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Currency Undervaluation and Economic Growth in Central and Eastern European Countries

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Abstract

This paper analyzes the relationship between currency undervaluation and economic growth in Central and Eastern European (CEE) countries. Rodrik (2008) finds that, in general, developing countries experience higher economic growth when their currency is undervalued. We show that, due to their relatively rapid transition from centrally-planned to market systems, CEE economies are not expected to behave in the same manner as other developing countries. We use Rodrik's procedure of quantifying the undervaluation of a currency, and a sample of 12 countries with about 20 years of data to run panel data regressions with various control variables. In all instances we find that, for the CEE countries, currency undervaluation is associated with reduced economic growth.

Keywords: exchange rates, purchasing power parity, economic growth, CEE countries

1. Introduction

An increasing literature, starting with Rodrik (2008), shows that currency undervaluation promotes economic growth in developing countries (but not in developed countries). However, Fabrizio et al. (2010) look at developing countries in different areas in the world and they find striking differences. They divide developing countries into Central and Eastern European (CEE), East Asian, and Latin American countries.

Fabrizio et al. (2010) point out that, in 1995, the average real GDP per capita for the CEE countries was 29% of the US real GDP per capita and it went up to 41% in 2007. In East Asian countries, it was around 40% in 1995 and it kept increasing to about 45% in 2007 (a slow-down in part due to the Asian crisis of 1997-98). For the Latin American countries, it has stayed below 25% since 1995. In terms of exchange rates, CEE countries experienced real appreciation, Asian countries – real depreciation, and Latin American countries – flat exchange rates.

Therefore, it makes sense to treat CEE countries differently from other developing countries, and that is exactly what we do in this paper: We analyze the relationship between undervaluation and economic growth in CEE countries. The transition from centrally-planned to free market economy took place fairly rapidly (in a matter of two decades) for the CEE countries, therefore their experience with a market economy is very different from that in the developed world and even from the experience in the rest of the developing world.

First, we use Rodrik's (2008) procedure to compute a measure of currency undervaluation. Then, using different control variables, we test whether the relationship between currency undervaluation and economic growth for CEE countries is the same as the one found, for instance, in Rodrik (2008) and Razmi et al. (2012) for developing countries. Our results do not match any of these papers. We find that currency undervaluation is actually negatively associated with economic growth.

The rest of the paper is organized as follows. The next section provides a brief literature review on the relationship between undervaluation and economic growth. Section 3 describes the theoretical model, while section 4 analyzes the empirical model. Section 5 concludes.

2. Literature Review

Even though the discussion on how currency undervaluation can affect economic growth intensified in the 1990s, it was not an entirely new idea. In their seminal work, Barro and Gordon (1983) believe that keeping a currency

undervalued involves an expansionary monetary policy. This in turn creates inflation, but does not affect real economic growth. This line of thought is continued by the so-called "Washington Consensus" (WC) (Williamson, 1990).

The WC regards currency manipulation by the government as a harmful strategy. Overvaluation in particular is considered to be malignant, but undervaluation is also harmful to the economy because, if the exchange rate is too competitive, it generates unnecessary inflationary pressures and limits resources for domestic investment. Eichengreen (2008) suggests that exchange rate volatility is not beneficial for economic growth. He advocates that keeping the real exchange rate (RER) at competitive levels can help jump-start economic growth, but does not substitute the need for a more mature institutional system. This means that, eventually, the policymakers will have to stop influencing the exchange rate. Eichengreen et al. (1998) and Eichengreen (1999) suggest that abandoning this policy should be done while confidence is still strong and while growth is still rapid. A number of papers (Cottani et al., 1990; Dollar, 1992; Ghura & Grennes, 1993) find that there is a negative relationship between RER misalignment and economic growth.

Essentially, the WC view suggests that a high degree of overvaluation hinders economic growth because it might be associated with corruption, rent seeking, foreign currency shortages, and other macroeconomic problems. Conversely, Hausmann et al. (2005) notice that, in order for growth to happen, a country needs more investment, more exports, and a more competitive RER. These are the starting points in Rodrik (2008). He shows empirically that, especially in the case of developing countries, currency undervaluation leads to economic growth.

Rodrik's (2008) model is linear, in that overvaluation is "bad" and undervaluation is "good". As previously noted, the WC characterizes any currency misalignment as "bad". Berg and Miao (2010) show that Rodrik's (2008) mirror image findings hold. However, after controlling for fundamentals, deviations from fundamental real exchange rates (as used in WC) and not deviations from PPP (as used in Rodrik, 2008) explain long-term economic growth. Therefore, Berg and Miao's (2010) results are inconclusive (with slightly stronger results for the WC view).

In recent years, in part as a reaction to Rodrik (2008), the literature on how currency undervaluation leads to economic growth has expanded considerably. Sosa and Magud (2010) offer a comprehensive literature review of the different currents of thought on the effects of currency depreciation on economic growth. Rapetti et al. (2012) test Rodrik's (2008) model using different criteria for categorizing the various countries into developed and developing countries. Even though the threshold used matters, their results are still in agreement with Rodrik (2008). According to Levy-Yeyati et al. (2013), due to increase in globalization, developing countries are finding their monetary policies more and more ineffective, as capital flows are increasingly difficult to control. Therefore, countries start focusing on the side of the *impossible trinity* that they can control: exchange rates. Levy-Yeyati et al. (2013) conclude that the *fear of appreciation* is the prevailing trend in countries with active exchange rate policies.

Prasad et al. (2007) and Gala (2008) find a negative relationship between overvaluation and economic growth, while Berg et al. (2012) conclude that avoiding currency overvaluation leads to longer growth spells. Razin and Collins (1999) and Aguirre and Calderón (2005) analyze RER misalignments and find asymmetries in their relationship with economic growth, in that only overvaluation slows down economic growth.

Empirically, Rodrik's (2008) results hold well for developing countries. However, the literature fails to agree on what causes the symmetry that he observes in the developing world. Rodrik (2008) argues that tradable economic activities are "special", as they benefit from more learning-by-doing externalities and technological spillovers than the non-tradable sector. A more competitive currency leads to an increased focus on the tradable sector and a shift in resources from the non-tradable sector. Moreover, the developing countries have areas with substantial hidden unemployment in the non-tradable sector and this shift utilizes those unemployed resources, leading to economic growth. So, Rodrik (2008) considers that the exporting industry is a "special" industry, as it creates positive externalities. However, Eichengreen (2008) argues that these externalities are inconclusive and usually indirect. He concludes that, even though an undervalued currency can jump-start growth, long-term economic growth should be based on strong fundamentals. Conversely, Razmi et al. (2012) notice a positive relationship between capital accumulation, undervaluation and economic growth especially in developing countries.

Alternatively, according to the neo-mercantilist view, a depreciated currency increases exports, decreases imports and thus leads to economic growth. Levy-Yeyati et al. (2013) reject this channel, claiming that the volume of exports, as well as export diversification (a proxy for export quality) are unaffected by a central bank's intervention on currency. Dooley et al. (2005) and Prasad et al. (2007) suggest that a depreciated currency leads

to higher interest rates, which in turn increase savings. Levy-Yeyati et al. (2013) empirically find that real depreciation does lead to an increase in savings and investments and therefore leads to economic growth. Nevertheless, Montiel and Servén (2008) find no empirical or theoretical link between higher savings and undervalued currencies.

3. Theoretical Model

The RER, *Q*, is a function of the nominal spot exchange rate (*S*, expressed as domestic currency per foreign currency) and the price levels in the two analyzed countries:

$$Q = S \times \frac{P^*}{P} \tag{1}$$

where *P* is the price level in the home country and P^* is the price level in the foreign country.

We assume that the economic activity in a country can be divided into two sectors: a tradable (T) and a non-tradable (NT) sector. Therefore, the price level can be written as a geometric weighted average of the prices in the T sector and NT sector (Note 1).

$$P = P_{NT}^{\alpha} P_T^{1-\alpha} \text{ and } P^* = P_{NT}^{*\propto} P_T^{*1-\alpha}, \tag{2}$$

where α is the share of the NT sector in the economies of the home and foreign country, respectively (Note 2).

Plugging equation (2) into equation (1) yields:

$$Q = S \times \frac{P_T^*}{P_T} \times \frac{(P_{NT}^*/P_T^*)^{\alpha}}{(P_{NT}/P_T)^{\alpha}} \tag{3}$$

This equation tells us that the RER changes if the ratio between the prices of NT and T goods changes in any of the two countries. Moreover, if we assume that Purchasing Power Parity (PPP) holds for tradable goods, then we can conclude that:

$$Q = \frac{(P_{NT}^*/P_T^*)^{\alpha}}{(P_{NT}/P_T)^{\alpha}} \tag{4}$$

Taking the logarithm of both sides of equation (4) and representing the log-variables with lowercase letters, we obtain:

$$q = \alpha(p_{NT}^* - p_T^*) - \alpha(p_{NT} - p_T) \tag{5}$$

Taking first differences, we obtain:

$$\Delta q = \alpha(\Delta p_{NT}^* - \Delta p_T^*) - \alpha(\Delta p_{NT} - \Delta p_T) \tag{6}$$

Intuitively, if the relative price of the NT goods (with respect to the traded goods) in the home country rises, or the relative price of the NT goods (with respect to the traded goods) in the foreign country decreases, then we say that the RER depreciates.

The Balassa-Samuelson effect can explain this observation. The hypothesis is that economic growth is usually associated with an increase in productivity for T goods, which in turn leads to a decrease in their prices relative to the NTs. According to equation (6), *q* should fall. In this paper, we intend to verify whether that is the case for the CEECs.

There is actually a straightforward way to relate productivity growth to the RER. Profit maximization implies that:

$$\frac{W_T}{P_T} = MPL_T \text{ and } \frac{W_{NT}}{P_{NT}} = MPL_{NT} \tag{7}$$

where *W* and *MPL* are the wage and the marginal product of labor in the home country, respectively. Labor market equilibrium requires that wages equalize within the borders of a country:

$$W_T = W_{NT} \tag{8}$$

From equations (7) and (8), it follows that:

$$\frac{MPL_T}{MPL_{NT}} = \frac{P_{NT}}{P_T} \tag{9}$$

Same analysis can be done for the foreign country:

$$\frac{MPL_T^*}{MPL_{NT}^*} = \frac{P_{NT}^*}{P_T^*} \tag{10}$$

Therefore, equation (3) can be re-written as:

$$Q = S \times \frac{P_T^*}{P_T} \times \left(\frac{MPL_T^*/MPL_{NT}^*}{MPL_T/MPL_{NT}}\right)^{\propto} \quad (11)$$

We can safely assume that $MPL_{NT} = MPL_{NT}^*$, due to the nature of the NT goods. Intuitively, a good example of NT goods is haircuts. It is fair to assume that haircuts use similar technologies and capital in different countries; therefore the productivities in different countries are also comparable. Also assuming that PPP holds (just like before), equation (11) is transformed into:

$$Q = \left(\frac{MPL_T^*}{MPL_T}\right)^{\propto} \quad (12)$$

Taking logs and the first difference yields:

$$\Delta q = \alpha \Delta mpl_T^* - \alpha \Delta mpl_T \quad (13)$$

Equation (13) tells us that an increase in productivity in the home country relative to the foreign country is associated with a decrease in the RER (i.e., a real appreciation of the home currency).

Let us analyze if this is what the CEECs actually experienced in their transition years. Fabrizio et al. (2010) divide the transition into two waves. The initial wave ends in 1995, then a second wave of increased economic sophistication and globalization follows (including the accession to the European Union – hereafter EU – for most CEECs). We analyze the two time periods separately, as follows.

The capital stock to labor force ratio in the CEECs was high around 1990 (when the transition to market economies started). Doyle et al. (2001) show that after World War II, the CEE economies initially grew at an impressive pace due to a high accumulation of capital and a shift from agriculture to industry. That growth spell did not last too long though, due to the same fact that had generated it in the first place: emphasis on the heavy industry and neglect of the light industry. Sachs (1996a) notices that "this heavy industry was not only vastly inefficient, frequently producing negative value-added outputs when measured in world prices, but it was also unsustainable, since it depended upon foreign borrowing, resource depletion, and environmental despoliation" (p. 130). Soon after the transition started, during the first wave, this state of affairs became clear. Even in the 1990s, as Égert et al. (2003) report, CEECs were still experiencing a low productivity, due this time not only to a small capital stock, but also to poor governance, weak public administration, insufficient legislature, and lack of know-how. During those years, these countries were mainly exporting food, manufactured goods and machinery of low quality and technological content. Equation (13) suggests that during those times, when the productivities were low, the currency was also depreciated.

Halpern and Wyplosz (1997) note that the currencies of the CEE countries were extremely undervalued when the transitions to market economies started. This was due to their initial collapse and also due to the capital flight right after the transition to capitalism started. The different currency exchange rate systems for our sample of 12 countries are presented in Table 1 (Note 3). We choose these 12 CEE countries based on data availability and also based on their popularity in the literature (Note 4). Figure 1 synthesizes the observations from Table 1. As can be seen, a downward movement of floaters, before 1995, is followed by an upward trend in their number (and proportion), after 1995. Most of the gain in flexibility comes from a reduction in the number of soft pegs, while the more tightly managed arrangements (hard pegs) have remained fairly constant in number, accounting for an average proportion of roughly 22 percent. With only two exceptions (1993 and 2008), the share of conventional fixed pegs has also remained constant (at 8.3 percent). The intermediate pegs have thinned out, from a maximum share of 50 percent (in 1995 and 1996), down to 8.3 percent (towards the end of our sample period).

Table 1. De facto classification of exchange rate regimes in CEECs, 1993-2013

	ALB	BGR	HRV	CZE	EST	HUN	LVA	LTU	POL	ROU	SVK	SVN
1993	0	0	0	1	3	1	0	0	0	0	0	1
1994	0	0	1	1	3	1	2	3	0	0	1	1
1995	0	0	1	1	3	1	2	3	1	0	1	1
1996	0	0	1	1	3	1	2	3	1	0	1	1
1997	0	3	1	0	3	1	2	3	1	0	1	1
1998	0	3	1	0	3	1	2	3	1	0	1	1
1999	0	3	1	0	3	1	2	3	1	0	1	1
2000	0	3	1	0	3	1	2	3	0	0	1	1
2001	0	3	1	0	3	1	2	3	0	1	0	1
2002	0	3	0	0	3	1	2	3	0	1	1	1
2003	0	3	0	0	3	1	2	3	0	1	0	1
2004	0	3	0	0	3	1	2	3	0	1	0	1
2005	0	3	0	0	3	1	2	3	0	0	1	1
2006	0	3	0	0	3	1	2	3	0	0	1	1
2007	0	3	0	0	3	1	2	3	0	0	1	0
2008	0	3	2	0	3	0	2	3	0	0	1	0
2009	0	3	0	0	3	1	2	3	0	1	0	1
2010	0	3	1	0	3	0	2	3	0	0	0	0
2011	0	3	1	0	0	0	2	3	0	0	0	0
2012	0	3	1	0	0	0	2	3	0	0	0	0
2013	0	3	1	0	0	0	2	3	0	0	0	0

Note. The table reports the annual, de facto exchange rate arrangement for each CEE country in our sample. Following Markiewicz (2006), we name the categories as follows: 0/ float (independently or managed floating), 1/ intermediate (peg within horizontal bands, crawling peg, or crawling band), 2/ peg (conventional fixed peg), and 3/ hard peg (currency board). Sources: Annual Report on Exchange Arrangements and Exchange Restrictions (various issues), Reinhart and Rogoff (2002), and Markiewicz (2006).

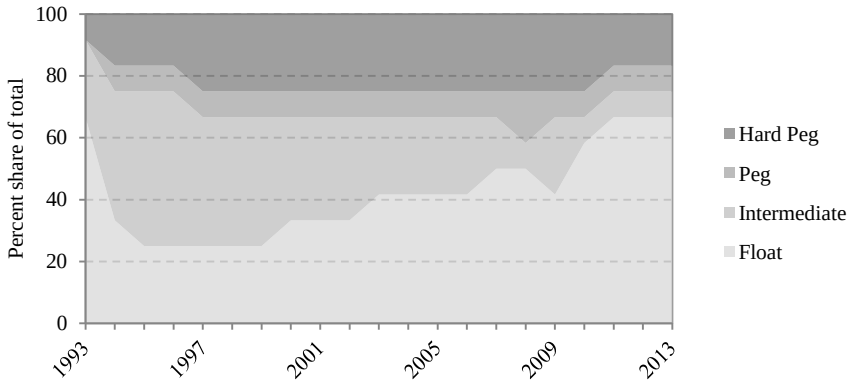

Figure 1. Evolution of de facto exchange rate regimes, 1993-2013

Note. The figure shows the distribution of exchange rate arrangements for our sample of CEE countries: Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia. The regimes are classified as floating, soft pegs, and hard pegs. Following Markiewicz (2006), we further divide soft pegs into intermediate and conventional fixed peg arrangements. Details about each category are presented in Table 1. Sources: Annual Report on Exchange Arrangements and Exchange Restrictions (various issues), Reinhart and Rogoff (2002), and Markiewicz (2006).

Even if arguably a pegged rate had been better suited to those countries at the start of their transition, under IMF advice, many CEECs quickly adopted a floating rate (Note 5). With double- or even triple-digit inflation rates that lasted for several years in these countries and no prior experience with currency convertibility, it was only natural that the CEE currencies were depreciated. Therefore, we can safely say that the relationship described in equation (13) holds for the beginning of the 1990s. Figure 2 shows the evolution in time of the RERs, computed using the formula in equation (1). A high RER represents a depreciated currency. It is obvious that in the 1990s, all currencies were struggling with RER depreciation. For some of them (e.g., Hungary), it was more severe than for others (e.g., Slovenia), but the initial turmoil, in which currencies were trying to achieve an equilibrium was evident in all cases. In the late 1990s, all currencies started a process of real appreciation, a trend which continued until the end of our sample period (with the exception of the global recession of 2008-09).

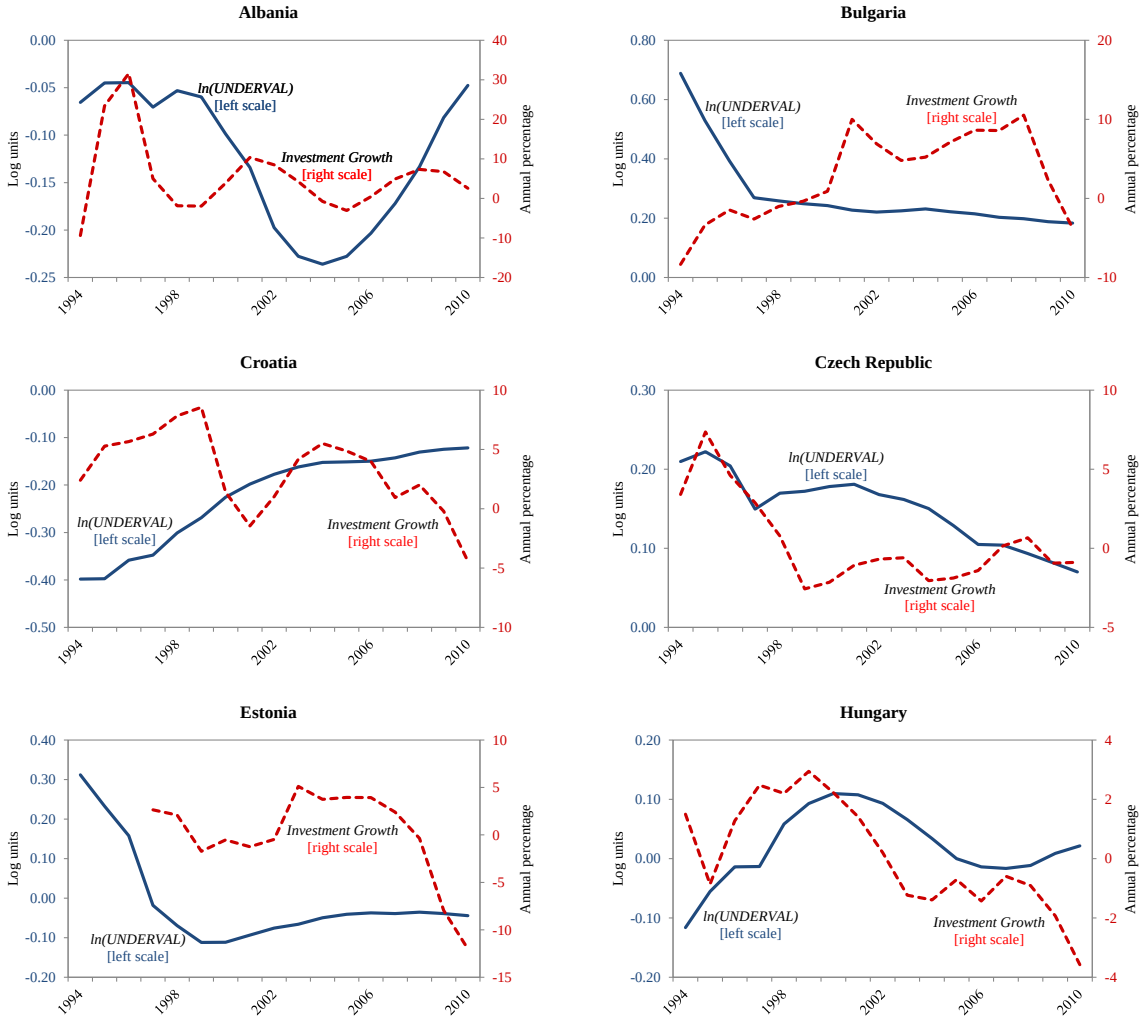

Figure 2. Panel A. Relationship between investment growth and currency undervaluation

Note. The figure shows the evolution in time of the capital accumulation (or investment growth) and currency undervaluation for six of the 12 analyzed CEE countries, from the beginning of the 1990s until 2010. Capital accumulation is computed as the average annual growth rate of gross fixed capital formation, over 5-year periods (data source: World Bank and OECD National Accounts data files). It is measured relative to the vertical right-hand scale. Undervaluation more exactly, the natural logarithm of the variable UNDERVAL) is computed according to equations 14 – 16 and is measured relative to the vertical left-hand scale.

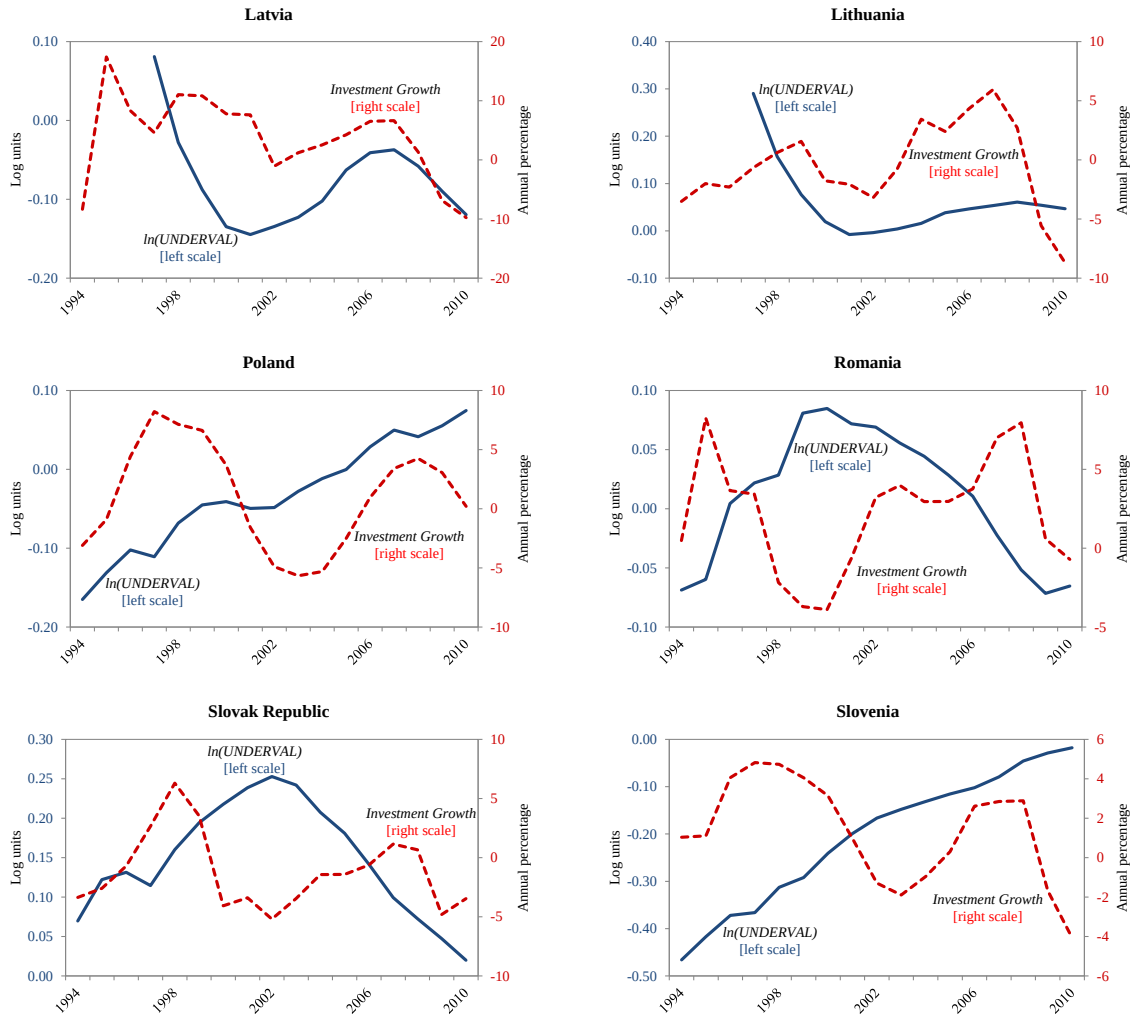

Figure 2. Panel B. Relationship between investment growth and currency undervaluation

Note. The figure shows the evolution in time of the capital accumulation (or investment growth) and currency undervaluation for six of the 12 analyzed CEE countries, from the beginning of the 1990s until 2010. Capital accumulation is computed as the average annual growth rate of gross fixed capital formation, over 5-year periods (data source: World Bank and OECD National Accounts data files). It is measured relative to the vertical right-hand scale. Undervaluation (more exactly, the natural logarithm of the variable *UNDERVAL*) is computed according to equations 14 – 16 and is measured relative to the vertical left-hand scale.

It is important to note that the CEECs have very strong relationships with the euro zone, as most of them joined the EU during our sample period (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia on May 1, 2004, then Romania and Bulgaria on January 1, 2007). Frankel and Rose (1998) notice that countries with closer trading relationships also have more correlated business cycles. Additionally and more importantly for our research, at the time of the adherence, all of them were also expected to join the euro zone at some point in the future (as none of them requested an opt-out from the monetary union), which in fact happened for five of them: Slovenia (2007), Slovakia (2009), Estonia (2011), Latvia (2014), and Lithuania (2015). In order to adopt the euro, a country needs to meet the five currency convergence criteria established by the Maastricht Treaty of 1992 regarding inflation, budget deficit, government debt, interest rates, and stable exchange rates. For our research, this issue is important as it involves the possible existence of economic convergence in terms of real output, but also in terms of monetary variables and exchange rates. The literature on this issue shows heterogeneity on all fronts for CEECs. For instance, Hayes and Hayes (2016) use cluster analysis and find that Slovakia, Latvia, and Estonia show some similarity with a cluster composed of Western European countries (surprising given that they joined the euro around the Great Recession of 2008-09), but as a whole the countries in the euro zone are still very complex and the differences and similarities among them are ever changing. Earlier research, such as Boone and Maurel (1998) cannot find a strong correlation between the whole EU and

the accession countries in terms of business cycles, while Kočenda (1999) shows that some of the CEECs are converged to some extent in terms of industrial production. Furthermore, Korhonen (2003) finds very low correlation in terms of business cycles, but higher integration for Hungary and Slovenia (as opposed to Romania, for instance). Based on the methodological model of convergence establishing the optimal conditions for adhering to a monetary union proposed by Bayoumi and Eichengreen (1993), Brada et al. (2005) find little cointegration between newly joined and older members in terms of base money and real output, but more cointegration in terms of M2 and inflation. Kutan and Zhou (2008) analyze the variance and persistence of RER between Germany (as the benchmark country for "old" EU) and new members and find that RER convergence improved over time for some countries, such as Estonia and Slovenia. In our sample, the undervaluation pattern also shows great heterogeneity among CEE countries (see Figure 2).

4. Results

In order to compute the undervaluation of each currency, we use Rodrik's (2008) PPP-based approach (Note 6). We collect data on the nominal exchange rates (*XRAT*) and the purchasing power parity conversion factor (*PPP*) from the Penn World Tables 7.1, in order to compute the real exchange rates (*RER*), as follows:

$$RER_{it} = XRAT_{it}/PPP_{it}, \tag{14}$$

where *i* is the country and *t* is the year.

Both exchange rates are expressed in local currency per US dollar. In order to correct for the fact that real exchange rates can diverge from equilibrium in the short- and medium-run, we use 5-year averages. If *RER* is greater than one, it means that the currency is more depreciated than the *PPP* indicates, and vice versa.

Since *PPP* considers both tradable and non-tradable goods, we need to control for the Balassa-Samuelson effect and hence we use the following regression model:

$$ln(RER_{it}) = \beta_0 + \beta_1 ln(RGPDPC_{it}) + f_t + \varepsilon_{it} \tag{15}$$

where *RGDPC* is the real GDP per capita, while *f* accounts for time fixed effects.

We obtain $\widehat{\beta_1}$ = –0.30, statistically significant at the 1% level. The sign is in line with Balassa-Samuelson prediction, but the effect here is slightly stronger than in Rodrik (2008). Intuitively, an increase in real income by 10% leads to a decrease (i.e., an appreciation) in RER of 3% (compared to a lower 2.4% obtained by Rodrik, 2008).

The undervaluation index is the ratio between the actual and the estimated *RER*:

$$UNDERVAL_{it} = RER_{it}/\widehat{RER_{it}} \tag{16}$$

Defined this way, the index makes comparisons among countries possible. A value greater than one indicates that a country has an undervalued currency, with relatively less expensive goods in the international markets. A value less than one indicates an overvalued currency. We will be using the natural logarithm of this index. Its distribution is represented in Figure 3 and has a sample mean of 0 and standard deviation of 0.17 (Rodrik, 2008, finds the same mean, but a larger standard deviation, which is expected due to his much larger dataset with 181 countries, over more than 50 years).

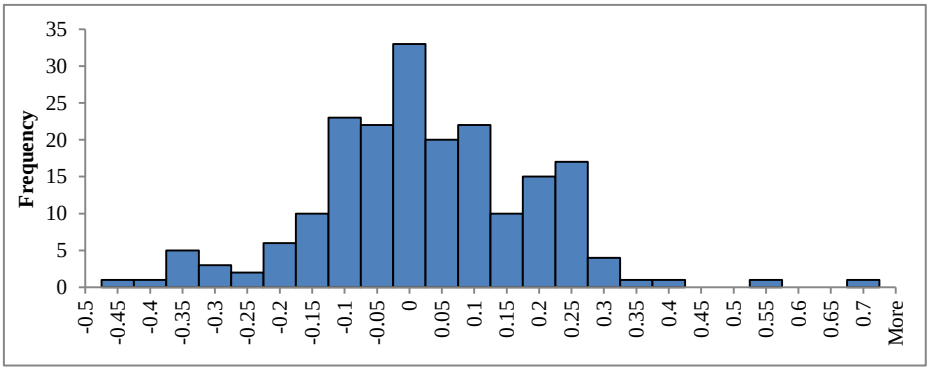

Figure 3. Frequency distribution of ln(*UNDERVAL*)

Note. The figure shows the frequency distribution of ln(*UNDERVAL*), as defined in equations 14 – 16, for our sample of 12 CEE countries, over a time interval 1990 – 2010. The mean value is 0 and the standard deviation is 0.17. The minimum and maximum values are -0.47 and 0.69, respectively.

Next, we test our hypothesis that undervaluation is actually associated with negative economic growth in CEE countries. For that, we use the following econometric model:

$$GROWTH_{it}=\beta_0+\beta_1 ln(RGDPC_{it-1})+\beta_2 ln(UNDERVAL_{it})+\gamma X_{it}+f_t+f_i+\varepsilon_{it} \quad (17)$$

The dependent variable is the annual growth rate of real GDP per capita. The lagged real GDP per capita accounts for the convergence effect, while f_t and f_i are included for the fixed time and cross-section effects, respectively (Note 7). All other independent variables and their sources are presented in Table 2.

Table 2. List of variables – definitions and data sources

Variable	Explanation	Source
GROWTH	$\ln(RGDPC_t/RGDPC_{t-5})^{0.2}-1$	authors' calculations
RGDPC	PPP Converted GDP Per Capita (Laspeyres), at 2005 constant prices.	PWT 7.1
UNDERVAL	equations 14 - 16.	authors' calculations
XRAT	Nominal Exchange Rate to US dollar.	PWT 7.1
PPP	Purchasing Power Parity over GDP (in national currency units per US dollar).	PWT 7.1
OPENC	Openness at 2005 constant prices (%).	PWT 7.1
LAW	Law & Order index (yearly averages) with values 1-6 (1=worst law; 6=best law).	ICRG
EXTERNAL_DEBT	Total external debt stocks to gross national income.	World Bank, International Debt Statistics.
TOT	The terms of trade effect equals capacity to import less exports of goods and services in constant prices. Data are in constant local currency.	World Bank and OECD National Accounts data files.
INFL	Inflation rate computed using the CPI.	International Monetary Fund.
G	General government final consumption expenditure (formerly general government consumption).	World Bank and OECD National Accounts data files.
RERVOL	Coefficient of variation of RER over a five-year period.	authors' calculations
EDUC	Gross enrollment ratio, as the ratio of total enrollment to the population.	United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics.
SAVINGS	Gross domestic savings, calculated as GDP less final consumption expenditure.	World Bank and OECD National Accounts data files.

Note. The table reports all the variables we use in this paper, as well as their data sources.

Before reporting the results in Table 3, we show the relationship between the mean undervaluation and mean economic growth for each country in Figure 4. The correlation coefficient between the two variables is a negative number (-0.35) and statistically significant at the 1% level. This gives us an idea of what we can expect in Table 3, where we also take into consideration different control variables. The coefficients of all the control variables bear the expected sign, or are statistically insignificant. β_1 has a negative sign, as predicted by economic theory. The interesting and important result is that β_2 is negative. This means that as a currency is more undervalued, the economic growth in CEE countries actually decreases. This coefficient ranges from – 0.04 to – 0.07. In Razmi et al. (2012), this coefficient is usually around 0.01 to 0.02 for developing countries. Therefore, not only that we find a negative relationship between undervaluation and economic growth, but we also find a stronger effect for the CEE countries. The only case in which β_2 is insignificant is when we add the debt variable, but in that case, due to data availability, our sample is restricted to only 4 countries and 45 total observations. For all other models, β_2 is statistically significant at the 5% level or better. When including the interaction term in model (7), the positive sign of its coefficient suggests that, as income per capita increases, the effect of undervaluation also increases.

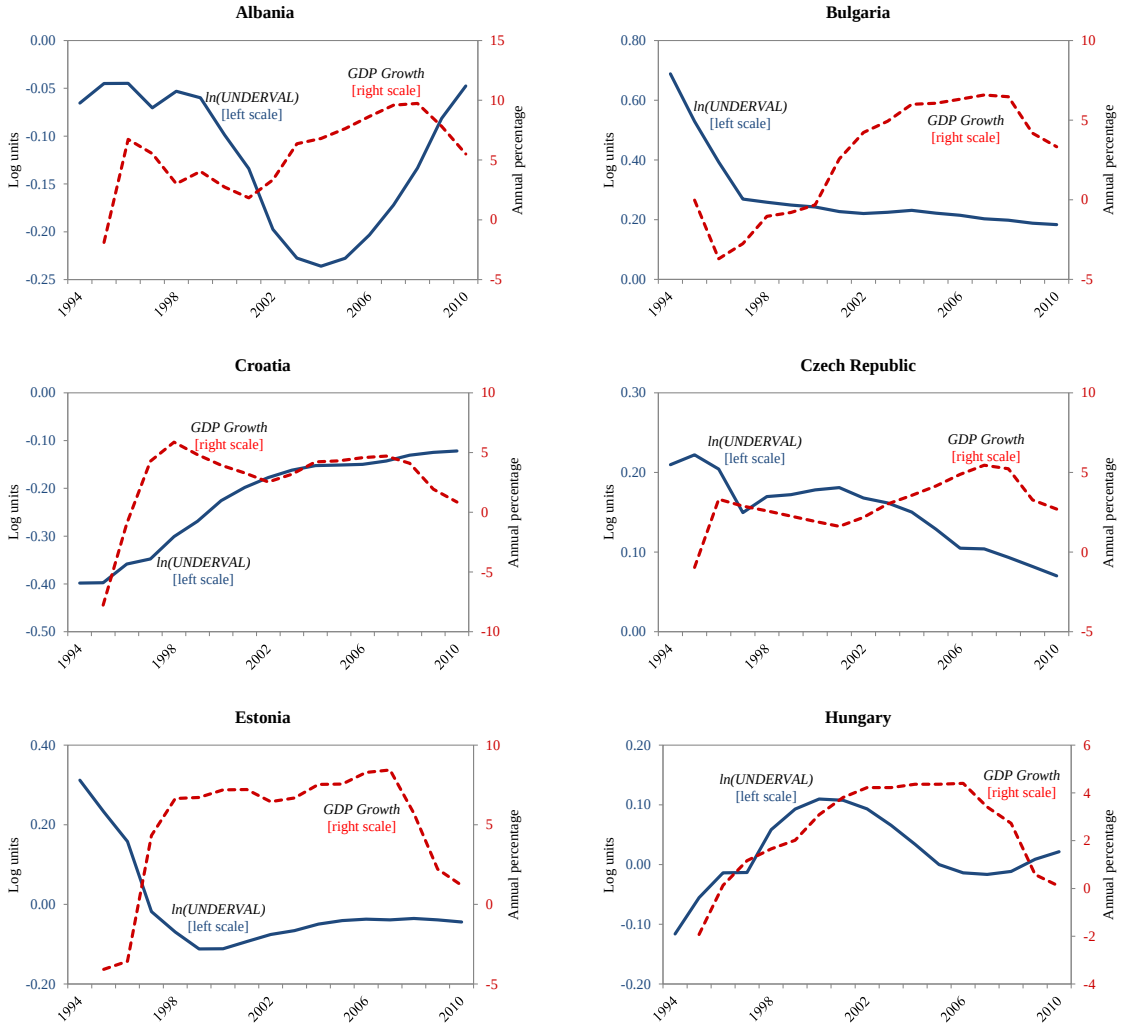

Figure 4. Panel A. Relationship between economic growth and currency undervaluation

Note. The figure shows the evolution in time of the economic growth and currency undervaluation for six of the 12 analyzed CEE countries, from the beginning of the 1990s until 2010. Economic growth is computed as the average annual growth rate of real GDP per capita, over 5-year periods. It is measured relative to the vertical right-hand scale. Undervaluation (more exactly, the natural logarithm of the variable *UNDERVAL*) is computed according to equations 14 – 16 and is measured relative to the vertical left-hand scale.

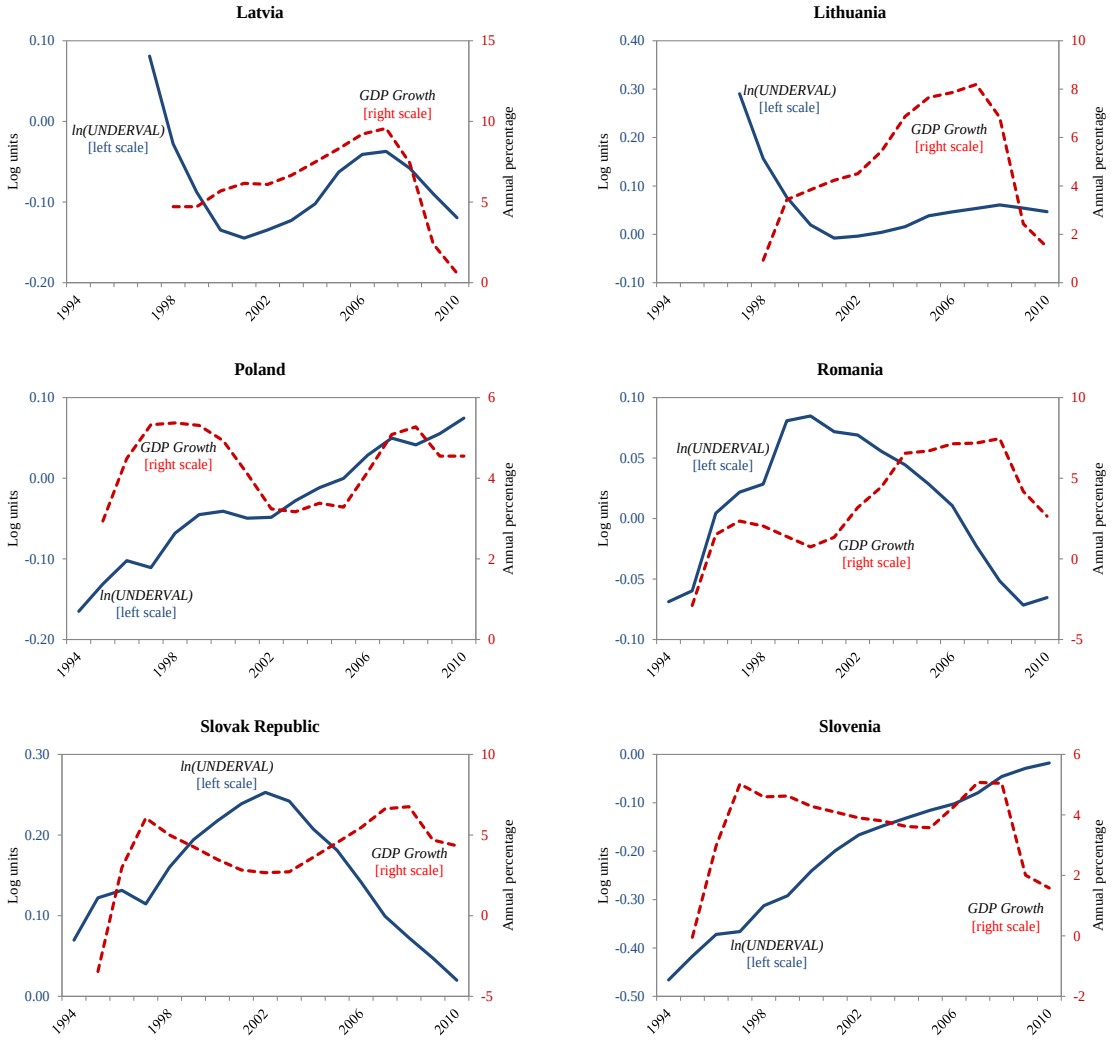

Figure 4. Panel B. Relationship between economic growth and currency undervaluation

Note. The figure shows the evolution in time of the economic growth and currency undervaluation for six of the 12 analyzed CEE countries, from the beginning of the 1990s until 2010. Economic growth is computed as the average annual growth rate of real GDP per capita, over 5-year periods. It is measured relative to the vertical right-hand scale. Undervaluation (more exactly, the natural logarithm of the variable *UNDERVAL*) is computed according to equations 14 – 16 and is measured relative to the vertical left-hand scale.

Table 3. Panel regression results

Dependent variable: Growth rate of real GDP per capita							
	Baseline Model	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
ln(*RGDPCH* $_{t-1}$)	-0.0294	-0.1424 ***	-0.0887 ***	-0.0435 *	-0.1077 ***	-0.2553 **	-0.0382 *
	-1.297	*-5.161*	*-4.199*	*-1.933*	*-4.456*	*-2.741*	*-1.704*
ln(*UNDERVAL*)	-0.0697 ***	-0.0393	-0.0554 ***	-0.0416 **	-0.0429 **	-0.0560	-0.8012 ***
	-3.883	*-1.576*	*-3.003*	*-2.302*	*-2.320*	*-1.119*	*-2.951*
INFL		-0.0682 ***	-0.0837 ***	-0.0935 ***	-0.0885 ***	-0.0549 **	
		-6.158	*-7.429*	*-7.809*	*-7.291*	*-2.417*	
ln(*RERVOL*)		0.0018	0.0002	-0.0010	-0.0004	0.0081 ***	
		1.290	*0.152*	*-0.936*	*-0.335*	*2.835*	
EDUC		0.0007	-0.0004	0.0004	-0.0003	0.0027 ***	
		1.390	*-0.801*	*0.824*	*-0.674*	*4.334*	
TOT		0.0000 ***					
		4.086					
LAW		0.0081 *					
		1.716					
SAVINGS			0.0019 **				
			2.571				
OPENC				0.0006 ***			
				3.304			
G					-0.0031 **		
					-2.483		
EXTERNAL_DEBT						-0.0008 ***	
						-4.395	
ln(*RGDPCH* $_{t-1}$) * ln(*UNDERVAL*)							0.0812 ***
							2.700
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.62	0.81	0.77	0.78	0.77	0.92	0.63
Number of countries	12	12	12	12	12	4	12
Observations	186	121	135	135	135	45	186

Note. This table reports the results for the following regression: $GROWTH_{it}=\beta_0+\beta_1 ln(RGDPC_{it-1})+\beta_2 ln(UNDERVAL_{it})+\gamma X_{it}+f_t+f_i+\varepsilon_{it}$. We use a sample of 12 CEE countries, over the time interval 1990 – 2010. To control for the fact that real exchange rates can diverge from equilibrium in the short- and medium-run, we use 5-year averages. We report the *t*-statistics in italics. *, ** and *** represent significance levels of 10%, 5% and 1%, respectively.

While our focus is not on the direction of causality, but rather on association or correlation, the problem of reverse causality can arise when interpreting our findings, just as it does in Rodrik's (2008) and Razmi et al.'s (2012) studies. Undervaluation should be treated as an endogenous variable and we would need instrumental variables to ameliorate the simultaneity problem. It is however difficult to find instrumental variables that affect the exchange rates, but not the economic growth. Therefore, we implement a dynamic panel approach using the Generalized Method of Moments (GMM) to correct this issue. The baseline model is tested in Table 4, using the lagged independent variables as instruments and the lagged dependent variable as an extra independent variable. What we obtain using this approach is in line with the OLS results in Table 3. The undervaluation coefficient is still negative (though not as statistically significant as before) and in the same range. In Table 4 we also check for outlier effects. For that, we run the baseline model in Table 3 again, but this time we only consider different ranges for $ln(UNDERVAL_{it})$. The obtained coefficients β_2 are still consistent with the results in Table 3 (in sign, amplitude and significance).

Table 4. Robustness checks

Dependent variable: Growth rate of real GDP per capita				
	GMM	-1 < ln(UNDERVAL) < 1	-0.5 < ln(UNDERVAL) < 0.5	-0.25 < ln(UNDERVAL) < 0.25
ln(*RGDPCH* $_{t-1}$)	-0.0821 ***	-0.0361	-0.0511 **	-0.0156
	-3.683	*-1.635*	*-2.381*	*-0.728*
ln(*UNDERVAL*)	-0.0404 *	-0.0748 ***	-0.0948 ***	-0.1085 ***
	-1.827	*-4.238*	*-5.377*	*-5.138*
Time dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Number of countries	12	12	12	12
Observations	174	186	185	171
Adjusted R^2	-	0.62	0.65	0.65
J -statistic	5.90	-	-	-
p -value	0.02	-	-	-

Note. This table reports the GMM results, as well as a check for outliers, for model (1) in Table 3. We use a sample of 12 CEE countries, over the time interval 1990 – 2010. To control for the fact that real exchange rates can diverge from equilibrium in the short- and medium-run, we use 5-year averages. We report the *t*-statistics in italics. *, ** and *** represent significance levels of 10%, 5% and 1%, respectively.

As mentioned in Section 3, eight of the analyzed 12 CEE countries joined the EU on May 1, 2004 with five of them eventually adopting the euro. Therefore, as an additional robustness check, we run the regression in equation (17) without the eight aforementioned countries in column (1) of Table 5 below, then also for all countries except for those who joined the euro in column (2) of Table 5. The results hold, with undervaluation still bearing the negative sign. Additionally, we also run the same regression only for the period before the start of the Great Recession of 2008-2009 (last column in Table 5). Our results are robust (Note 8).

Table 5. Additional robustness checks

Dependent variable: GDP per capita growth			
	(1)	(2)	(3)
ln(*RGDPCH*$_{t-1}$)	-0.2637 ***	-0.1959 ***	0.0080
	-3.894	*-3.449*	*0.295*
ln(*UNDERVAL*)	-0.1380 ***	-0.0673 **	-0.0552 **
	-5.240	*-2.236*	*-2.555*
INFL	-0.0902 ***	-0.1066 ***	-0.0803 ***
	-5.253	*-7.274*	*-7.710*
ln(*RERVOL*)	0.0054 **	0.0062 ***	-0.0003
	2.100	*2.969*	*-0.362*
EDUC	0.0000	0.0001	-0.0007
	-0.020	*0.097*	*-1.394*
Time dummies	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes
Adj R2	0.92	0.71	0.85
Number of countries	4	7	12
Observations	40	76	103

Note. This table reports the results for the following regression: $GROWTH_{it}=\beta_0+\beta_1 ln(RGDPC_{it-1})+\beta_2 ln(UNDERVAL_{it})+\gamma X_{it}+f_t+f_i+\varepsilon_{it}$. We use a reduced sample of 4 CEE countries (countries who did not adhere to the EU during our sample time period) in column (1) and a reduced sample of 7 CEE countries (countries who did not adhere to the euro during our sample time period) in column (2), over the time interval 1990 – 2010. Column (3) reports the results for the whole sample of 12 countries, but only for the time period 1990 – 2007. To control for the fact that real exchange rates can diverge from equilibrium in the short- and medium-run, we use 5-year averages. We report the *t*-statistics in italics. *, ** and *** represent significance levels of 10%, 5% and 1%, respectively.

From our results so far, it seems obvious that currency undervaluation and economic growth move inversely in the CEE countries, which is the opposite of what other papers find for developing countries in general. We also want to examine the relationship between growth accelerations and undervaluation. Rodrik (2008) finds that Asian countries experience increased undervaluation before the year when a growth acceleration occurs. In the following years, the undervaluation is still high. An acceleration, as defined in Hausmann et al. (2005), is a period in which the economic growth is more than 2 percentage points, and is sustained for at least 8 years. Fabrizio et al. (2010) find however that CEE countries differ from other countries in terms of growth accelerations. The probability of a growth acceleration was greater by 7% in CEE countries, but the length of acceleration episodes was greater in East Asia (average of 15 years compared to 12 years in CEE and 8 in Latin America). We report the mean undervaluation in the 10 years preceding and the 10 years following an acceleration for the CEE countries. All CEE countries experienced a growth acceleration in the 2000s. One of them (Poland) experienced another episode in the 1990s. We present the results of our analysis in Figure 5. Our findings are definitely different from what Rodrik (2008) obtains for the Asian countries. In our case, in the years preceding the growth acceleration, the undervaluation increases for the first 5 years until it reaches about 10%. Then, it starts decreasing and it becomes negative in year 0, the year when the growth acceleration sets off. In the 10 years following year 0, the undervaluation is almost constant at around –2%.

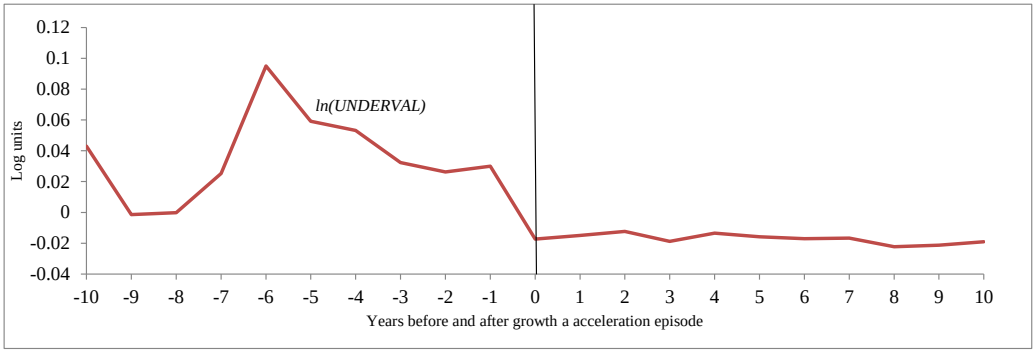

Figure 5. Evolution of undervaluation before and after growth accelerations

Note. The figure illustrates the mean undervaluation in log units, in the 10 years preceding and the 10 years following a growth acceleration for the 12 analyzed CEE countries. A growth acceleration, as defined in Hausmann et al. (2005), is as a period in which the economic growth is sustained at more than 2 percentage points, for at least 8 years. Year 0 is the year when the growth acceleration starts.

5. Conclusions

The literature on whether currency undervaluation leads to economic growth is inconclusive. Some authors believe that developing countries benefit from undervaluing their currency, while others claim that any form of misalignment from equilibrium is bad for the economy in the long run. We also need to keep in mind that there is an almost unanimous agreement in the international trade world that having a depreciated currency makes a country's products more price competitive. In the CEE countries however, as noted by Benkovskis and Wörz (2012), this measure of price competitiveness is negatively correlated with economic growth. It is entirely possible that, in the CEE countries, a stronger currency boosts people's trust in government policies and, consequently, promotes economic growth. For these countries, as Benkovskis and Wörz (2012) show, it was not price competitiveness, but rather non-price competitiveness that improved their world market share.

We offer a theoretical and empirical model suggesting that CEE countries are different from other developing countries, due to their rapid transition from communism to capitalism. We find that currency undervaluation is negatively correlated with economic growth in CEE countries. This result holds when considering different control variables, as well as when using GMM to account for any endogeneity problems (not a perfect econometrical procedure though, as it might worsen possible biases), and also when eliminating outliers. We acknowledge that there might be some omitted factors such as FDI, choice of privatization approach, or price controls, but data availability prevents us from including them in our analysis. Another drawback is the short time interval, as the CEE countries started their transition to a market economy at the beginning of the 1990s. As more time passes and the legislature and mentality in CEE countries become more in line with those in other, more experienced capitalist countries, it would be interesting to see if undervaluation continues to play the same role in those countries.

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Notes

Note 1. This is common practice in the literature. See for instance Engel (1999).

Note 2. We use the same values of α across countries. See, for instance, Drozd and Nosal (2010) who find only a very small variation in this weight, for a sample of 210 pairs of currencies.

Note 3. The countries included in our analysis are: Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia.

Note 4. See for instance Kočenda (2001) and Fabrizio et al. (2010).

Note 5. Sachs (1996b) gives the following reasons: a) a pegged rate gives credibility to the government's efforts of economic stabilization; b) price- and wage-makers can harmonize their actions and expectations; c) high inflation can be kept in check.

Note 6. There are numerous other approaches in measuring currency undervaluation, such as the IMF's CGER exchange rate assessment (see Lee et al., 2006), but the goal of our paper is to show that CEE countries do not follow the same pattern as predicted in Rodrik (2008) for developing countries.

Note 7. The fixed effect adjustment is achieved by removing time and cross-section specific means from all variables, then performing the regression with the demeaned data. They serve to remove time-invariant and country-specific, or country-invariant and time-specific determinants of economic growth.

Note 8. We do not run the same regression for the period following the Great Recession due to the very small number of observations for this time period.