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Nominal and Real Convergence in Alternative Exchange Rate Regimes in Transition Countries: Implications for the EMU Accession

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Abstract

This paper discusses the processes of nominal and real convergence and their dependence on exchange rate regimes adopted in Central and Eastern European countries (CEECs) in the context of their future EMU accession. We focus our argument on the possibility of trade-off between the pace of disinflation and the maintenance of competitiveness and growth. Fixed nominal exchange rate shifts the burden of adjustment on to the tradable sector but whether this pressure results in faster restructuring and faster productivity growth or becomes a straightjacket for the economy is an open question. The paper implements a simple empirical assessment of convergence of inflation to EU levels and economic growth of 7 CEE economies which had adopted different exchange rate regimes in period 1993-2002. Results indicate that fixed exchange rates seem to have been a better tool of fighting inflation as compared to floating exchange rates or intermediate regimes. The presence of a fixed exchange rate has also been characterised by higher real GDP growth rates implying an absence of trade-off between nominal and real convergence in the investigated sample. Qualifications attached to these results are discussed.

1. Real and nominal convergence in the run up to EMU [1]

The imminent EU accession determines the long-term exchange rate and monetary policy regime in the acceding countries. Nevertheless, the issues of timing of EMU entry as well as the interim exchange rate regime remain to be resolved. As far as the choice of regime is concerned, crawling pegs, free floats and pegs to currencies other than euro are considered incompatible with the ERM II (e.g. Solans, 2002). The euro-based currency boards are already in place in Lithuania and Estonia largely determining their EMU accession paths but hard-peg arrangements are less likely to be adopted by other acceding countries (see e.g. Rostowski, 2003). These countries have recently declared their broad EMU accession strategies with Hungary, Poland and Slovenia opting for early accessions and Czech Republic for a deferred accession. However, the timing of entry depends on the fulfilment of Maastricht criteria and as such remains tentative. In addition, a number of other pertinent issues such as the path of entry to ERMII or other ERMII-compatible regime, the levels of central parities as well as the width of the ERM band are currently open to debate.

Since the beginning of the EU accession process, the achievement of nominal and real convergence have been frequently considered as necessary for successful integration of CEECs into the EU and, subsequently, EMU. Nominal convergence pertains to convergence of certain macroeconomic indicators to levels ensuring macroeconomic stability in an economically integrated area[2]. In the context of CEECs and their initially high inflation rates, convergence of inflation rates to EU levels translates into increasing stability of the economic environment, improvement of development prospects and, ultimately, more rapid growth. Hence, no trade-off between nominal and real convergence is expected in longer term.

While nominal convergence is supportive of any form of economic integration, it gains on importance in the context of a monetary union. Notwithstanding the nominal anchor argument in the context of high-inflation countries, more generally, monetary integration of economies with substantially different inflation levels may be undesirable for both the entrants and the incumbents[3]. While it is often argued that parameters of the Maastricht criteria do not sufficiently account for the specificity of the CEECs' economies (e.g. productivity growth and HBS or demand effects), they have been established with a view of ensuring the overall stability of the single currency. As such, they provide the institutional benchmark for measuring nominal convergence in the accession countries.

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[1] Author is an economist at the OECD Secretariat but views expressed herein are those of the author and should not in any case be attributed to the OECD. I am grateful to Lukasz Rawdanowicz and Wojciech Paczynski for helping with the data. Address for correspondence: Przemyslaw.Kowalski@oecd.org

[2] Maastricht criteria include criteria on: inflation, long term nominal interest rate, budget deficit, public debt and exchange rate stability.

[3] The more pronounced the inflation rate heterogeneity between the members the less optimal the single monetary policy for any one member and thereby the less desirable and credible the single currency.

Real convergence, referred to as convergence of productivity and standards of living levels, is usually measured by decreasing differentials in per capita expenditure or income. It can occur through either better utilisation of productive factors or increased productivity i.e. higher intensity with which these factors of production are being used. While per capita income levels vary widely even between the existing EU members, the real convergence is one of the aims of the European integration. Underlying is the objective to ensure similar standards of living in all countries and regions of the Community. The 2004 enlargement will have no precedence in terms of wealth differentials between the incumbents and entrants. Low per capita incomes of accession countries as compared with the EU average (Table 1) are perceived as a potential source of social and economic costs of enlargement. Fears about the costs of integration of regions at different levels of development have already been a part of political debate and were a factor in establishing temporary restrictions on freedom of movement of factors of production (mostly labour) in the accession negotiations.

Table 1. GDP per capita, PPP (current international $)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Poland	5,580	5,860	6,300	6,910	7,330	7,800	8,110	8,620	9,320	9,450
Slovenia	10,500	11,110	11,600	12,480	13,080	13,740	14,190	15,280	16,530	17,130
Slovak Republic	7,880	7,700	8,250	8,970	9,590	10,120	10,440	10,890	11,550	11,960
Estonia	6,110	5,830	5,960	6,450	6,870	7,860	8,110	8,330	9,480	10,170
Hungary	8,190	8,290	8,740	9,250	9,420	9,850	10,390	11,050	11,960	12,340
Czech Republic	10,340	10,610	11,050	12,170	13,040	12,880	12,720	13,150	14,110	14,720
Lithuania	7,090	6,060	5,610	6,050	6,500	7,070	7,450	7,370	7,930	8,470
European Monetary Union	18,061	18,120	18,888	19,883	20,295	20,627	21,077	22,020	23,546	23,942

Source: WB Development Indicators

In fact, no explicit real convergence criteria for EMU membership have been articulated. While the stability of the EMU is said to depend on “a high degree of sustainable convergence”[4] the real component of this convergence is understood as the synchronicity of business cycles rather than convergence of per capita income levels (e.g. Welteke, 2001).

Notwithstanding the ultimate obligation to fulfil the Maastricht criteria, the single most important objective underlying the choice of exchange rate / monetary policy framework in the run-up to EMU, and beyond, is economic growth. Nominal convergence, as its name suggests - “in name only”, is not an objective in itself and should be rather considered as a mean of facilitating the achievement of real convergence in the long term.

Implications of nominal exchange rate regime for the process of nominal convergence have received a great deal of attention but the impact of a nominal exchange rate regime on real variables including growth is still an area where research does not provide clear-cut answers (see e.g. Levy-Yeyati and Sturzenegger, 2003; for Kowalski et al. 2003 for discussion of the CEECs). Stockman and Baxter (1989) compare the behaviour of macroeconomic variables for a sample of 49 countries in the post-war period and except for greater exchange rate variability under floating exchange rate regimes find no evidence of systematic differences of macroeconomic aggregates

[4] Article 121 of the Treaty.

under alternative exchange rate regimes. Levy-Yeyati and Sturzenegger (2003) investigate a sample of 183 countries over the period 1974-2000 and find that while for industrial countries exchange rate regimes do not have a significant impact on growth, for developing countries less flexible exchange rates are associated with slower growth and with greater output volatility.

The mixed results are partially a reflection of the lack of simple theoretical prediction. In particular, the sign of the link between exchange rate regime and growth depends on the variance-covariance matrix of shocks affecting particular economy as well as the underlying exchange rate mechanism. In an economy characterised by a degree of price or wage rigidity the lack of possibility of nominal exchange rate adjustment may result in price distortions and misallocation of resources in the event of shocks. On the other hand the stability of relative prices in international commerce associated with fixed exchange rates is likely to promote trade, investment and improve comparative advantage-driven allocation of resources leading to growth.

In CEECs, perhaps more so than in more industrialised countries, exchange rate is an important price, firstly, because of its high flexibility relative to flexibility of domestic prices and wages and, secondly, due to the relatively high openness of the CEECs' economies (see Table 1. in Rostowski, 2003). Under conditions of liberalized capital account, a fixed exchange rate regime implies a shift of monetary policy away from domestic objectives towards the exchange rate objective. In such a regime, other things being equal, disinflation occurs directly through the convergence of inflation rate in the tradable sector, and indirectly through impact of wages and demand on inflation in non-tradable sector. Nevertheless, in the event of price or wage rigidity the adjustment may happen on the quantity, rather than the price, side resulting in large fluctuations of output and employment[5]. While it is uncertain whether the floating exchange rate regime indeed helps in smoothing such fluctuations, or rather generates them, it certainly entails a possibility of such adjustment.

There are numerous arguments in favour of fixed exchange rate regime arrangement as a facilitator of growth. These propositions range from the relatively old, though far from empirically confirmed, paradigm of benefits from certainty in international commerce to more region-specific arguments. Bratkowski and Rostowski (2002), for instance, point to unilateral euroization as an arrangement providing CEECs with financial stability in conditions of high growth-driven capital account surpluses.

Overall, however, the possibility of a trade-off between the nominal and real convergence cannot be excluded and the choice of an exchange rate / monetary policy framework should certainly include assessment of such risks. In this paper we make a small step towards this objective by exploring the past experience of seven CEECs with adopted exchange rate policies in the context of selected indicators of real and nominal convergence. Given the complexity of the topic, the aim of this analysis cannot be, and is not, to provide hard arguments in favour of early or deterred EMU accession or to discuss specific parameters of ERMII entry. Instead, we provide a

[5] Indeed, persistent labour market problems in Poland , Slovakia and to some extent Hungary suggest the existence of significant structural barriers impeding adjustment.

reflection on past experiences with exchange rate regimes in these countries which may be considered by policy makers when they are making their decisions.

2. Transition and exchange rate regime

Despite similar economic and geo-political situation at the beginning of the transition, different economies in Central and Eastern Europe have opted for different and completely uncoordinated[6] paths of improving macroeconomic stability and growth. The Czech Republic started with a peg, widened its band in 1996 and proceeded to managed float in 1997. Hungary started with a frequently adjusted peg, adopted a crawling peg in 1995 and moved to a crawling band in 1998, so as to finally broaden this band to +/- 15% in 2001. Poland started with the adjustable peg in 1990, moved to a crawling peg in 1991, which was converted into the crawling band in 1995, bands of which were gradually widened in 1998-1999 finally resulting in adoption of a fully floating exchange rate regime in 2000. Estonia had a currency board from 1992. Lithuania and Bulgaria, on the other hand, started with floating rates to retreat to currency boards in 1994 and 1997 respectively.

This wide range of choices revealed different starting points (e.g. availability of monetary reserves) and different macroeconomic conditions: differentials in the levels of credibility of monetary authorities; diverse degrees of the need for effective macroeconomic stabilisation (Calvo and Reinhart, 2002); different initial inflation developments; or finally different structures of the real sector, which may have resulted in different lobbying patterns. An analytical classification of exchange rate regimes into floating, intermediate and fixed exchange rate regime used in this paper builds[7] on Kowalski et al. (2003) and is included in the Annex. In practical implementation, the differences between the exchange rate polices have been less pronounced. Fixers had to change the official parity or widen the permissible bands of fluctuations and floaters frequently intervened in the exchange rate markets.

For purposes of an empirical analysis a distinction between the formally declared and actual exchange rate regime should be made. The classification adopted here is not based on cluster indicator analysis as e.g. in Levy Yeyati and Sturzenegger (2003) but on an ad hoc approach which combines the information on the formally declared and actually implemented regimes.

Freeing up of prices in formerly centrally planned economies resulted in inflationary pressures on prices of goods and services for which excess demand existed under the central plan (and a deflationary pressure on prices of excessively supplied goods and services). Hence, inflation – driven initially by price liberalization and deep fiscal and monetary imbalances, and then sustained due to inertia and deficiency of central bank credibility – was the top priority in macroeconomic policy design. Nevertheless, to a certain extent the possible influence of a chosen exchange rate regime on both macroeconomic stability and microeconomic performance has already been then

[6] Lavrac (1999) points out that membership of these countries in CEFTA has remained an unused opportunity to harmonise their exchange and monetary regimes.

[7] The modification has incorporated suggestions by a referee.

recognised (see e.g. Lavrac, 1999). The choice of an exchange rate regime, among other considerations and constraints, was driven by these countries' different preferences towards two alternative goals: (a) stabilizing role of an exchange rate as a nominal anchor in the economy for repressing inflationary pressures and expectations and (b) equilibrating role of the real exchange rate as an instrument for preserving international competitiveness of the economy and for equilibrating the balance of payments.

At the heart of the nominal anchor argument is that in an inflationary environment, profit margins of firms competing internationally are under downward pressure. If they are to be maintained, the growth rate of wages should decelerate contributing to deceleration of inflation. In such a case nominal convergence can be neutral to the real growth process as the adjustment occurs through prices, not quantities. If on the other hand prices/wages are rigid, the adjustment may occur on the quantity side without significant impact on inflation. The real outcomes, depending on the degree of flexibility will be probably situated in between the two cases.

In a floating exchange rate regime the nominal exchange rate may, but does not have to, evolve so as to equilibrate the prices of internationally traded products. Nevertheless, the profit margins can theoretically be maintained without a downward pressure on wages. In such a case the exchange rate does not provide an anchor for domestic prices. Finally, if the nominal exchange rate depreciates at a rate specified by authorities (as in a crawling peg regime) a margin in favour of domestic firms competing in international markets allows them to maintain a degree[8] of competitiveness given the inflationary environment. Depending on the relative dynamics of initial inflation and exchange rate depreciation as well as transmission mechanisms, such an arrangement may result in a decrease or increase in inflation.

Even though it is possible that under a nominal anchor the bulk of the adjustment may happen on the price side, the adjustments may not be immediate and the tradable sector may be put under considerable strain in the interim period. In an economy with a tradable and non-tradable sector where the economy-wide real wage is normalized to unity:

(1) $W = P = P_T^a P_N^{1-a}$

(where P is the price index comprising tradable P_T and non-tradable P_N prices and one unit of labour produces δ (γ) units of output[9] in tradable (non-tradable sector) so that rates of growth of parameters δ and γ can represent respective labor productivity growth rates) the profit per unit of output in the tradable and non-tradable sector can be represented as:

(2) $\pi_T = \frac{\delta P_T}{W} = \frac{\delta P_T^{1-a}}{P_N^{1-a}}$ and $\pi_N = \frac{\gamma P_N}{W} = \frac{\gamma P_N^a}{P_T^a}$

and expressed as growth rates as:

[8] The magnitude would depend on the relative dynamics of inflation and the rate at which the currency is crawling.

[9] Such a specification implies that productivity increases are entirely internalized by firms in the form of profits and not real wages.

(3) $$\begin{aligned}\hat{\pi}_T &= (1-a)\left[\hat{P}_T - \hat{P}_N\right] + \hat{\delta} \\ \hat{\pi}_N &= a\left[\hat{P}_N - \hat{P}_T\right] + \hat{\gamma}\end{aligned}$$

If the purchasing power parity is assumed to hold in the tradables sector:

(4) $$\hat{P}_T = \hat{E} + \hat{P}_T^*$$

equations (3) become:

(5) $$\begin{aligned}\hat{\pi}_T &= (1-a)\left[\hat{E} + \hat{P}_T^* - \hat{P}_N\right] + \hat{\delta} \\ \hat{\pi}_N &= a\left[\hat{P}_N - \hat{E} - \hat{P}_T^*\right] + \hat{\gamma}\end{aligned}$$

Equations (3) and (5) show that, assuming away productivity growth differences, in a fixed exchange rate regime in order for tradables profits to be unaffected, prices in the non-tradable sector would have to be growing at the rate equal to that of foreign tradables. If growth of prices in non-tradables is higher, tradable profits are reduced, ceteris paribus, through the wage mechanism (1). This problem will be less significant in an economy with large share of tradables (high *a*) [10] which is similar to the observation about the role of openness for the choice of an exchange rate regime made by McKinnon(1963).

In a floating exchange rate regime the nominal exchange rate can adjust so that profitability of the tradable sector is maintained. It has to be pointed out that the nominal depreciation and resulting tradables price inflation (4) is not necessarily detrimental to profitability of the non-tradable sector as the non-tradable prices are not bound by external constraints and may be more easily adjusted. Under such a scenario we deal with a pass-through of nominal depreciation into domestic prices but no effect on profitability of either tradable or non-tradable sector.

Hence, especially in an environment characterised by a degree of inflationary inertia, the nominal exchange rate may be an important tool of preserving competitiveness or smoothing fluctuations. Of course, as (5) indicates, exogenous productivity growth may compensate or even outweigh the negative effects without undermining the argument that profits may be affected by behaviour of nominal exchange rate. It is also clear that a crawling peg, provides a margin of extra profitability for the tradable sector while also generating or sustaining inflation.

The mechanism described above provides a rough intuition of how profits, especially in the tradable sector, may be affected. This, however, prompts a further question of how this may feed into the productivity growth. As Lafrance and Schembri (2000) point out both the exchange rate and productivity depend on a large set of underlying factors and a simple causal relationship is unlikely. However, the traditional assumption of productivity being exogenous to nominal exchange rate regime (see e.g. Harris, 2001) is not fully realistic. The Harrod-Balassa-Samuelson is the most famous theoretical framework that is based on this assumption. A competing paradigm is related to

[10] In our framework this is modeled through parameter a, which describes the weight of tradables in the price index P (Equation 1).

our discussion in previous paragraphs and posits that under nominal rigidities nominal exchange rate behaviour may impact upon profit margins and investment and thereby affect productivity growth. One variation of this paradigm is that of the exchange-rate-sheltering which suggests that a depreciating exchange rate protects competitiveness of firms resulting in slow productivity growth (see Lafrance and Schembri (2000) for a discussion of Canada's case). An alternative hypothesis states that a positive stimulus to profit margin is likely to result in higher investment and thereby more rapid productivity growth.

The exchange-rate-sheltering hypothesis posits that a depreciating exchange rate protects firms from external competitive pressure, like a tariff, and thus removes the incentive to make productivity enhancing investments. An implicit assumption in this kind of reasoning is the "satisficng behaviour"[11] of the managers who are seeking a quiet life rather then maximising firms' profits. As Lafrance and Schembri (2000) point out this is only possible if the shareholders are inattentive to the value of the firm and capital and product markets are not functioning effectively[12]. The reverse side of the exchange-rate-sheltering hypothesis is the hypothesis of productivity enhancing restructuring or creative destruction where firms or industries increase their productivity in periods when they are faced with though competitive conditions.

Overall, the analysis suggests a possibility of a trade-off between the pace of disinflation and the pace of economic growth and its connection to the choice of an exchange rate regime. If product and labour markets are, or can become, flexible such trade-off may not arise. If, on the other hand, prices are sluggish, the tradable sector may be particularly vulnerable. Whether this additional pressure results in faster restructuring and faster productivity growth or becomes a straightjacket for the economy is an open question.

3. Convergence under different exchange rate regimes - empirical findings

In this context, the remainder of the paper provides an assessment of the impact of an adopted exchange rates regime on nominal convergence and growth rates for a panel of seven CEECs[13] in period 1993Q1-2002Q4.

Inflation rates

Following Kocenda (2001) who applied similar methodology to an investigation of convergence of a number of macroeconomic indicators within a group of CEECs, we model the convergence of rates of CPI inflation, tradables and non-tradables inflation to the EU equivalents.

[11] Original term used after Lafrance and Schembri (2000).

[12] This is not an unrealistic assumption in transition economies.

[13] Czech Republic, Estonia, Poland, Lithuania, Slovenia, Slovak Republic and Hungary.

Convergence to an equivalent EU indicator is expressed as:

$$(6)\quad X_{it} - X_{EUt} = \phi\left(X_{it-1} - X_{EUt-1}\right) + u_{it}$$

where X_{it} is the variable of interest in country i (EU denotes European Union) in period t.

The above equation describes a time path of a "distance" of respective variable in a given CEE economy to the EU level. Convergence (divergence) requires these differentials to be smaller over time and is realised if the estimated coefficient φ <1 (>1). Low estimated φ in (6) implies rapid nominal convergence to the EU levels.

We focus on three measures of nominal convergence: CPI inflation, tradable prices inflation (and non-tradable prices inflation). While, apart from CPI inflation, these indicators do not directly correspond to Maastricht criteria they are consistent with the framework presented in the first part of the paper.

It has to be pointed out that the estimation of (6) is of purely "statistical" character and is not underpinned by any particular convergence theory. Nevertheless, it allows us to empirically verify the evidence for systematic differences in rates of nominal convergence between adopted exchange rates regimes.

In order to remove the problem of unit roots in the investigated time-series, equation (6) is transformed into the Dickey-Fuller specification.

$$(7)\quad \Delta d_{it} = \rho d_{it-1} + z_{it}$$

where:

$$d_{it} = X_{it} - X_{EUt}$$
$$\Delta d_{it} = d_{it} - d_{it-1}$$
$$\rho = \phi - 1$$

In fact, we estimate (7) and test the significance of ρ as in the standard Dickey Fuller test. Statistical significance of ρ implies convergence if the resulting ϕ coefficients is smaller than 1. The above econometric framework is implemented using an unbalanced panel data set containing information on 7 CEECs in period 1993q1 to 2002q4. The structure of the data allows us for estimation of (7) for: (i) all countries; (ii) separate countries in the sample and (iii) various adopted exchange rate regimes.

The results are discussed focusing on estimations of (ii) and (iii). Panel estimations of (iii) are performed using feasible generalized least squares controlling for heteroskedasticity across panels and autocorrelation within panels (FGLS). Individual country estimations are OLS. As constant term has no interpretation in the context of (7) none of the estimations includes a constant.

Growth

As consistent data on levels of productivity across the sample is not available, the measures of real convergence adopted are quarterly year-on-year seasonally adjusted *growth rates* of real GDP. As is implied by the current GDP per capita differences between the EU and CEECs (see Table 1) convergence in income *levels* requires that the rates of growth are considerably higher in the CEECs. Effectively, the question of real convergence in the CEECs is a question of fast growth. Therefore, in the real convergence part of this empirical exercise, we follow Levy-Yeyati and Sturzenegger (2003) and perform an estimation of a standard specification of the growth regression augmented with exchange rate regime dummies. As far as other growth-explaining variables are concerned, in addition to initial per capita GDP level and the share of gross capital formation to GDP we include the share of FDI inflows in GDP to capture the role of foreign capital and technology transfer, the share of general government final consumption in GDP to capture the extent of state intervention and share of exports in goods and services to capture outward orientation of the economy. In addition, we include the contemporary inflation level in order to capture the stage of disinflation process.

The estimated equation takes the form:

(8) $\Delta GDP_{it} = f(GDPPC_{i1993}, GFCF_{it}, FDI_{it}, EX_{it}, GGFC_{it}, FLOAT, FIX, C)$

where:

GDP_{it}	- seasonally adjusted year–on-year real GDP growth rate *(Source: national accounts)*
$GDPPC_{i1993}$	- per capita GDP level in 1993 (Source: WB)
$GFCF_{it}$	- percentage share of gross fixed capital formation in GDP *(Source: WB)*
FDI_{it}	- percentage share of FDI inflows in GDP *(Source: WB)*
EX_{it}	- percentage share of exports in GDP *(Source: WB)*
$GGFC_{it}$	- percentage share of government final consumption in GDP *(Source: WB)*
FLOAT	- dummy for a floating exchange rate regime (Source: see Annex)
FIX	- dummy for a fixed exchange rate regime (Source: see Annex)
INF_{it}	- inflation level
C	- constant among others picking up the effect of an intermediate exchange rage regime

The equation is estimated on a panel of seven CEECs in period 1q1993-4q2002. The estimations are performed with three different types of estimators: (i) feasible generalized least squares estimators controlling for heteroskedasticity across panels and autocorrelation within panels (FGLS), (ii) fixed effects estimator with robust standard errors (FE) and (iii) random effects estimator (RE).

Results

Using the methodology described above we aim to establish some facts about the dynamics of nominal and real convergence in the context of adopted exchange rate regimes in period 1993 – 2002 and to reconcile these facts with theoretical analysis. Results are reported in Tables 1-11 in the Annex.

Prior to the discussion of results it has to be stressed that the regime classification included in the Annex is to some extent arbitrary. First of all, classification of Slovakian and Czech fixed but adjustable regimes at the beginning of the period as fixed, and thereby analytically equivalent to currency boards in Estonia and Lithuania, may be considered problematic. Secondly, the current exchange rate regime in Slovakia is classified as managed floating according to the IMF definition and as floating in our classification.

Secondly, the incidence of fixed exchange rates is concentrated at the beginning of the sample and the incidence of the floating exchange rates at the end of the sample. This poses some problems with interpretation of the exchange coefficient estimates for the exchange rate dummies in the growth regression. In particular, we may be picking up effects characteristic for the beginning of transition process (in the case of fixed exchange rate regime dummy) and later stages of transition (in the case of floating exchange rate regime dummy). To address these concerns we include the inflation rate to capture the impact of inflation on growth directly but also to account for the stage of the disinflation process. This variable proves to be an important and statistically significant explanation of growth patterns with high inflation periods characterised by significantly lower growth rates. In addition, robustness checks with time trend and a variable measuring the time since the establishment of an independent central bank were performed. These specifications yield insignificant results on trend variables (also when raised to various powers) in the growth regression. We do not report these results.

Overall, despite these robustness checks, our sample is fairly limited both in time and across countries. The frequent regime changes introduce further fragmentation of the sample: floating exchange rate regimes are observed in three countries (Czech republic, Poland and Slovakia) and mostly in the second half of the investigated period and fixed exchange rate regimes are dominated by currency boards in Estonia and Lithuania as well as “fixed but adjustable regimes” in Slovakia and Czech Republic at the beginning of the sample. Therefore, the results presented should be treated with appropriate caution.

As far as nominal convergence is concerned the estimations are reported for convergence of CPI inflation, tradable price index inflation and non-tradable price index inflation to the equivalent EU indicators. In a country by country estimation, the incidence of convergence to EU CPI inflation rates is reported for Estonia, Lithuania, Poland, Slovenia and Slovakia with the first two countries displaying the fastest rates of convergence. For Hungary and Czech Republic the adopted methodology yields statistically insignificant results implying that in the investigated period certain inertia in inflation was observed.

Statistical properties of obtained estimates improve considerably if CPI inflation convergence is estimated for three panels which extract observations for three different adopted exchange rate regimes (Annex 1). Results for all three regimes are significant at 5% level. The estimated 95% confidence intervals for the convergence coefficient Φ suggest that the fixed exchange rate regime was characterised by the fastest convergence of CPI inflation to the EU level. Countries which adopted the intermediate exchange rate regime have been converging much more slowly. Finally,

while for the floating exchange rate regime panel the estimated coefficient is statistically significant, the 95% confidence interval for the convergence coefficient Φ suggest a possibility of no convergence.

As far as convergence of tradable prices inflation to the EU levels is concerned results for Estonia and Slovakia suggest convergence. Results for Poland are also statistically significant but given the confidence interval divergence is a possibility. The panel results for the three exchange rate regime are again more robust statistically. The fixed and the intermediate regimes were characterised by the most rapid convergence of tradables inflation to the EU level. Floating exchange rate regime recorded a statistically significant result but the upper band of the confidence interval suggested a possibility of divergence. The country results for the non-tradable sector inflation suggest convergence only in the case of Lithuania. Panel estimations by regime suggest a statistically significant convergence under fixed exchange rates and to a lesser extent in the floating exchange rate regime while the intermediate exchange rate regime is characterised by insignificant results.

Overall, in the investigated period the fixed exchange rate regime was characterised by the fastest convergence of all three inflation measures. There is no evidence that the floating exchange rate regime has speeded up the inflation convergence. Interestingly, this seems to have been driven by lack of convergence in tradable goods inflation which outweighed the convergence of non-tradable goods inflation. The evidence for convergence of price inflation in the intermediate exchange rate regime is mixed: the tradables inflation was converging but non-tradables inflation was not.

The results for the estimated growth equation (8) are reported in Tables 7-11. Overall, roughly 40 per cent of the variation in the GDP growth rates is explained by this specification. Firstly, the estimated results indicate lack of evidence of beta convergence[14] in the analysed period. This is not surprising given the long–term nature of this concept and the shortness of our sample. It is worth observing that all estimators yield economically plausible signs of influence on growth rates with share of gross capital formation, exports and FDI inflows in GDP having positive impact on growth and the share of general government final consumption GDP having a negative impact. However, the statistical significance of coefficients estimated with some estimators is not very robust. We obtain statistically significant impact of exports' share on growth in the FGLS estimator with heteroscedastic panels and FE estimator with robust standard errors as well as significantly negative influence of government consumption with the FGLS estimator with heteroscedastic panels.

The results on inflation rates and exchange rate regimes stand out by their statistical significance across various applied estimators. One extra percentage point of year-on-year inflation

[14] Conditional beta convergence applies if the growth rate of real per capita GDP is negatively related to the starting level of real per capita GDP after holding fixed some other variables such as initial levels of human capital, measures of government policies, the propensity to save etc. (Barro and Sala-i-Martin, 1995).

is estimated to diminish the quarterly year-on-year real GDP growth, depending on the estimator, by 0.4 to 0.8 percentage points.

The statistical properties of coefficients on exchange rate regime dummies are robust, and consistent with respect to signs, across different estimators. The contributions of exchange rate regime dummies are surprisingly high. The fact of having a fixed exchange rate regime is associated with having on average 1.37 to 4.76 percentage points higher quarterly year-on-year growth rates. The fact of having a floating exchange rate regime is associated with having on average 1.71 to 2.89 percentage points lower growth rates. As discussed above, given the small data sample fragmented further by observed exchange rate regime changes, such significant contributions to growth rates associated with particular regimes have to be treated with caution.

On the one hand, it is possible that the results reflect an exogenous to regimes high growth in the early stage of transition when fixed or pegged regimes prevailed and lower growth later on when more flexible exchange rate regimes were adopted. However, this is, as discussed in preceding sections, not an exclusive explanation. In fact, as we argued above it is plausible that in an inflationary environment the discipline of a fixed exchange rate triggers productivity growth which becomes the only way of maintaining competitiveness. Later on when inflation is reduced the benefits of earlier productivity advancements are fully realized. In addition, in the absence of external flexibility, flexibility has to be ensured domestically and domestic institutions have to be reformed more quickly. This, in turn, creates a better environment for future growth.

4. Conclusions

This paper discussed the processes of nominal and real convergence in the context of exchange rate regimes adopted in Central and Eastern European countries (CEECs). We focused our argument on the theoretical possibility of trade-off between the pace of disinflation process and the maintenance of competitiveness and growth. We argued that while stabilisation based on fixed nominal exchange rate may shift the burden of adjustment on to the tradable sector, this additional pressure may result in faster restructuring and more rapid productivity growth or become a straightjacket for the economy.

The presented simple empirical assessment of convergence of inflation rates and growth rates of 7 CEE economies which had adopted different exchange rate regimes in period 1993-2002 suggests that fixed exchange rates seem to have been a better tool of fighting inflation as compared to floating exchange rates or intermediate regimes. In addition, fixed rates have also been characterised by higher real GDP growth rates suggesting no presence of trade-off between nominal and real convergence in the investigated sample. In fact, these results are consistent with the long-term prediction of positive relationship between low inflation and growth.

While, as discussed in the main body of the paper, these results should be treated with some caution, they do provide a point of reference for the discussion of the EMU accession. Overall, the presented discussion and results suggest that the risk of a trade-off between the nominal and real

convergence may be smaller in Central and Eastern European countries than sometimes suggested and that hard pegs may be an attractive option for achievement of both nominal and real goals. The constraint of a credibly fixed exchange rate is likely to trigger productivity growth which becomes the only effective way of ensuring competitiveness. In addition, in the absence of external flexibility, flexibility has to be ensured domestically and institutions have to be reformed more quickly than would otherwise be the case. This, in turn, creates a better environment for future growth.

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Annex. Classification of exchange rate systems, 1Q94-4Q02

	Czech Republic	Estonia	Hungary	Lithuania	Poland	Slovakia	Slovenia
Q11994	0	0	0.5	…	…	0	…
Q21994	0	0	0.5	…	…	0	…
Q31994	0	0	0.5	…	…	0	…
Q41994	0	0	0.5	…	…	0	…
Q11995	0	0	0.5	0	0.5	0	0.5
Q21995	0	0	0.5	0	0.5	0	0.5
Q31995	0	0	0.5	0	0.5	0	0.5
Q41995	0	0	0.5	0	0.5	0	0.5
Q11996	0	0	0.5	0	0.5	0	0.5
Q21996	0.5	0	0.5	0	0.5	0	0.5
Q31996	0.5	0	0.5	0	0.5	0	0.5
Q41996	0.5	0	0.5	0	0.5	0	0.5
Q11997	0.5	0	0.5	0	0.5	0	0.5
Q21997	0.5	0	0.5	0	0.5	0	0.5
Q31997	1	0	0.5	0	0.5	0	0.5
Q41997	1	0	0.5	0	0.5	0	0.5
Q11998	1	0	0.5	0	0.5	0	0.5
Q21998	1	0	0.5	0	0.5	0	0.5
Q31998	1	0	0.5	0	0.5	0	0.5
Q41998	1	0	0.5	0	0.5	1	0.5
Q11999	1	0	0.5	0	0.5	1	0.5
Q21999	1	0	0.5	0	0.5	1	0.5
Q31999	1	0	0.5	0	0.5	1	0.5
Q41999	1	0	0.5	0	0.5	1	0.5
Q12000	1	0	0.5	0	0.5	1	0.5
Q22000	1	0	0.5	0	1	1	0.5
Q32000	1	0	0.5	0	1	1	0.5
Q42000	1	0	0.5	0	1	1	0.5
Q12001	1	0	0.5	0	1	1	0.5
Q22001	1	0	0.5	0	1	1	0.5
Q32001	1	0	0.5	0	1	1	0.5
Q42001	1	0	0.5	0	1	1	0.5
Q12002	1	0	0.5	0	1	1	0.5
Q22002	1	0	0.5	0	1	1	0.5
Q32002	1	0	0.5	0	1	1	0.5
Q42002	1	0	0.5	0	1	1	0.5

Notes: '0' denotes fixed exchange rate regime, '0.5' – intermediate regime, '1' – floating regime.

Source: Classification based on declared *de jure* and observed *de facto* regimes.

Table 1. CPI inflation rate convergence by country

country	ρ		Implied Φ	t-statistic	95% conf. interval		Implied Φ 95% conf, interval		No. of observations
CZE	-0,05		0,95	-1,23	-0,14	0,03	0,86	1,03	35
EST	-0,07	***	0,93	-3,12	-0,12	-0,03	0,88	0,97	35
HUN	-0,02		0,98	-0,97	-0,05	0,02	0,95	1,02	35
LIT	-0,25	***	0,75	-8,40	-0,30	-0,19	0,70	0,81	35
POL	-0,05	***	0,95	-3,22	-0,08	-0,02	0,92	0,98	35
SLK	-0,08	*	0,92	-1,73	-0,16	0,01	0,84	1,01	35
SLO	-0,05	**	0,95	-2,36	-0,10	-0,01	0,90	0,99	35

***,**,* denote significance at 1,5 and 10% rescpectively, DF critical values at 1,5,10% respectively -2.63, -1.95, -1.61

Table 2. CPI inflation rate convergence by regime

regime	ρ		Implied Φ	z-statistic	95% conf. interval		Implied Φ 95% conf, interval		No. of observations
Floating	-0,11	***	0,89	-1,23	-0,05	0,03	0,95	1,03	35
Intermediate	-0,04	**	0,96	-2,27	-0,07	-0,01	0,93	0,99	35
Fixed	-0,16	***	0,84	-6,80	-0,21	-0,12	0,79	0,88	35

***,**,* denote significance at 1,5 and 10% rescpectively

Table 3. Tradables inflation rate convergence by country

country	ρ		Implied Φ	t-statistic	95% conf. interval		Implied Φ 95% conf, interval		No. of observations
CZE	-0,14		0,86	-1,57	-0,33	0,04	0,67	1,04	35
EST	-0,15	**	0,85	-2,56	-0,26	-0,03	0,74	0,97	35
HUN	-0,15		0,85	-1,65	-0,33	0,03	0,67	1,03	35
LIT	-0,13		0,87	-1,43	-0,32	0,06	0,68	1,06	35
POL	-0,15	*	0,85	-1,72	-0,33	0,03	0,67	1,03	35
SLK	-0,28	**	0,72	-2,27	-0,54	-0,03	0,46	0,97	35
SLO	-0,15		0,85	-1,65	-0,33	0,03	0,67	1,03	35

***,**,* denote significance at 1,5 and 10% rescpectively

Table 4. Tradables inflation rate convergence by regime

regime	ρ		Implied Φ	z-statistic	95% conf. interval		Implied Φ 95% conf, interval		No. of observations
Floating	-0,16	***	0,84	-2,75	-0,05	0,03	0,95	1,03	65
Intermediate	-0,23	***	0,77	-3,03	-0,38	-0,08	0,62	0,92	76
Fixed	-0,14	***	0,86	-3,44	-0,22	-0,06	0,78	0,94	80

***,**,* denote significance at 1,5 and 10% rescpectively

Table 5. Non-tradables inflation rate convergence by country

country	ρ		Implied Φ	t-statistic	95% conf. interval		Implied Φ 95% conf, interval		No. of observations
CZE	-0,09	**	0,91	-1,76	-0,20	0,01	0,80	1,01	31
EST	-0,07		0,93	-1,32	-0,17	0,04	0,83	1,04	35
HUN	-0,02		0,98	-0,51	-0,11	0,07	0,89	1,07	35
LIT	-0,14	***	0,86	-2,84	-0,24	-0,04	0,76	0,96	27
POL	-0,06		0,94	-1,36	-0,16	0,03	0,84	1,03	27
SLK	-0,14	**	0,86	-1,79	-0,29	0,02	0,71	1,02	31
SLO	-0,02		0,98	-0,51	-0,11	0,07	0,89	1,07	35

***,**,* denote significance at 1,5 and 10% rescpectively

Table 6. Non-tradables inflation rate convergence by regime

regime	ρ		Implied Φ	z-statistic	95% conf. interval		Implied Φ 95% conf, interval		No. of observations
Floating	-0,11	***	0,89	-3,07	-0,18	-0,04	0,82	0,96	65
Intermediate	-0,04		0,96	-0,94	-0,11	0,04	0,89	1,04	76
Fixed	-0,11	***	0,89	-4,20	-0,16	-0,06	0,84	0,94	80

***,**,* denote significance at 1,5 and 10% rescpectively

Table 7. Growth equation estimated with FGLS

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GFCF	0,13	0,06	2,26	0,02	0,02	0,24
FDI	0,15	0,10	1,49	0,14	-0,05	0,36
EX	-0,03	0,02	-1,47	0,14	-0,07	0,01
GGFC	-0,07	0,07	-1,09	0,28	-0,21	0,06
GDPPC	0,00	0,00	2,26	0,02	0,00	0,00
FLOAT	-2,89	0,73	-3,94	0,00	-4,33	-1,46
FIX	1,37	0,73	1,88	0,06	-0,06	2,80
INF	-6,40	2,16	-2,97	0,00	-10,63	-2,17
C	1,68	1,78	0,94	0,35	-1,82	5,17

Table 8. Growth equation estimated with FGLS with heteroscedastic panels

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GFCF	0,03	0,04	0,62	0,53	-0,06	0,11
FDI	0,05	0,09	0,57	0,57	-0,12	0,22
EX	-0,03	0,02	-1,71	0,09	-0,06	0,00
GGFC	-0,10	0,04	-2,30	0,02	-0,19	-0,02
GDPPC	0,00	0,00	3,19	0,00	0,00	0,00
FLOAT	-2,29	0,63	-3,62	0,00	-3,53	-1,05
FIX	2,42	0,55	4,40	0,00	1,34	3,50
INF	-8,54	2,55	-3,35	0,00	-13,54	-3,55
C	5,26	1,66	3,17	0,00	2,00	8,52

Table 9. Growth equation estimated with FGLS with heteroscedastic panels and autocorrelation within panels

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GFCF	0,06	0,06	1,10	0,27	-0,05	0,17
FDI	0,03	0,09	0,38	0,71	-0,14	0,21
EX	-0,01	0,02	-0,46	0,65	-0,06	0,04
GGFC	-0,08	0,07	-1,14	0,25	-0,22	0,06
GDPPC	0,00	0,00	1,55	0,12	0,00	0,00
FLOAT	-1,71	0,80	-2,12	0,03	-3,28	-0,13
FIX	2,36	0,75	3,15	0,00	0,89	3,83
INF	-4,84	2,67	-1,81	0,07	-10,08	0,39
C	2,65	2,12	1,25	0,21	-1,49	6,80

Table 10. Growth equation estimated with FE with robust standard errors

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GFCF	0,18	0,12	1,49	0,14	-0,06	0,42
FDI	0,16	0,16	1,05	0,29	-0,14	0,47
EX	0,13	0,03	4,03	0,00	0,07	0,20
GGFC	-0,05	0,32	-0,16	0,87	-0,69	0,59
GDPPC	(dropped)					
FLOAT	-2,66	0,53	-5,07	0,00	-3,70	-1,62
FIX	4,76	1,30	3,65	0,00	2,19	7,33
INF	-4,93	1,63	-3,03	0,00	-8,14	-1,72
C	-9,56	7,13	-1,34	0,18	-23,62	4,50

Table 11. Growth equation estimated with random effects

dgdp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GFCF	0,13	0,06	2,21	0,03	0,01	0,24
FDI	0,15	0,11	1,45	0,15	-0,05	0,36
EX	-0,03	0,02	-1,44	0,15	-0,07	0,01
GGFC	-0,07	0,07	-1,07	0,29	-0,21	0,06
GDPPC	0,00	0,00	2,21	0,03	0,00	0,00
FLOAT	-2,89	0,75	-3,85	0,00	-4,36	-1,42
FIX	1,37	0,75	1,83	0,07	-0,09	2,84
INF	-6,40	2,21	-2,90	0,00	-10,73	-2,07
C	1,68	1,82	0,92	0,36	-1,90	5,25