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Short- and Long-Term Growth Effects of Exchange Rate Adjustment

Evžen KOČENDA, Mathilde MAUREL, Gunther SCHNABL

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Short- and Long-Term Growth Effects of Exchange Rate Adjustment

Evžen Kočenda^a, Mathilde Maurel^b, Gunther Schnabl^c

Abstract

During the European sovereign debt crisis the discussion concerning the pros and cons of exchange rate adjustment in the face of asymmetric shocks was revived. Whereas one side has recommended (in the spirit of Keynes) the exit from the euro area to regain rapidly international competitiveness, exchange rate stability cum structural reforms have been argued (in the spirit of Schumpeter) to be a beneficial long-term strategy towards the reanimation of a robust growth performance. Previous literature has estimated the average growth of countries with different degrees of exchange rate volatility. We augment this literature by econometrically separating between the short-term and long-term growth effects of exchange rate volatility based on a panel-cointegration framework for a sample of 60 countries clustered in five country groups. The estimations show that countries with a low degree of exchange rate volatility exhibit a higher long-term growth performance, whereas over the short-run exchange rate flexibility provides some benefits. In line with Mundell (1961) we show that the degree of business cycle synchronization with the (potential) anchor country matters for the impact of exchange rate volatility on growth.

JEL codes: F31, F32.

Keywords: Exchange rate regime, crisis, shock adjustment, theory of optimum currency areas, Mundell, Schumpeter, cointegration, competitive depreciations.

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1. Introduction

The recent wave of financial, balance of payments and sovereign debt crises has revived the discussion about the appropriate adjustment strategy in the face of asymmetric shocks. In most crisis events such as the 1997/98 Asian crisis, the 1998 Japanese financial crisis, the 1998 Russian flu, the 2001 collapse of the Argentine currency board and even the US subprime market crisis, the crisis countries embarked on monetary expansion and depreciation as crisis solution strategies. In contrast, during the most recent European sovereign debt crisis a set of European crisis countries opted for staying in the Economic and Monetary Union (EMU; the EMU crisis countries) or maintaining tight exchange rate pegs to the euro (the Baltic countries and Bulgaria). The consequence was a strong pressure to curtail government expenditure and to cut nominal wages.

The different adjustment strategies in the face of crisis based on inflation or deflation are embedded into different theoretical frameworks. Keynes (1936) and Mundell (1961) favoured monetary expansion and depreciation to provide a quick fix for missing international competitiveness and high unemployment. In contrast, Schumpeter (1911) and Hayek (1929) stressed the role of wage and price cuts to boost long-term growth via an increasing marginal efficiency of private investment. In the context of the choice of the exchange rate regime, Mundell (1961) modelled the benefits of exchange rate adjustment in the face of asymmetric shocks to stimulate (short-term) growth, whereas McKinnon (1963) highlighted the role of fixed exchange rates for macroeconomic stabilization and therefore as a tool for preserving the (long-term) growth performance. From an economic historical perspective Bordo (2002) argues that the exchange rate stability of the gold standard has fostered global trade and growth, whereas Eichengreen (2002) sees the early exit from the gold standard as the reason for UK's early recovery from the world economic crisis.

Empirical studies on the impact of the exchange rate regime on growth have come to mixed results. For instance, Levy-Yeyati and Sturzenegger (2002) who examine the impact of the exchange rate regime on growth for a sample of 183 countries in the post-Bretton-Woods era (1974-2000) with the help of a pooled regression framework find a negative impact of exchange rate stability on growth for emerging market economies. In contrast, Maurel and Schnabl's (2011) static and dynamic panel estimations find a positive impact of exchange rate stability on growth for a set of 60 mostly emerging market economies.

We aim to augment this literature by isolating the long-term and short-term growth effects of exchange rate stability / flexibility based on a cointegration framework. This research allows us – with the help of a panel of 60 countries in East Asia, Europe, Latin America and

the CIS for the period from 1994 to 2010 – to reconcile Mundell's (1961) and McKinnon's (1963) view on the impact of exchange rate flexibility / stability on growth in the face of asymmetric shocks.

2. Short- and Long-Term Growth Effects of (Non-) Exchange Rate Adjustment

From 2008 to 2012 the European debt crisis revealed the different adjustment strategies to asymmetric shocks and crisis. When many European periphery countries were hit by bursting bubbles, the reversal of capital inflows and (near to) unsustainable debt levels, the EMU membership barred the way towards depreciation as a quick fix for the adjustment of unit labour costs to regain international competitiveness.

The loss of independent monetary policy and the exchange rate as adjustment tools to asymmetric shocks made price and wage adjustments necessary, which amplified the crisis and triggered different policy responses. Whereas Ireland (like the Baltic countries and Bulgaria in the east of the European Union) embarked on doughty adjustment measures in the private and public sector, in Greece political resistance retarded reforms. The delayed reforms in Greece were reflected in substantial rescue packages (Vogel 2011) and rising imbalances in the ECB's TARGET2 mechanism (Sinn and Wollmershäuser 2011), which both provided a substitute for pre-crisis private capital inflows as financing mechanism of persistent current account deficits.

The issue of the appropriate adjustment mechanism for unsustainable current account deficits within the EMU boils down to the question of short-term and long-term adjustment strategies to economic crisis in an open economy as it had already emerged during world economic crisis in the 1930s. Table 1 provides an overview of the different theoretical approaches. Whereas Keynes (1936) called for a depreciation to provide a short-term growth impulse, Hayek (1937) - in the spirit of Schumpeter (1911) - stressed the need of price and wage adjustment. The controversy between Keynes (1936) and Hayek (1937) reflected different attitudes concerning the role of the government for macroeconomic stabilization. Whereas Keynes (1936) stressed the need for a timely anti-cyclical macroeconomic impulse, Hayek (1937) believed in the self-healing forces of the market.

The real exchange rate adjustment, which is needed to rebalance the current account position of crisis countries, is framed by the theory of optimum currency areas. Mundell (1961) assumed that countries with a high probability of asymmetric shocks need to preserve the exchange rate as an adjustment mechanism to stabilize growth, if labour markets are rigid. This reflects the Keynesian assumption of (short-term) price and wage rigidity and the crucial

role of the government for macroeconomic stabilization. In contrast, McKinnon (1963) argued that in small and open economies a fixed exchange rate needs to serve as a macroeconomic stabilizer by absorbing nominal shocks to promote growth. To maintain a fixed exchange rate, sufficient price and wage flexibility is necessary, which is line with Hayek's (1937) and Schumpeter's (1911) notion that declining prices and wages are the prerequisite for a robust recovery after crisis. Some empirical evidence of the connection between exchange rate volatility and price and wage flexibility is provided in Belke and Setzer (2003), who argue that the former can be considered as a substitute for a removal of employment protection legislation.

The growth effects of the crisis adjustment strategies based on exchange rate or wage adjustment have furthermore a goods market and a capital market perspective. Keynes (1936) stressed the short-term dimension with a focus on goods markets. In his view depreciation in the case of crisis can help to "jumpstart" the economy as monetary expansion and real depreciation restore instantaneously the international competitiveness. Real wages decline without cumbersome wage negotiations as inflation increases, in particular via the import price channel.

Hawtrey (1919), who dedicated his academic work to the deflationary consequences of the return to the gold standard, pioneered the financial market based arguments in favour a monetary expansion during crisis. He assumed that low-cost credit during crisis helps to prevent a credit crunch (which is triggered by increasing risk perception in the private banking sector) and a dismantling of investment projects (which leads into a cumulative process downwards). New investment is encouraged which helps to speed up the recovery. As a fundamental restructuring process in the economy is circumvented, dire wage cuts become dispensable, which helps to maintain economic activity via the consumption channel.

In contrast, Hayek (1937) and Schumpeter (1911) help to understand the negative long-term growth effects of crisis therapy via monetary expansion and depreciation, when restructuring and structural reforms are postponed. In Schumpeter's (1911: 350) real overinvestment theory the recession is a process of uncertainty and disorder, which forces a reallocation of resources on the enterprise sector ("cleansing effect"). The reallocation is a pre-requisite for long-term growth as speculative investment is abandoned, inefficient enterprises leave the market, the efficiency of the remaining enterprises is strengthened, and new enterprises, products and production processes emerge at the cost of old ones. Exchange rate depreciation during crisis is an impediment to long-term growth as the "*unadapted and*

unlivable” persists (Schumpeter 1911: 367).¹ Hence, in this context the exchange rate regime matters, as a fixed exchange rate (or membership in a monetary union) imposes the need for structural reforms.

The monetary overinvestment theory of Hayek (1931) allows approaching the long-term growth effects of monetary expansion and depreciation from a capital market perspective. The pivotal point is the impact of monetary expansion on the marginal efficiency of investment. During the upswing artificially low interest rates set by the central bank encourage investment with declining marginal efficiency. When rising inflation urges the central bank to lift interest rates again, investment projects with low marginal return have to be dismantled. The resulting cleansing effect is the prerequisite for a sustained recovery, as only dynamic investment persists. If, however, the central bank responds to the crisis by decisive interest rate cuts, investment projects with low marginal returns, i.e. a distorted production structure, are conserved. A structurally declining interest rate deprives the interest rate of its allocation function – which separates high-return investment from low-return investment – thereby putting a drag on long-term growth (Schnabl 2012).

This implies that – depending on the theoretical framework – exchange rate adjustment in the face of crisis has a positive or negative growth effect depending on the time horizon. As stressed by Mundell (1961) the question of if the exchange rate regime has a positive or negative effect on the growth performance of countries may – within an asymmetric world monetary system – further hinge on the degree of business cycle synchronization with the (potential) anchor country. Because of underdeveloped goods and capital markets small and open economies have an inherent incentive to stabilize the exchange rate versus the currency of a large anchor country (usually the dollar or the euro) (Calvo and Reinhart 2002). If business cycles are synchronized with the anchor country, the monetary policy of the anchor country will be in line with the macroeconomic needs of the small open economy. If, however, business cycles are idiosyncratic, there is a larger need to stabilize growth via exchange rate adjustment.

Previous papers have tested for the overall average growth effects of exchange rate flexibility / volatility, partially contingent on business cycle synchronization. We augment this literature by separating between the long-term and short-term growth effects of exchange

¹ Schumpeter’s (1912) argument, which has been designed for the private enterprise sector, can be applied for the government sector as well. A strong recession will trigger only structural reforms if there are restrictions on fiscal and monetary expansion in place.

rate movements based on a sample of 60 small, open emerging market economies with the help of an error correction framework.

3. Data, Volatility Measures and Business Cycle Correlation

To trace the short-term and long-term impact of exchange rate flexibility, i.e. exchange rate volatility,² on growth, we choose five country groups for which the choice of the appropriate exchange rate regime has been high on the political agenda. In the EU15 as well as in Central, Eastern and Southeastern Europe (Emerging Europe), the discussion about membership in the EMU and/or the optimum degree of exchange rate stability against the euro continues to be high on the political agenda.³ The discussion about the pro and cons of EMU membership and exchange rate stability against the euro was revived during the most recent crisis.

In East Asia and South America the optimum degree of exchange rate stability against the dollar continues to be discussed, in particular since the Asian crisis and drastic US interest rate cuts following the subprime crisis. Most recently, Japan, China and Brazil have been involved in a discussion on “currency wars” and competitive interest rate cuts (McKinnon 2010). In the Commonwealth of Independent States, Russia’s move towards a currency basket and the depreciation of the CIS currencies during the recent crisis have revived the question about the optimum exchange rate policy. In this context, the choice of the anchor currency and the degree of business cycle synchronization with the anchor country play an important role.

The five country groups include all countries of the respective region excluding microstates – which may bias the sample towards a very high positive effect of exchange rate stability on growth (Rose 2004) – and excluding countries with insufficient data such as Turkmenistan, Uzbekistan, Guyana etc. This brings us to a sample size of 60 countries. Table 2 provides an overview of all countries under research, grouped into regions. We also list the prevalent anchor currencies and thereby the reference countries for measuring business cycle correlation. For the countries in East Asia, South America and the CIS the dollar has been the prevailing target of exchange rate stabilization. Business cycle correlation is measured versus the US.

² The wording exchange rate volatility and exchange rate flexibility can be argued to hinge on the impact of exchange rate fluctuations on growth. Implicitly the wording exchange rate volatility implies a negative impact of exchange rate fluctuations on growth, whereas the wording exchange rate flexibility implies a positive impact of exchange rate adjustment on growth.

³ Kočenda and Poghosyan (2009) show empirically that to stabilize the domestic currency the new EU members should promote nominal as well as real convergence with the core EU members since both real and nominal factors have an important impact on the variability of their exchange rate risk.

For the European countries before the introduction of the euro in 1999, the German mark has been the dominant anchor currency. Since then, the euro has become the natural anchor for the European non-EMU countries. Exchange rate volatility is measured against the German mark before 1999 and against the euro after 1999. Once a country has entered the EMU the proxy for exchange rate volatility is set to zero. Business cycle correlation in Europe is measured versus Germany, which is the largest European economy (and therefore a country with a high degree of business cycle correlation with the euro area). For Germany, France as the second largest European economy is used as a reference country to measure business cycle correlation.

The data source is the International Monetary Fund International Financial Statistics. Detailed information is provided in Table 3. Missing or inconsistent data are completed and cross-checked with national statistics, mainly national central banks. For all macroeconomic data we use quarterly frequencies. Quarterly GDP growth rates are calculated as year-over-year quarterly growth rates to filter out seasonal pattern and lower the volatility of the transformed series. Quarterly volatility measures for exchange rates are computed based on month-over-month percent changes. The sample period starts in January 1994 to exclude the first years of the nineties, which for most of the European and CIS countries implied high volatility and data uncertainty linked to the transition process. Further, we compute a measure of trade integration (as exports plus imports over GDP) and a year-over-year quarterly inflation rate. We include the interest rate of the potential exchange rate anchor country as indicated in Table 1 as a proxy for external monetary conditions, which have been an important determinant of growth in emerging market economies (Maurel and Schnabl 2012).

We use de facto exchange rate volatility measures, because de jure volatility measures are likely to be flawed by fear of floating (Calvo and Reinhart, 2002; De Grauwe and Schnabl, 2008). Quarterly de facto exchange rate volatility is measured by the standard deviation of monthly percent exchange rate changes of the respective quarter and the quarterly arithmetic average of monthly percent exchange rate changes. Both measures are summarized by the z-score as in Schnabl (2009) and Maurel and Schnabl (2012). All three variables are calculated against the euro or the dollar, depending of the respective anchor currency as listed in Table 2.

As we aim to analyze the impact of exchange rate flexibility/volatility on growth contingent on business cycles synchronization we construct a dummy for business cycle synchronization (*Dbcc*) for every country based on country groups. If business cycle correlation of specific countries with the reference country is lower than the country group average the dummy is set equal to one. The dummy is zero if the degree of business cycle

correlation is above average. Figure 1 reveals pronounced differences in the degrees of business cycle synchronization for different countries and different country groups.

4. Empirical Analysis

Given the different time dimensions of economic theories concerning the impact of exchange rate stability/flexibility on growth, the issue of crisis adjustment via the exchange rate is an empirical one. In contrast to previous papers, we aim to address the question about the optimum exchange rate regime by identifying the impact of exchange rate flexibility on both short-term and long-term growth. Hawtrey (1918), Keynes (1936) and Mundell (1961) argued that exchange rate adjustment during crisis increases the (short-term) growth performance of countries with a high likelihood of asymmetric shocks. In contrast, for Schumpeter (1911), Hayek (1931) and McKinnon (1963) exchange rate stability during crisis enhances the need for internal adjustment, what is seen as a prerequisite for buoyant long-term growth. The foregoing empirical analysis aims to disentangle the long-term and short-term effect of exchange rate flexibility on growth, which may, possibly, reconcile both strands of literature by attributing a time dimension to them.

In this respect, we focus on the direct transmission of exchange rate volatility on growth in the context of global monetary policy behavior -- for instance via its impact on investment and trade.⁴ Hence, in the spirit of Schnabl (2009), Schnabl and Maurel (2012), or Boar (2010), we use exchange rate volatility as main explanatory variable of growth, while we control for additional variables widely recognized in the literature as having a key link with respect to the growth. Specifically, we control for domestic inflation (Barro, 1995, Bruno and Easterly, 1995, and Fischer, 1983) and the interest rate in the large industrial countries (Fisher, 1993; McKinnon, 2012) proving international (anchor) currencies as determinants of growth. Further, we control for trade openness, which is a good candidate for summarizing the role of external markets in driving growth (Edwards, 1993; Harrison and Rodríguez-Clare, 2010).

4.1. Model Specification and Estimation Procedure

Equation (1) is our benchmark specification to model the changes in economic growth:

⁴ The traditional neoclassical drivers of growth are not a matter of our analysis and we do not attempt to estimate a neoclassical growth model.

$$w_{it} = \alpha_0 + \alpha_1 ERV_{it} + \alpha_2 Inflation + \alpha_3 InterestRate + \alpha_4 TradeOpeness + \alpha_5 Trend + ec(\beta_1 ERV_{it} + \beta_2 Inflation) + \varepsilon_t \quad (1)$$

In specification (1) w_{it} are the quarterly real growth rates from 1994 to 2010. Right-hand side of the specification is divided into two parts to distinguish short and long-term effects. First, long-run part of the equation contains the following explanatory variables. Exchange rate volatility (ERV_{it}) is to account for the long-run effect of exchange rate policy. We use three different measures of exchange rate volatility as described in detail in previous section: standard deviations, mean of percent exchange rate changes against the anchor currency, and z-score. Further, we employ theoretically motivated explanatory variables that affect economic growth via direct or indirect channels. Inflation serves as a proxy for monetary policy. Interest rate accounts for the influence of the price of money with respect to investments and their effect on economic development; we use a short-term interest rates of the respective reference country. Finally, we include trade openness to account for the extent of the international economic integration, and a time trend. We assume that the latter variables have an impact on the long-term economic performance while they do not matter in the short-term. Hence, the second, short-run, part of the equation contains two key variables: exchange rate volatility for the exchange rate policy and inflation for monetary policy. To sum up, the term after the error correction term ec in parentheses refers to the short-run adjustment while the first part of the equation displays the long-term relationship.

There is a large number of other potential explanatory variables like investment, government spending, schooling etc. which could increase the fit of the model. However, these variables would also generate endogeneity -- for instance between investment and growth -- and multicollinearity bias -- for instance between government spending and inflation as argued by De Grauwe and Schnabl, 2008. Therefore, we opt for a parsimonious specification, restricted to the control variables mentioned above.

As a next step we modify our benchmark model into specification (2) in order to account for the effect of asymmetric countries:

$$w_{it} = \alpha_0 + \alpha_1 ERV_{it} + \alpha_2 Inflation + \alpha_3 InterestRate + \alpha_4 TradeOpeness + \alpha_5 Trend + ec(\beta_1 ERV_{it} + \beta_2 Inflation + \beta_3 ERV_{it}^{asymmetric}) + u_t \quad (2)$$

In specification (2), we control for the fact that countries with asymmetric business cycles face bigger constraints to achieve the same growth by using the dummy $Dbbc$ (see earlier explanation in Section 3). The combined dummy variable $ERV_{it}^{asymmetric}$, constructed as ERV_{it} times $Dbbc$, is set equal to one for countries characterized by relative asymmetric business cycles, and zero otherwise. The inclusion of the interaction term ($ERV_{it}^{asymmetric}$) in the short-term equation helps to model the short-term nature of asymmetric shocks.

By estimating both specifications (1) and (2) our objective is threefold: to highlight the impact of exchange rate volatility on growth, to disentangle the short-term versus long-term effect of exchange rate volatility on growth, and to quantify the weight of countries with asymmetric business cycles (which we call asymmetric countries) in this impact. Our prior is that the impact of exchange rate volatility should be positive in the short term, especially for asymmetric countries, but negative in the long term.

Three econometric estimation frameworks are chosen for the error-correction specification for panel data: pooled mean group, mean group, and dynamic fixed-effects estimators. The most restrictive is the dynamic fixed-effects estimator that assumes that all parameters are constant across countries, except for the intercept, which is allowed to vary across countries. The pooled mean group estimator is more general than the dynamic fixed-effects estimator as it imposes the restriction that all countries share the long-term coefficients. The mean group estimator is even more general as it assumes that economies differ in their short-term and long-term parameters.

The choice between the three estimators entails a tradeoff between consistency and efficiency. The dynamic fixed-effects estimator dominates the other two in terms of efficiency if the restrictions are valid. If they are not valid, the dynamic fixed effects will generate inconsistent estimates and is dominated by the pooled mean group and mean group estimates. In many studies the pooled mean group estimator is assumed to offer the best compromise between consistency and efficiency, because one would expect the long-term growth path to be driven by a similar process across countries while the short-term dynamics around the long-term equilibrium path differ because of idiosyncratic news and shocks to fundamentals. An alternative way to proceed is to run formal Hausman tests to accept or reject the implied restrictions, which is the step we describe in the subsequent section.

4.2. Estimation Results

In Figure 2 average growth (vertical axis) is plotted against the different measures of exchange rate volatility (horizontal axis) without differentiating between short-term and long-term growth. Most exhibit a downward-sloping inverse relationship between growth and exchange rate volatility thereby associating exchange rate stability with higher growth. Nevertheless in some cases, nonlinear patterns prevail. The graphical presentation serves only as a simple illustration of the link between an average growth and exchange rate volatility. For precise assessment of this pattern over time an econometric estimation is an imperative.

The econometric estimation results are presented in Tables 4 to 6. The null hypothesis of equality of coefficients between pooled mean group and mean group is in most cases rejected at 1 % level.⁵ The Hausman test favors the mean group model (Table 4) against the pooled mean group estimator (Table 5). The dynamic fixed effects estimates are presented in Table 6. All estimates support our main assumptions regarding the long- versus short-run impact of exchange rate volatility on growth and the more specific case of asymmetric countries.

The mean group results as presented in Table 4 suggest a negative effect of exchange rate volatility on growth in the long term and a positive effect of exchange rate flexibility on growth in the short term.⁶ For all three volatility measures (standard deviation, average yearly change, and z-score) exchange rate volatility has a highly significant negative effect on growth in the long term, when controlling for foreign interest rates, trade openness, and inflation. Both trade openness and the interest rate in the large reference country have the expected signs and a highly significant. This implies that open economies grow faster and the gradual decline of the interest rate level in the large reference countries (US, euro area, Germany) has boosted growth in the emerging market economies. In the long term higher growth levels are linked to higher inflation levels, associating expansionary monetary policies with higher growth.⁷

The short-run equation suggests a positive effect of exchange rate flexibility (volatility) on growth for standard deviation as volatility measure. The overall coefficients of the short-term impact of exchange rate flexibility on growth are negative for average exchange rate changes and positive for standard deviations and z-scores. The positive coefficient of standard deviations is significant at the 5% level. The interaction term for asymmetric business cycles reveals an additional positive effect of exchange rate flexibility on growth for all three

⁵ The test comparing mean group and dynamic fixed effects coefficients is reported in Table 5.

⁶ This is in line with Furceri and Zdzienicka (2011) who show that flexible exchange rates attenuate crises in the short and medium run but tend to have a negative effect on long-run growth, given that the cleansing effects did not materialize.

⁷ The inflation term is dropped from the equation in the specification with standard deviations as proxies for exchange rate volatility.

volatility measures, with standard deviations and z-scores being significant at the 5% level. This supports the view of exchange rate flexibility helps to smooth out asymmetric shocks in the short run.⁸ In the short-term equation inflation has mostly no significant impact on growth.

The results of the pooled mean group estimation are presented in Table 5. They are mainly in line with the mean group estimation and therefore can be regarded as evidence for the robustness of the results. The long-run effect of exchange rate volatility on growth is clearly negative, significant at the 1% level for all volatility measures. In the pooled mean group estimations inflation has no positive impact on growth. Openness and declining interest rates in the reference country are clearly associated with higher growth.

In contrast, in the short-term equation exchange rate flexibility in general seems to be positively linked to higher growth, with average exchange rate changes being significant at the 1% level and standard deviations at the 5% level (whereas the z-score remain statistically insignificant). The interaction term identifies an additional positive effect of exchange rate flexibility on growth for specifications with standard deviations and z-scores as volatility measures. In contrast in the long-term equation a statistically significant positive effect of expansionary monetary policy on growth is revealed.

The results of the dynamic fixed effects estimation are reported in Table 6. The negative long-term effect of exchange rate volatility on growth remains highly significant for all three volatility measures (except for specification (1), average change measure). There is no statistically significant long-term impact of expansionary monetary policy on growth. The highly significant impact of trade openness and interest rates cuts in the reference country on growth in our sample is confirmed. In the short-run equation a highly significant positive impact of exchange rate flexibility on growth is revealed (except for specification (1), average change measure). In contrast to the previous two estimation frameworks this result applies to both countries with comparatively synchronized as well as countries with idiosyncratic business cycles. The dynamic fixed effects estimation does not reveal any significant short-term link between inflation and growth.

All in all, the estimations provide evidence in favor of the hypothesis that in the short-run exchange rate flexibility helps to smooth the business cycle, in particular for countries with idiosyncratic business cycles. In contrast, in the long-run the impact of exchange rate volatility on growth is clearly negative. The positive impact of exchange rate flexibility on

⁸ Bubák et al. (2011) document the existence of volatility spillovers between the Central European foreign exchange markets as well as the fact that exchange rate volatility increases in medium-term for those countries with troubled financial sector development.

growth in the short-term supports the policy propositions of Keynes (1936), Hawtrey (1919), and Mundell (1961), whereas negative long-run impact of exchange rate volatility on growth is in line with Hayek (1937), Schumpeter (1911), and McKinnon (1963).

5. Conclusion

With the European sovereign debt crisis a controversial discussion concerning the appropriate monetary policy and exchange rate strategy to asymmetric shocks has reemerged. We have aimed to derive from our econometrical exercise for a panel of 60 countries a policy recommendation for crisis countries. Our estimation results have provided evidence that exchange rate adjustment stimulates growth in the short-term, but puts a drag on the long-term growth performance. As the overall effect is negative, the policy implication is to keep exchange rates stable to promote long-term growth via price and wage flexibility, in the spirit of the seminal research of Schumpeter (1911), Hayek (1937), and McKinnon (1963).

Based on our findings we recommend the crisis countries to proceed with structural reforms and real wage cuts. Painful restructuring and declining output today are likely to be rewarded with a robust economic recovery and rising income in the future. In contrast, monetary expansion and depreciation as a crisis solution strategy can be expected to provide short-term relief, but long-term pain. Mutual monetary expansion would lead into a wave of competitive depreciations and therefore global financial and economic instability. This would be an antidote of the coordinated structural reforms.

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Table 1: Adjustment Strategies and Mechanisms to Asymmetric Shocks

Strategy/Mechanism	Short-Term	Long-Term
Adjustment institution	government	market
Monetary policy	expansionary	tight
Exchange rate	flexible (Mundell 1961)	fix (McKinnon 1963)
Prices / wages	rigid	flexible
growth effects goods markets	Keynes (1936)	Schumpeter (1911)
growth effects capital markets	Hawtrey (1919)	Hayek (1931)

Table 2
Groups of countries

Country Group	Anchor Reference Country	Countries
EU15	Euro/DM Germany	Austria, Belgium, Denmark, Finland, France, Germany*, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden, UK
Emerging Europe	Euro/DM Germany	Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia
CIS	Dollar US	Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Ukraine
South Asia	Dollar US	China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand
Balkans	Euro/DM Germany	Albania, Bosnia-Herzegovina, Croatia, Macedonia, Serbia, Turkey
Latin America	Dollar US	Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Paraguay, Peru, Uruguay, Venezuela

* France, as the second largest country of the European Union, is used as a reference country for Germany.

Table 3
Data Description: Type, Definition, and Source

Data type	Definition	Source
Gross domestic product (GDP); \$ mln	Quarterly GDP; Real growth rate calculated as year- on-year quarterly change in GDP adjusted for inflation	IFS, October 2011, monthly edition
Goods exports; \$ mln	Quarterly goods exports;F.O.B.	IFS, October 2011, monthly edition
Goods imports; \$ mln	Quarterly goods imports; F.O.B.	IFS, October 2011, monthly edition
Trade integration	Import plus Export over GDP	IFS, October 2011, monthly edition
Exchange rate volatility	Standard deviation of monthly percent exchange rate changes (σ ; erstd).	IFS, October 2011, monthly edition
	Arithmetic average of percent exchange rate change (μ ; eraver)	IFS, October 2011, monthly edition
	z -score ($z = \sqrt{\sigma^2 + \mu^2}$; erzscore)	
Average inflation	Year-on-year quarterly change in consumer price index	IFS, October 2011, monthly edition
Interest rate	Quarterly short-term interest rate of the respective reference country	IFS, October 2011, monthly edition

Table 4 Short- and Long-Run Effects (mean group)

Variable	Exchange Rate Volatility Measures					
	Average change		Standard deviation		z-score	
	I	II	I	II	I	II
<i>Long-run coefficients</i>						
Time	-0.0013 ^a (0.0004)	-0.0016 ^a (0.0005)	-0.0009 ^b (0.0004)	-0.0010 ^b (0.0004)	-0.0012 ^a (0.0004)	-0.0013 ^a (0.0004)
Trade openness	0.2808 ^a (0.0911)	0.2975 ^a (0.0926)	0.2540 ^a (0.0838)	0.2564 ^a (0.0841)	0.2927 ^a (0.0922)	0.2997 ^a (0.0928)
ER volatility	-0.1840 (0.1894)	-0.7334 ^a (0.2587)	-0.9552 ^a (0.3008)	-1.0218 ^a (0.3334)	-0.6116 ^a (0.2625)	-0.6093 ^b (0.2652)
Inflation	0.2737 ^c (0.1536)	0.3119 ^b (0.1365)			0.3112 ^a (0.1146)	0.3165 ^a (0.1165)
Interest rate	-1.2151 ^a (0.4148)	-1.4087 ^a (0.4830)	-0.9563 ^a (0.3370)	-1.0026 ^a (0.3322)	-1.2629 ^a (0.4173)	-1.3023 ^a (0.4114)
<i>Short-run coefficients</i>						
Error correction coefficient	-0.3632 ^a (0.0316)	-0.3709 ^a (0.0342)	-0.3829 ^a (0.0311)	-0.3790 ^a (0.0309)	-0.3611 ^a (0.0256)	-0.3597 ^a (0.0261)
ER volatility	-0.0566 (0.0446)	0.1243 (0.0822)	0.1166 ^c (0.0629)	0.0568 (0.0754)	0.0411 (0.0530)	-0.0119 (0.0580)
ER volatility for asymmetric countries		0.0095 (0.0945)		0.1687 ^b (0.0700)		0.1225 ^b (0.0491)
Inflation	0.0295 (0.0269)	0.0181 (0.0268)	0.0436 ^c (0.0248)	0.0377 (0.0246)	0.0071 (0.0276)	-0.0019 (0.0287)
Intercept	-0.0321 (0.0224)	-0.0342 (0.0225)	-0.0346 ^c (0.0200)	-0.0304 (0.0199)	-0.030 (0.0221)	-0.0276 (0.0221)

Note: Significance levels at 1, 5, and 10% are denoted by ^a, ^b, and ^c, respectively. ER volatility denotes one of the three exchange rate volatility measures used; e.g. average change, standard deviation, and z-score. Columns denoted by I contain overall results and columns denoted by II contain results from specification including exchange rate volatility measure for asymmetric countries. Numbers in parentheses are standard errors.

Table 5 Short- and Long-Run Effects (pooled mean group)

Variable	Exchange Rate Volatility Measures					
	Average change		Standard deviation		z-score	
	I	II	I	II	I	II
<i>Long-run coefficients</i>						
Time	-0.0008 ^a (0.0001)	-0.0009 ^a (0.0001)	-0.0005 ^a (0.001)	-0.0005 ^a (0.0001)	-0.0013 ^a (0.0001)	-0.0014 ^a (0.0016)
Trade openness	0.0294 ^a (0.0072)	0.0372 ^a (0.0092)	0.0559 ^a (0.0111)	0.0581 ^a (0.0113)	0.0795 ^a (0.0153)	0.0856 ^a (0.0160)
ER volatility	-0.2498 ^a (0.0382)	-0.7184 ^a (0.1201)	-0.8403 ^a (0.0672)	-0.8618 ^a (0.0677)	-0.8576 ^a (0.0949)	-0.8833 ^a (0.0985)
Inflation	0.0110 (0.0227)	0.0161 (0.0234)			0.0046 (0.0250)	0.0080 (0.0256)
Interest rate	-0.8989 ^a (0.1848)	-1.0427 ^a (0.1937)	-0.3793 ^a (0.1229)	-0.3733 ^a (0.1217)	-0.9544 ^a (0.1828)	-0.9968 ^a (0.1861)
<i>Short-run coefficients</i>						
Error correction coefficient	-0.2407 ^a (0.0187)	-0.2374 ^a (0.0172)	-0.2681 ^a (0.0224)	-0.2653 ^a (0.0227)	-0.2416 ^a (0.0163)	-0.2367 ^a (0.0155)
ER volatility	0.0572 ^a (0.0050)	0.1387 (0.0873)	0.0845 ^b (0.0433)	0.0108 (0.0512)	0.0476 (0.0346)	-0.0135 (0.0356)
ER volatility for asymmetric countries		-0.0061 (0.1158)		0.1471 ^b (0.0588)		0.1170 ^b (0.0517)
Inflation	0.0577 ^b (0.0286)	0.0410 ^c (0.0215)	0.0412 ^b (0.0186)	0.0390 ^b (0.0185)	0.0377 ^c (0.0199)	0.0336 ^c (0.0196)
Intercept	0.0190 ^a (0.0020)	0.0204 ^a (0.0021)	0.0111 ^a (0.002)	0.0105 ^a (0.0021)	0.0197 ^a (0.0025)	0.0191 ^a (0.0026)
Hausman test (mean against pooled mean group)		20.23 [0.0011]		11.64 [0.0202]		16.97 [0.0045]

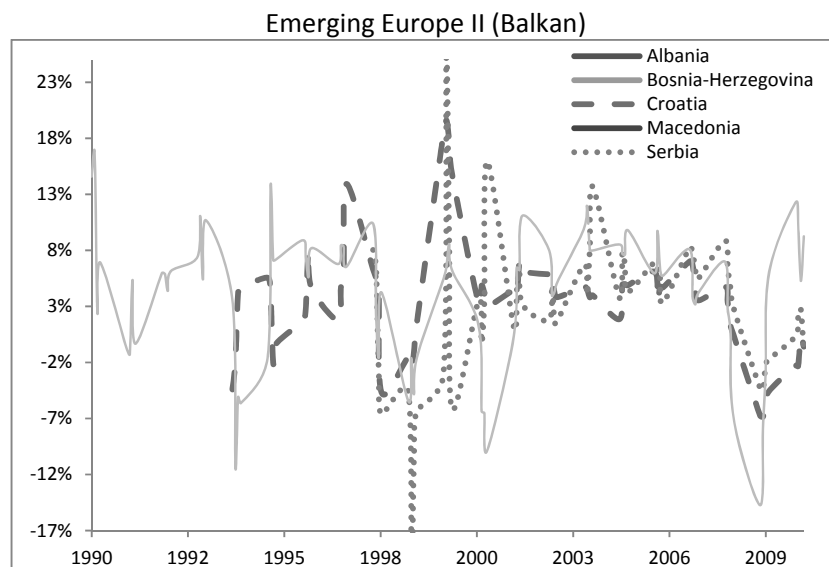
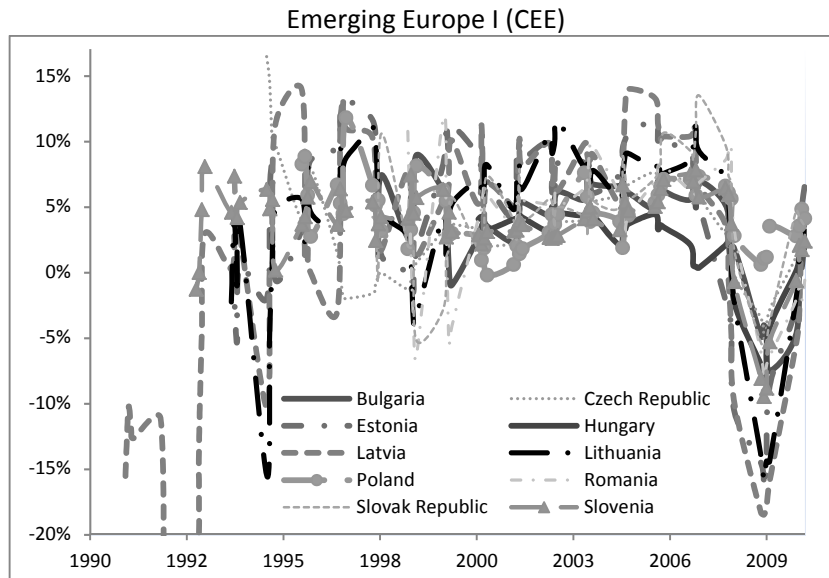
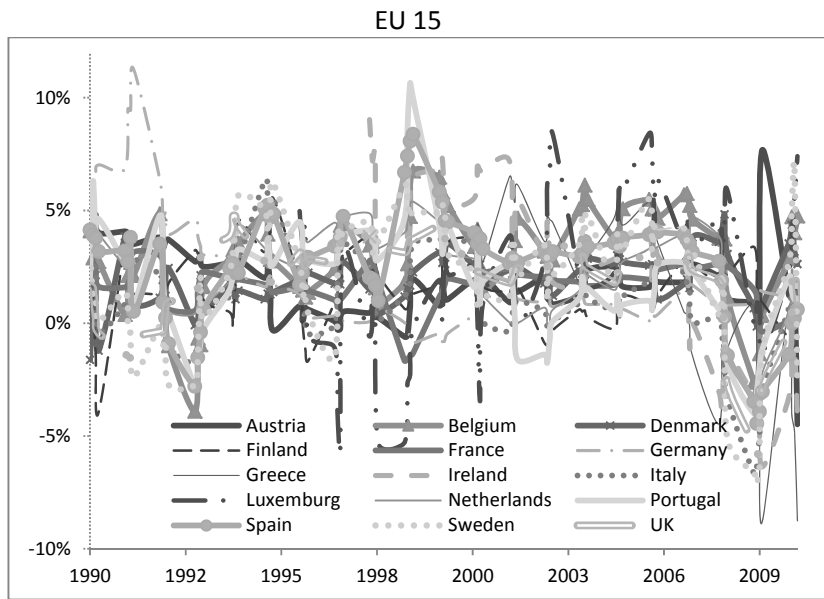
Note: Significance levels at 1, 5, and 10% are denoted by ^a, ^b, and ^c, respectively. ER volatility denotes one of the three exchange rate volatility measures used; e.g. average change, standard deviation, and z-score. Columns denoted by I contain overall results and columns denoted by II contain results from specification including exchange rate volatility measure for asymmetric countries. Numbers in parentheses are standard errors. *p*-values for Hausman test are indicated in brackets.

Table 6 Short- and Long-Run Effects (dynamic fixed effects)

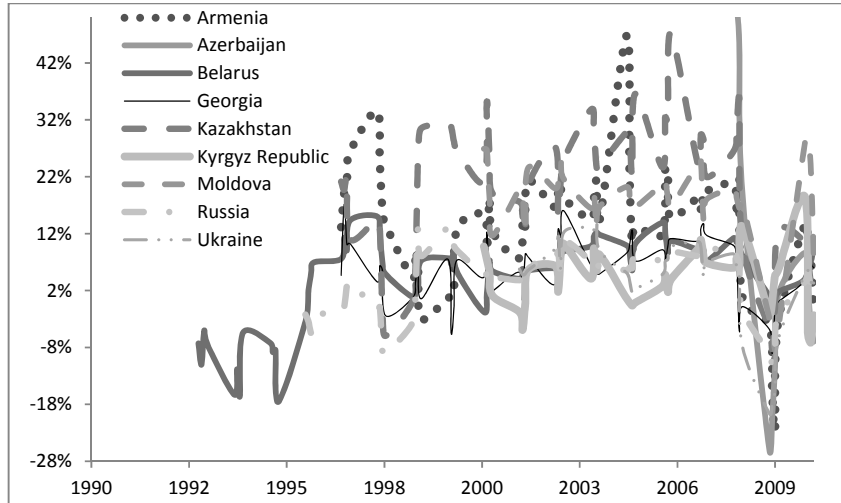
Variable	Exchange Rate Volatility Measures					
	Average change		Standard deviation		z-score	
	I	II	I	II	I	II
<i>Long-run coefficients</i>						
Time	-0.0007 ^b (0.0002)	-0.0009 ^a (0.0003)	-0.0008 ^a (0.0002)	-0.0008 ^a (0.0030)	-0.0008 ^a (0.002)	-0.0008 ^a (0.0003)
Trade openness	0.0530 ^b (0.0190)	0.0620 ^a (0.0198)	0.0518 ^b (0.0205)	0.0518 ^b (0.0204)	0.0502 ^a (0.0177)	0.0503 ^a (0.0178)
ER volatility	0.5723 ^a (0.1067)	-1.0198 ^a (0.1642)	-0.8444 ^a (0.1983)	-0.8501 ^a (0.1907)	-0.7056 ^a (0.1767)	-0.7035 ^a (0.1748)
Inflation	0.0048 (0.0459)	0.0382 (0.0305)			0.0282 (0.0353)	0.0283 (0.0353)
Interest rate	-0.5890 ^b (0.2033)	-0.6756 ^a (0.2004)	-0.5612 ^a (0.1890)	-0.5615 ^a (0.1894)	-0.5828 ^a (0.1941)	-0.5833 ^a (0.1935)
<i>Short-run coefficients</i>						
Error correction coefficient	-0.2676 ^a (0.0207)	-0.2734 ^a (0.0184)	-0.2744 ^a (0.0181)	-0.2745 ^a (0.0181)	-0.2740 ^a (0.0183)	-0.2740 ^a (0.0183)
ER volatility	-0.1531 ^a (0.0261)	0.1153 ^a (0.0264)	0.1122 ^a (0.0423)	0.1156 ^a (0.0372)	0.0805 ^a (0.0312)	0.0778 ^a (0.0280)
ER volatility for asymmetric countries		0.0479 (0.0431)		-0.0086 (0.0420)		0.0078 (0.0276)
Inflation	-0.0032 (0.0134)	-0.0093 (0.0120)	-0.0101 (0.0120)	-0.0101 (0.0120)	-0.0103 (0.0122)	-0.0104 (0.0122)
Intercept	0.0114 ^b (0.0051)	0.0125 ^b (0.0052)	0.0156 ^a (0.0052)	0.0157 ^a (0.0053)	0.0167 ^a (0.0049)	0.0168 ^a (0.0050)

Note: Significance levels at 1, 5, and 10% are denoted by ^a, ^b, and ^c, respectively. ER volatility denotes one of the three exchange rate volatility measures used; e.g. average change, standard deviation, and z-score. Columns denoted by I contain overall results and columns denoted by II contain results from specification including exchange rate volatility measure for asymmetric countries. Numbers in parentheses are standard errors.

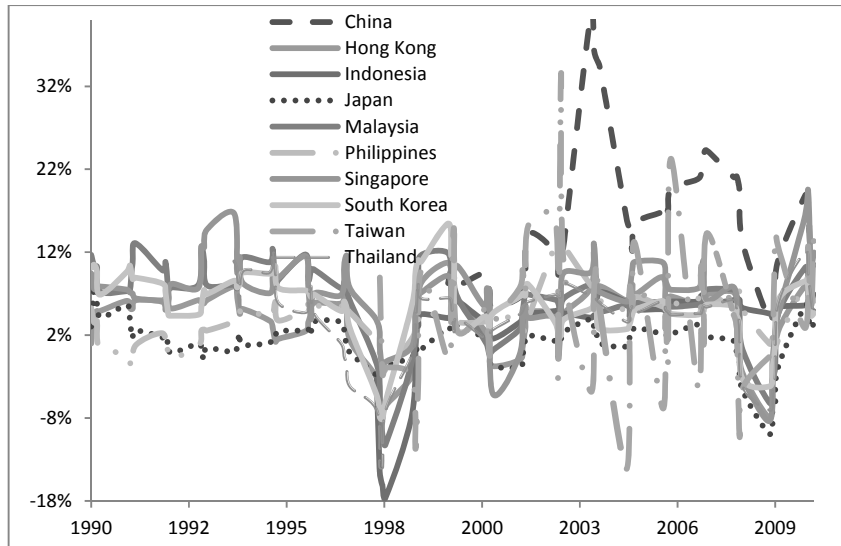
Figure 1. Growth rates by groups of countries



CIS



South Asia



Latin America

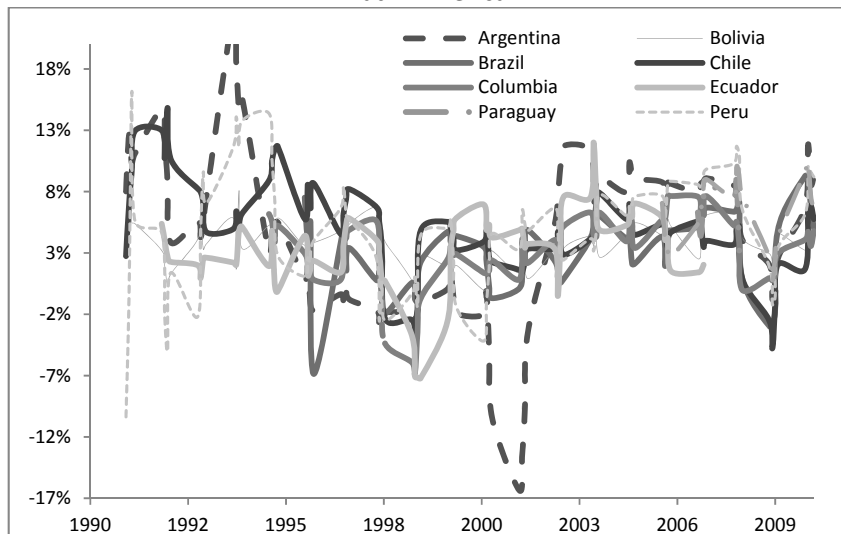


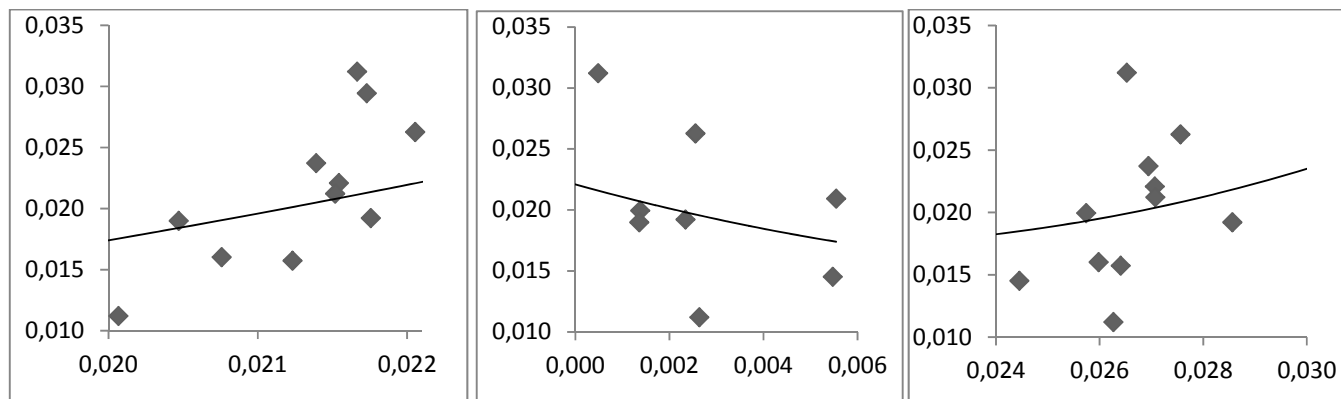
Figure 2. Growth and exchange rate volatility
 (Vertical axis: GDP growth, horizontal axis: exchange rate volatility - three measures)

Standard deviation

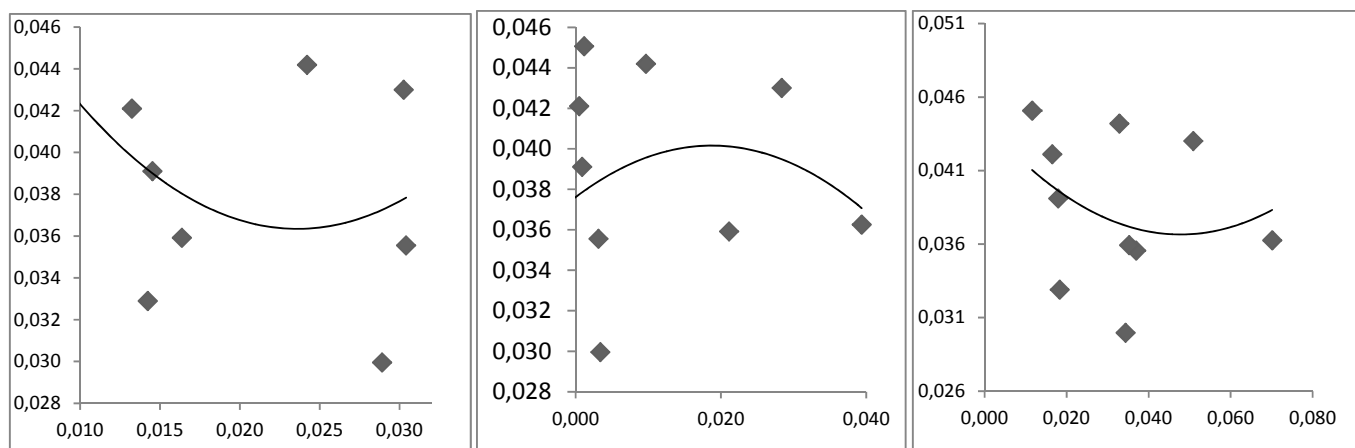
Arithmetic average

z-score

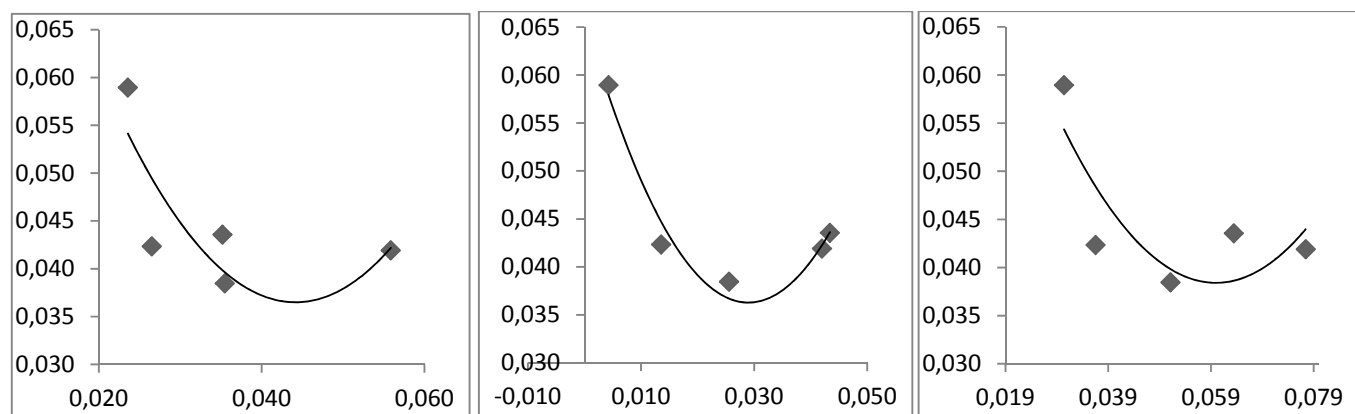
EU 15



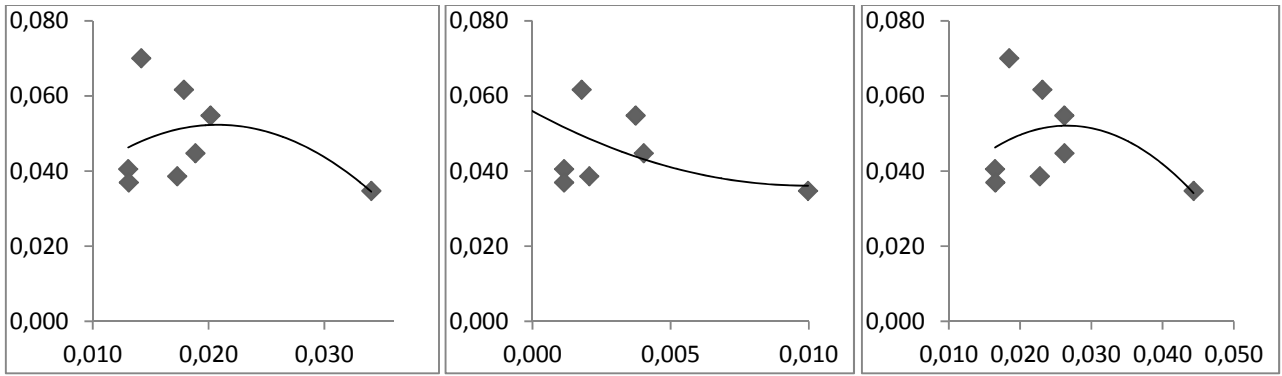
Emerging Europe



CIS



East Asia



South America

