally may partially reverse the positive growth effect.

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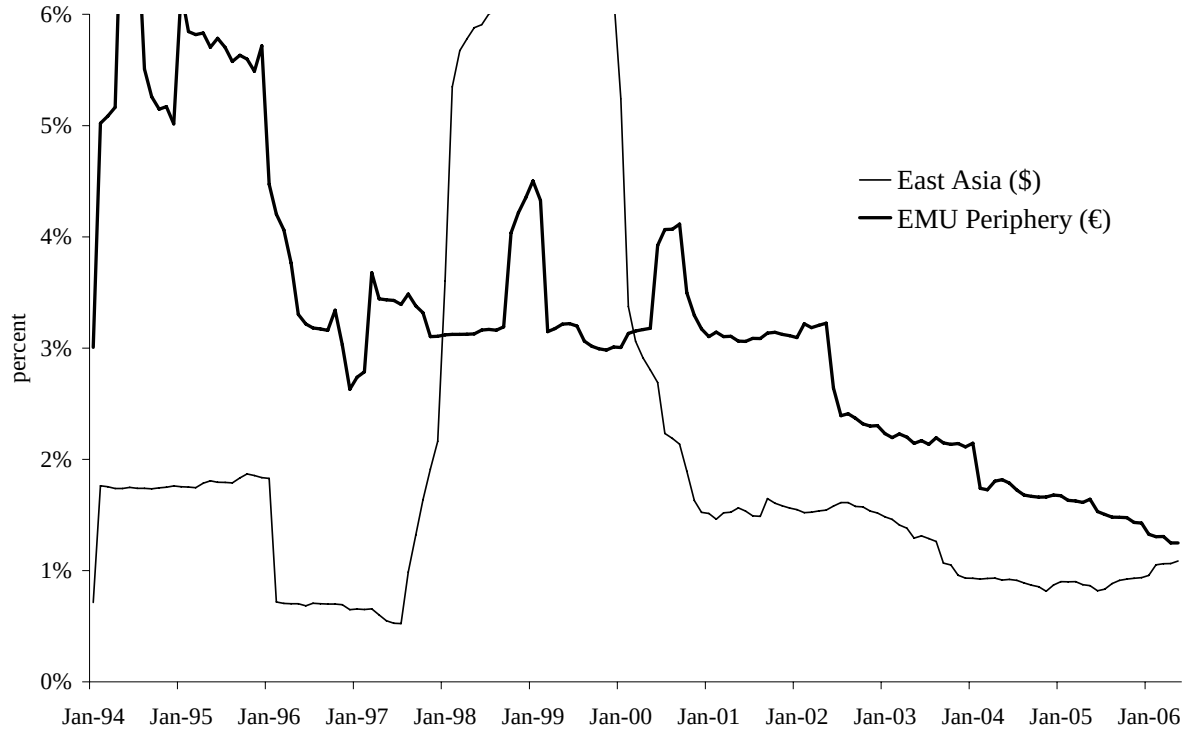
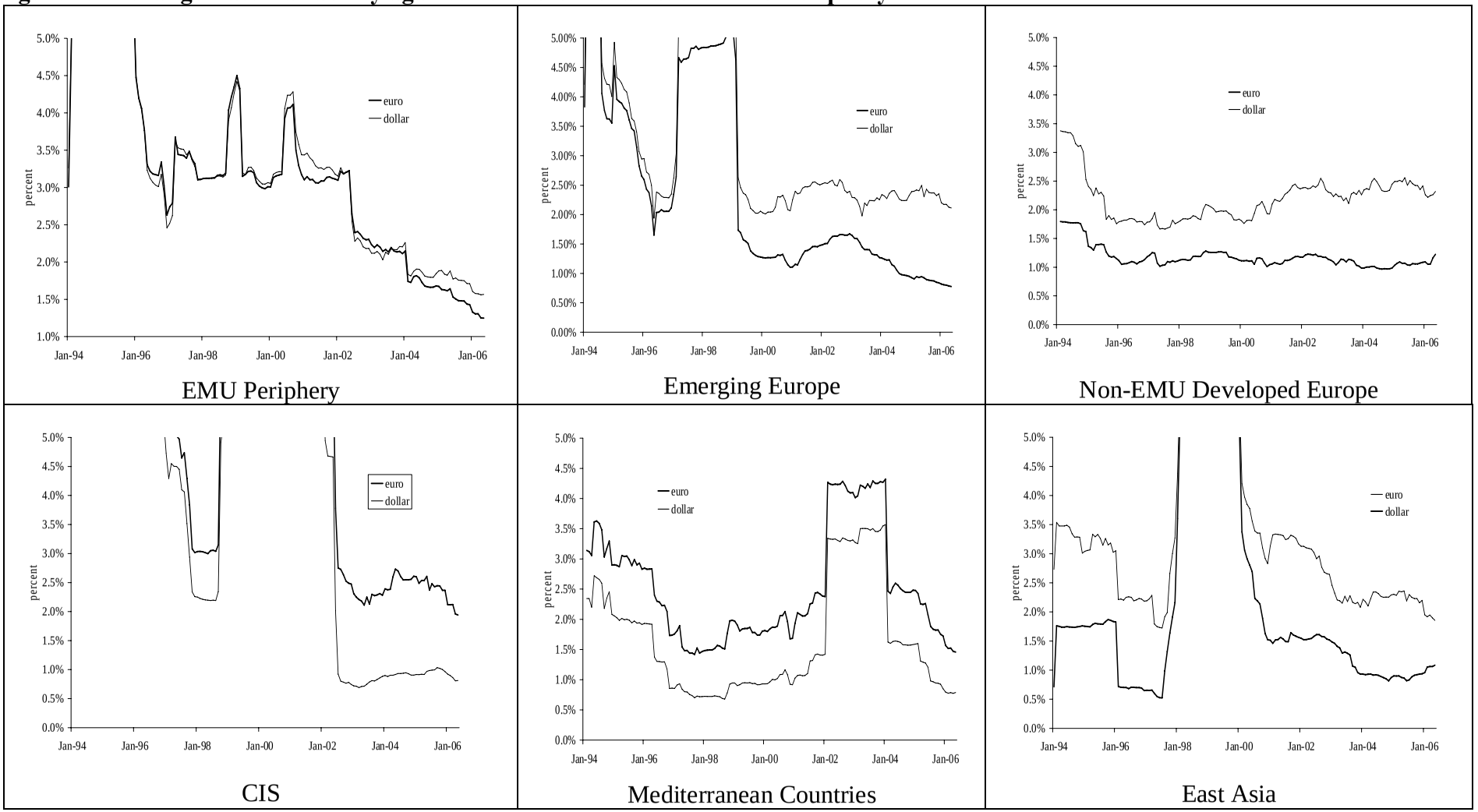
Figure 1: Exchange Rate Volatility in the EMU Periphery (against the Euro) and in East Asia (against the Dollar)



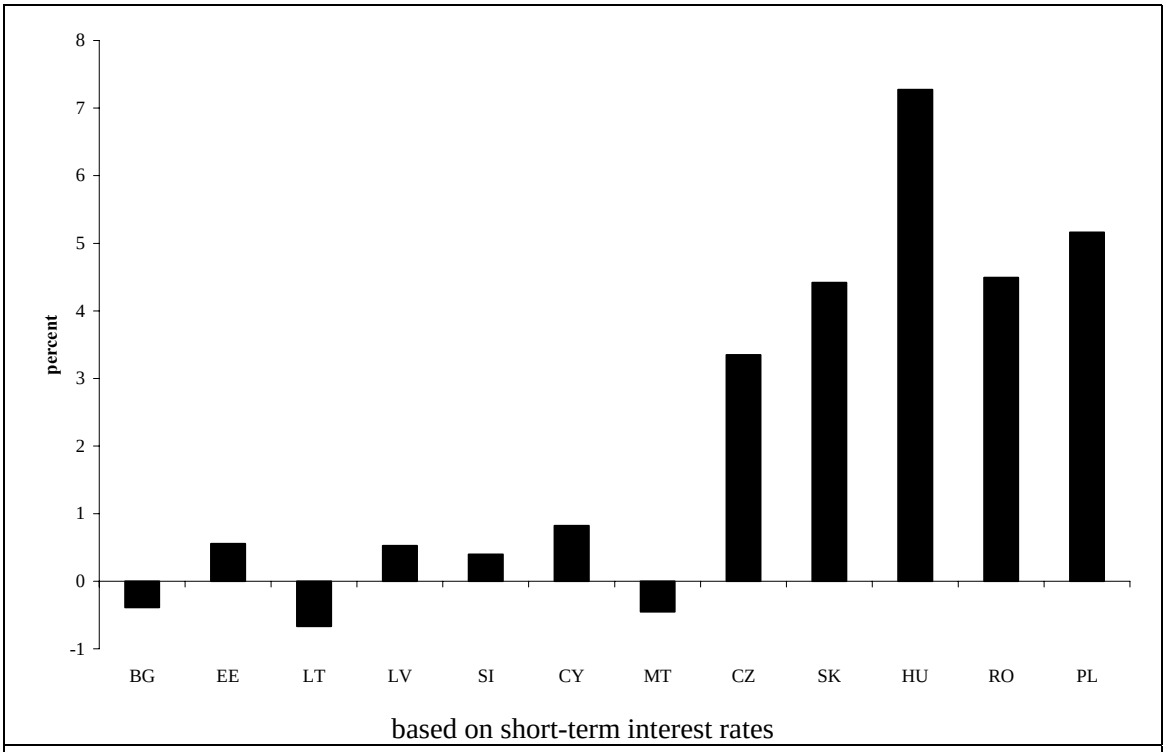
Source: IMF: IFS. Volatility defined as two year rolling standard deviations of monthly percent changes against the respective anchor currency. Country groups are calculated as arithmetic averages. East Asia includes China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. The German mark represents the euro before January 1999.

Figure 2: Exchange Rate Variability against Euro and Dollar at the EMU Periphery

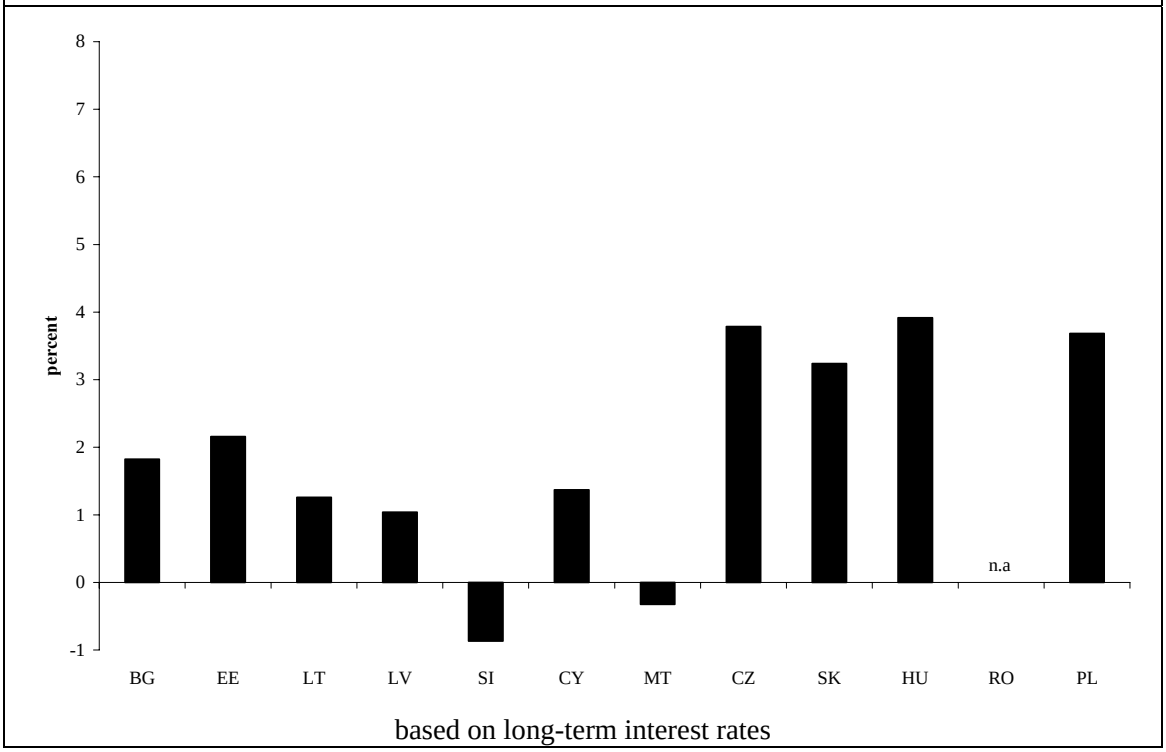


Source: IMF: IFS. Volatility defined as two year rolling standard deviations of monthly percent changes. Country groups calculated as arithmetic averages. The country groups are defined in Table 1.

Figure 3: Approximation of Risk Premiums in the EU New Member States (2001-2005)



based on short-term interest rates



based on long-term interest rates

Source: IMF, Eurostat. Yearly averages.

Table 1: Sub-Groups of EMU Periphery Panel

	Countries	IFS County Code	Panel ID
Mediterranean countries	Algeria	612	1
	Egypt	469	2
	Israel	436	3
	Jordan	439	4
	Lebanon	446	5
	Lybia	672	6
	Syria	463	7
	Morocco	686	8
	Tunisia	744	9
Emerging Europe	Bulgaria	918	10
	Croatia	960	11
	Romania	968	12
	Turkey	186	13
	Albania	914	14
	Bosnia-Herzegovina	963	15
	FYR Macedonia	962	16
	Cyprus	423	17
	Czech Republic	935	18
	Hungary	944	19
	Latvia	941	20
	Lithuania	946	21
	Estonia	939	22
	Malta	181	23
	Poland	964	24
	Slovak Republic	936	25
	Slovenia	961	26
CIS	Armenia	911	27
	Azerbaijan	912	28
	Belarus	913	29
	Georgia	915	30
	Kazakhstan	916	31
	Kyrgysistan	917	32
	Moldova	921	33
	Russian Federation	922	34
	Ukraine	926	35
Non-EMU	United Kingdom	112	36
Industrialized Europe	Iceland	176	37
	Norway	142	38
	Denmark	128	39
	Switzerland	146	40
	Sweden	144	41

Note: Serbia and Montenegro, Westbank-Gaza, Tajikistan, Turkmenistan und Uzbekistan are removed due to insufficient data.

Table 2: GLS Estimation Results for the EMU Periphery 1994 – 2005 (Euro)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.268***		-0.277***		-0.263***		-0.185***	
	(0.059)		(0.057)		(0.075)		(0.058)	
Yearly change	0.011*		0.013***		-0.016***		-0.014***	
	(0.006)		(0.005)		(0.005)		(0.003)	
Z-score		-0.199***		-0.171***		-0.397***		-0.323***
		(0.049)		(0.047)		(0.051)		(0.039)
Interest rate	-0.132***	-0.117***	-0.129***	-0.098***				
	(0.014)	(0.013)	(0.014)	(0.011)				
Export growth	0.012***	0.007**	0.014***	0.010***	0.010**	0.017***		
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)		
Inflation	0.002	0.005**			0.002	-0.000		
	(0.003)	(0.002)			(0.001)	(0.000)		
Inflation target	-0.020***	-0.020***	-0.020***	-0.019***	-0.012	-0.011	-0.013	-0.013
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)
Crisis	0.002	0.001	0.002	0.001	0.001	0.001	0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.063***	0.061***	0.062***	0.058***	0.046***	0.047***	0.046***	0.049***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	419	419	432	432	461	461	481	481
Number of id	41	41	41	41	41	41	41	41
R^2 within	0.357	0.349	0.349	0.332	0.189	0.180	0.163	0.144
R^2 between	0.052	0.059	0.054	0.067	0.118	0.069	0.089	0.087
R^2 overall	0.215	0.221	0.211	0.225	0.176	0.155	0.149	0.133

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 3: GLS Estimation Results for the EMU Periphery 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.267***		-0.275***		-0.273***		-0.194***	
	(0.058)		(0.057)		(0.074)		(0.059)	
Yearly change	0.008		0.012**		-0.016***		-0.015***	
	(0.006)		(0.005)		(0.005)		(0.004)	
Z-score		-0.208***		-0.177***		-0.399***		-0.324***
		(0.049)		(0.046)		(0.050)		(0.038)
Interest rate	-0.128***	-0.116***	-0.123***	-0.097***				
	(0.014)	(0.013)	(0.014)	(0.011)				
Export growth	0.011***	0.008**	0.013***	0.010***	0.011**	0.017***		
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)		
Inflation	0.003	0.005***			0.002	0.000		
	(0.006)	(0.002)			(0.001)	(0.001)		
Inflation target	-0.019***	-0.019***	-0.019***	-0.019***	-0.012	-0.011	-0.013***	-0.013
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)
Crisis	0.001	0.001	0.001	0.001	0.001	-0.000	0.000	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.061***	0.060***	0.059***	0.057***	0.045***	0.045***	0.045***	0.047***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	419	419	432	432	461	461	481	481
Number of id	41	41	41	41	41	41	41	41
R^2 within	0.359	0.353	0.348	0.334	0.195	0.185	0.167	0.149
R^2 between	0.081	0.084	0.080	0.088	0.191	0.141	0.112	0.121
R^2 overall	0.234	0.236	0.229	0.237	0.189	0.174	0.158	0.144

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 4: GMM - Two Step Estimation Results for the EMU Periphery 1994 – 2005 (Euro)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Growth	0.055***	0.113***	0.093***	0.088***	0.281***	0.293***	0.397***	0.401***
	(0.021)	(0.013)	(0.035)	(0.034)	(0.013)	(0.010)	(0.007)	(0.008)
Standard deviation	-0.264***		-0.199***		0.002		-0.076***	
	(0.028)		(0.027)		(0.020)		(0.004)	
Yearly change	0.016***		0.007***		-0.021***		-0.025***	
	(0.002)		(0.002)		(0.001)		(0.002)	
Z-score		-0.137***		-0.138***		-0.173***		-0.205***
		(0.022)		(0.017)		(0.011)		(0.015)
Interest rate	-0.169***	-0.131***	-0.139***	-0.118***				
	(0.006)	(0.004)	(0.007)	(0.007)				
Export growth	0.019***	0.013***	0.011***	0.009***	0.017***	0.022***		
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)		
Inflation	-0.003	-0.004***			-0.018***	-0.016***		
	(0.006)	(0.001)			(0.001)	(0.000)		
Inflation target	-0.010*	-0.015***	-0.005	-0.007	-0.022***	-0.026***	-0.012***	-0.011***
	(0.006)	(0.005)	(0.004)	(0.004)	(0.007)	(0.007)	(0.004)	(0.004)
Crisis	0.000	0.000	0.000	0.000	0.002***	0.002***	0.004***	0.003***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Constant	-0.001*	-0.000	-0.000*	-0.000	0.001***	0.001***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.001)
Observations	349	349	360	360	387	387	405	405
Number of id	40	40	41	41	40	40	41	41
Sargan test Chi^2	30.78	35.47	33.28	35.68	38.00	39.14	39.59	39.88
Prob > Chi^2	1.000	1.000	1.000	1.000	1.000	1.000	0.942	0.938
AR(2)	0.502	0.330	0.418	0.389	0.238	0.291	0.249	0.332

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 5: GMM - Two Step Estimation Results for the EMU Periphery 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Growth	0.085***	0.114***	0.063**	0.074**	0.305***	0.296***	0.412***	0.404***
	(0.017)	(0.015)	(0.029)	(0.033)	(0.015)	(0.015)	(0.003)	(0.006)
Standard deviation	-0.255***		-0.198***		-0.029		-0.081***	
	(0.034)		(0.021)		(0.023)		(0.003)	
Yearly change	0.013***		0.004*		-0.022***		-0.030***	
	(0.003)		(0.002)		(0.001)		(0.003)	
Z-score		-0.144***		-0.147***		-0.201***		-0.221***
		(0.016)		(0.017)		(0.015)		(0.015)
Interest rate	-0.156***	-0.127***	-0.126***	-0.115***				
	(0.009)	(0.003)	(0.008)	(0.007)				
Export growth	0.017***	0.013***	0.011***	0.009***	0.018***	0.023***		
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)		
Inflation	-0.002	-0.002***			-0.016***	-0.015***		
	(0.003)	(0.001)			(0.001)	(0.001)		
Inflation target	-0.012***	-0.015***	-0.009***	-0.006	-0.021***	-0.023***	-0.013***	-0.011***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.006)	(0.007)	(0.003)	(0.004)
Crisis	-0.000	-0.000	-0.000	0.001	0.002***	0.002**	0.004***	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Constant	-0.000**	-0.000	0.000	0.000	0.001***	0.001***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	349	349	360	360	387	387	405	405
Number of id	40	40	41	41	40	40	41	41
Sargan test Chi^2	32.71	35.64	33.64	35.33	36.84	33.56	40.51	40.00
Prob > Chi^2	1.000	1.000	1.000	1.000	1.000	1.000	0.928	0.936
AR(2)	0.396	0.322	0.448	0.421	0.235	0.289	0.265	0.332

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 6: GLS Estimation Results for Emerging Europe 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.597***		-0.697***		-0.493***		-0.103*	
	(0.160)		(0.129)		(0.161)		(0.063)	
Yearly change	0.001		0.006		-0.019***		-0.029***	
	(0.009)		(0.008)		(0.007)		(0.007)	
Z-score		-0.512***		-0.582***		-0.702***		-0.249***
		(0.119)		(0.114)		(0.108)		(0.048)
Interest rate	-0.069***	-0.057***	-0.082***	-0.065***				
	(0.021)	(0.017)	(0.017)	(0.016)				
Export growth	0.054***	0.056***	0.045***	0.041***	0.071***	0.073***		
	(0.012)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)		
Inflation	-0.013	-0.018*			-0.033***	-0.024***		
	(0.012)	(0.010)			(0.009)	(0.009)		
Inflation target	-0.013	-0.013	-0.013	-0.013	-0.008	-0.006	-0.013	-0.010
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.009)	(0.009)
Crisis	-0.001	-0.002	-0.001	-0.002	-0.003	-0.003	-0.005	-0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Constant	0.053***	0.052***	0.055***	0.054***	0.044***	0.045***	0.047***	0.047***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	184	184	184	184	197	197	200	200
Number of id	17	17	17	17	17	17	17	17
R^2 within	0.435	0.428	0.432	0.416	0.383	0.376	0.194	0.139
R^2 between	0.355	0.359	0.333	0.343	0.271	0.211	0.333	0.325
R^2 overall	0.354	0.346	0.344	0.337	0.345	0.318	0.214	0.163

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 7: GMM - Two Step Estimation Results for Emerging Europe 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Growth	-0.114	0.049	-0.025	0.038	-0.048	0.254*	0.227***	0.152***
	(0.15)	(0.015)	(0.096)	(0.080)	(0.226)	(0.149)	(0.076)	(0.041)
Standard deviation	-0.407		-0.903***		-0.019		-0.091***	
	(0.649)		(0.116)		(0.639)		(0.017)	
Yearly change	0.004		0.033***		-0.029*		-0.023***	
	(0.030)		(0.010)		(0.011)		(0.005)	
Z-score		-0.373		-0.605***		-1.059***		-0.141***
		(0.274)		(0.017)		(0.365)		(0.025)
Interest rate	-0.084	-0.098***	-0.189***	-0.106***				
	(0.071)	(0.037)	(0.039)	(0.027)				
Export growth	0.046***	0.088***	0.059***	0.045***	0.089***	0.083***		
	(0.016)	(0.021)	(0.007)	(0.009)	(0.018)	(0.016)		
Inflation	-0.019	-0.052***			-0.075**	-0.007		
	(0.036)	(0.017)			(0.039)	(0.021)		
Inflation target	-0.006	-0.003	0.000	-0.003	-0.002	0.004	-0.005	-0.011*
	(0.009)	(0.006)	(0.008)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Crisis	0.000	-0.001	-0.003	-0.001	-0.001	-0.005	0.001	0.001
	(0.000)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.002)
Constant	0.000	-0.002	-0.002*	-0.002	-0.000	-0.001	-0.000	0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Observations	153	153	153	153	164	164	167	167
Number of id	17	17	17	17	17	17	17	17
Sargan test Chi^2	8.66	10.23	13.82	13.71	10.07	11.08	13.26	15.49
Prob > Chi^2	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AR(2)	0.931	0.248	0.558	0.448	0.597	0.229	0.471	0.554

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 8: GLS Estimation Results for the Non-EMU Industrialized European Countries 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.214		-0.309		0.148		-0.088	
	(0.560)		(0.563)		(0.545)		(0.519)	
Yearly change	-0.002		-0.007		-0.006		-0.010	
	(0.038)		(0.039)		(0.039)		(0.039)	
Z-score		-0.113		-0.189		0.143		-0.107
		(0.497)		(0.500)		(0.478)		(0.447)
Interest rate	0.033	0.033	-0.102	-0.105				
	(0.141)	(0.142)	(0.108)	(0.112)				
Export growth	0.030	0.029	0.027	0.027	0.022	0.022		
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)		
Inflation	-0.401	-0.409			-0.335	-0.343		
	(0.268)	(0.265)			(0.209)	(0.211)		
Inflation target	-0.007	-0.007	-0.009*	-0.009*	-0.006	-0.006	-0.008	-0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Crisis	0.009**	0.009**	0.010***	0.010***	0.008**	0.008**	0.009**	0.009**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.033***	0.033***	0.033***	0.033***	0.031***	0.031***	0.029***	0.029***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Observations	68	68	68	68	72	72	72	72
Number of id	6	6	6	6	6	6	6	6
R^2 within	0.273	0.271	0.243	0.240	0.193	0.193	0.146	0.145
R^2 between	0.265	0.261	0.288	0.293	0.416	0.399	0.048	0.051
R^2 overall	0.094	0.099	0.055	0.060	0.052	0.053	0.059	0.058

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 9: GLS Estimation Results for the CIS 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.764***		-0.418***		-0.389**		-0.513**	
	(0.251)		(0.114)		(0.203)		(0.208)	
Yearly change	0.084***		0.037***		-0.010		-0.002	
	(0.032)		(0.009)		(0.012)		(0.009)	
Z-score		-0.139		-0.126		-0.460***		-0.454***
		(0.088)		(0.094)		(0.113)		(0.094)
Interest rate	-0.175***	-0.189***	-0.196***	-0.096***				
	(0.034)	(0.035)	(0.031)	(0.021)				
Export growth	0.048**	0.033*	0.038**	0.045**	0.025	0.024		
	(0.019)	(0.019)	(0.018)	(0.019)	(0.029)	(0.029)		
Inflation	-0.019	0.013***			0.001	0.000		
	(0.013)	(0.004)			(0.002)	(0.001)		
Crisis	-0.009	-0.002	-0.005	-0.004	0.013	0.012	0.005	0.005
	(0.008)	(0.008)	(0.008)	(0.009)	(0.013)	(0.014)	(0.014)	(0.014)
Constant	0.093***	0.088***	0.092***	0.073***	0.049***	0.052***	0.055***	0.055***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.009)	(0.009)	(0.008)	(0.008)
Observations	81	81	81	81	99	99	101	101
Number of id	9	9	9	9	9	9	9	9
R^2 within	0.617	0.577	0.603	0.507	0.244	0.241	0.219	0.218
R^2 between	0.327	0.254	0.252	0.604	0.233	0.166	0.084	0.059
R^2 overall	0.562	0.515	0.535	0.499	0.238	0.229	0.201	0.195

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 10: GLS Estimation Results for the Mediterranean Countries 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	0.254		0.210		0.182		0.205	
	(0.279)		(0.241)		(0.260)		(0.218)	
Yearly change	-0.066		-0.062		-0.056		-0.067	
	(0.062)		(0.053)		(0.058)		(0.481)	
Z-score		-0.016		-0.034		-0.043		-0.061
		(0.114)		(0.110)		(0.104)		(0.099)
Interest rate	-0.175	-0.158	-0.015	-0.042				
	(0.148)	(0.148)	(0.097)	(0.095)				
Export growth	-0.005	-0.006	-0.005	-0.004	-0.007	-0.007		
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)		
Inflation	0.096	0.044			-0.012	-0.047		
	(0.108)	(0.096)			(0.073)	(0.063)		
Inflation target	-0.043**	-0.045**	-0.042**	-0.042**	-0.042**	-0.044**	-0.041**	-0.039**
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)	(0.019)	(0.019)
Crisis	0.004	0.002	0.004	0.003	0.001	0.000	0.002	0.001
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
Constant	0.053***	0.056***	0.044***	0.047***	0.046***	0.048***	0.042***	0.043***
	(0.009)	(0.009)	(0.009)	(0.008)	(0.006)	(0.006)	(0.004)	(0.004)
Observations	86	86	99	99	93	93	108	108
Number of id	9	9	9	9	9	9	9	9
R^2 within	0.098	0.083	0.071	0.056	0.080	0.069	0.066	0.047
R^2 between	0.000	0.003	0.004	0.011	0.075	0.028	0.003	0.008
R^2 overall	0.044	0.031	0.031	0.021	0.039	0.028	0.027	0.017

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 11: GLS Estimation Results for the EMU Periphery 1994 – 1998 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.421***		-0.436***		-0.337**		-0.171**	
	(0.106)		(0.020)		(0.131)		(0.081)	
Yearly change	0.018**		0.020***		-0.004		-0.007	
	(0.009)		(0.007)		(0.007)		(0.005)	
Z-score		-0.255***		-0.221***		-0.328***		-0.219***
		(0.084)		(0.082)		(0.078)		(0.053)
Interest rate	-0.116***	-0.093***	-0.112***	-0.062***				
	(0.023)	(0.022)	(0.022)	(0.017)				
Export growth	0.023**	0.009	0.026***	0.013**	0.017*	0.017**		
	(0.009)	(0.007)	(0.008)	(0.007)	(0.010)	(0.007)		
Inflation	0.002	0.007**			0.001	0.000		
	(0.003)	(0.003)			(0.001)	(0.001)		
Inflation target	-0.037*	-0.004*	-0.037*	-0.004	-0.037	-0.004	-0.035	-0.034
	(0.022)	(0.022)	(0.021)	(0.023)	(0.029)	(0.029)	(0.031)	(0.032)
Crisis	0.005	0.003	0.006	0.004	0.007	0.007	0.002	0.002
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)
Constant	0.059***	0.056***	0.058***	0.050***	0.034***	0.034***	0.036***	0.036***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Observations	157	157	161	161	187	187	194	194
Number of id	38	38	38	38	40	40	41	41
R^2 within	0.372	0.338	0.366	0.305	0.160	0.154	0.117	0.107
R^2 between	0.265	0.288	0.264	0.324	0.270	0.265	0.219	0.210
R^2 overall	0.305	0.308	0.305	0.321	0.196	0.192	0.155	0.144

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 12: GLS Estimation Results for the EMU Periphery 1999 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	0.113		0.075		0.206		0.186	
	(0.118)		(0.113)		(0.126)		(0.117)	
Yearly change	-0.043**		-0.025*		-0.078***		-0.059***	
	(0.020)		(0.014)		(0.020)		(0.014)	
Z-score		-0.094		-0.088		-0.189**		-0.220***
		(0.074)		(0.064)		(0.081)		(0.067)
Interest rate	-0.166***	-0.177***	-0.169***	-0.179***				
	(0.024)	(0.024)	(0.024)	(0.024)				
Export growth	0.010**	0.011**	0.006	0.007	0.013**	0.014**		
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)		
Inflation	0.018	0.000			0.024	-0.010		
	(0.013)	(0.010)			(0.014)	(0.011)		
Inflation target	-0.013	-0.012***	-0.013	-0.012	-0.012	-0.008***	-0.012	-0.009***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
Crisis	0.003	0.002	0.003	0.002	-0.000	-0.003	-0.000	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	0.059***	0.062***	0.060***	0.062***	0.044***	0.049***	0.047***	0.049***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Observations	262	262	271	271	274	274	287	287
Number of id	40	40	40	40	40	40	41	41
R^2 within	0.277	0.263	0.260	0.251	0.129	0.082	0.098	0.047
R^2 between	0.008	0.004	0.006	0.006	0.072	0.030	0.035	0.065
R^2 overall	0.089	0.069	0.068	0.062	0.118	0.073	0.069	0.054

Data source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

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