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Convergence of interest rate pass-through in a wider euro zone?

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Abstract

This study investigates interest rate pass-through convergence for the eight Central and Eastern European countries (CEECs) that joined the European Union. Based on a unifying empirical pass-through model that allows for thresholds, asymmetric adjustment, and structural changes, we find that the pass-through in many CEECs has become faster over time and is generally more complete than in the euro zone. We find evidence for convergence across CEECs with market concentration, bank health, foreign bank participation and monetary policy regime as conditioning factors. No convergence of the CEEC pass-through is found vis-à-vis the heterogeneous euro zone.

JEL classification : E43; E52; E58; F36

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1. Introduction

The eastern enlargement of the European Union (EU) in 2004 will soon be followed by an eastern enlargement of the euro zone. While the so-called Maastricht criteria focus on nominal convergence of inflation rates, market interest rates and government deficits and debt, the issue of

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convergence of financial structures has recently become a focal point of the debate on the European integration project for at least two reasons: With respect to the genuine objective of EU integration policy to create a single European financial market it is now widely recognized that retail banking markets are still the least integrated financial markets within the EU (for a recent review see, e.g., Baele et al., 2004). With respect to the emergence of a (more) homogenous euro-zone monetary transmission, it has been argued that ''differences in financial structure are the proximate cause for [these] national asymmetries in the monetary transmission mechanism'' (Cecchetti, 1999). Pass-through (PT) studies which investigate how retail banking interest rates react to changes in market interest rates can provide evidence on both issues: First, banking markets are said to be integrating when different national bank rates react similarly to market interest rate ''news''.[1] Secondly, if monetary transmission heterogeneities are mainly driven by financial structure differences, then PT convergence may be at the heart of monetary transmission convergence. Building on previous work for the incumbent euro zone (Sander and Kleimeier, 2004) we here explore both the potential for interest rate PT convergence across the eight central and eastern European countries (CEECs) that joint the EU in 2004 and the potential for convergence of this group vis-à-vis the incumbent euro zone and some of its members.

Financial structure heterogeneity within the current European Monetary Union (EMU) is now well documented by various strands of research.[2] Heterogeneity is also confirmed in most euro-zone PT studies that are based on a variant of the pioneering work by Cottarelli and Kourelis (1994). Important contributions include BIS (1994), Cottarelli et al. (1995), Borio and Fritz (1995), Mojon (2001), de Bondt et al. (2002), Sander and Kleimeier (2002, 2004), Toolsema et al. (2002), Heinemann and Schüler (2003), de Bondt (2004), and De Graeve et al. (2004). Typically, these studies find considerable differences in the pass-through across the countries of the euro zone. Moreover, a substantial degree of short-run bank interest rate stickiness and very limited evidence for a full pass-through in the long run is found. Asymmetric adjustment of retail interest rates is also regularly documented. Finally, it is often argued that the single currency could act as a unifying force that has the potential to make the PT faster, more complete and more homogeneous. However, as argued by Sander and Kleimeier (2004), legal and cultural differences may continue to preclude full convergence in the incumbent euro zone. So can convergence towards a heterogeneous aggregate euro zone be meaningful? To address this issue comprehensively, we investigate three different concepts of convergence: convergence across CEECs, convergence of CEECs towards an aggregate euro zone and towards a few selected incumbent euro-zone countries chosen as representatives for different legal families.

Given the diverse macro-economic developments and financial structures in the new EU member countries, one might hypothesize that a wider euro zone will lead to an even more heterogeneous monetary policy transmission process. Until now, there exist only very few PT studies for CEECs. These are often limited to individual countries such as the studies by Opiela (1999), Wróbel and Pawłowska (2002), and Chmielewski (2004) for Poland, and Horváth et al. (2004) for Hungary, or they relate to selected countries only, such as Crespo-Cuaresma et al. (2004) and Kot (2004), who compare the Czech Republic, Hungary and Poland. In all studies,

[1] Baele et al. (2004) classify cross-country PT-studies as a ''news-based measure'' of financial market integration.

[2] Recent overviews on financial integration in the euro zone are given by Freixas (2003) and Baele et al. (2004). While the latter study predominantly uses so-called beta- and sigma-convergence measures, Kleimeier and Sander (2000, 2003), and Schüler and Heinemann (2002) investigate retail banking market integration using cointegration methodology. For an application of the cointegration approach to CEECs see Brada et al. (2005).

short-run stickiness of retail interest rates is confirmed. The latter two studies furthermore report evidence for a heterogeneous pass-through process across market interest rates and across the three countries. However, the existing CEEC PT is not carved in stone, in particular as an integrated banking market is generally considered a precondition for a smooth, efficient and homogeneous PT. For the euro-zone incumbents, it has been shown that the emergence of an integrated European banking market so far was much slower than expected, mainly due to a lack of cross-border lending and cross-border mergers and acquisitions. In contrast, in CEECs, participation of foreign banks is substantial and may thus play an important role for both an eventual emergence of an integrated banking market and a more homogeneous PT process. Furthermore, monetary stability can have an important homogenizing impact on the PT via low inflation and low volatility of market interest rates (see e.g. Mojon, 2001; Sander and Kleimeier, 2004). Thus, an adoption of the euro may lead to more convergence. Our study will address these issues and is thus not only the first to investigate comparatively the PT in all eight EU transition countries, but also to analyze the PT determinants in order to explore the potential for convergence.

Our research strategy is as follows: We start by modeling the PT-process using the unifying approach advocated in Sander and Kleimeier (2004) for all eight CEECs, for the aggregate euro zone, and for the four individual euro-zone member countries selected as representatives of the four ''legal families''. In order to take care of structural changes in the CEECs we follow Brada et al. (2005) and apply a rolling regression approach. The obtained PT coefficients are then used to investigate convergence over time. We study both convergence across the CEECs and convergence vis-à-vis the aggregate euro zone and its four representative members. The plan of the paper is as follows. Section 2 introduces the methodology and describes the data. Section 3 analyses the PT in CEECs and its convergence within the region. Section 4 analyses CEEC PT convergence vis-à-vis the euro zone. Section 5 concludes.

2. Data and methodology

Our study focuses on eight CEECs; the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia, the aggregate euro zone and the four countries chosen as representative for the different legal families Finland, Germany, Ireland, and Spain. For CEECs we collect monthly data from January 1993 to December 2003 for retail interest rates on mortgages, consumer loans, short- and long-term corporate loans, current account deposits, time deposits and savings accounts. For the aggregate euro zone these series are only available as of January 1996. We therefore also start the sample for individual euro-zone countries in 1996. It should also be noted that the ECB discontinued their retail interest rate statistics in the second half of 2003. Thus, we cannot extend our analysis beyond 2003. As a proxy for the central bank's policy rate we use a 1-month money market rate. The maturity choice is a matter of debate. So-called cost-of-funds based studies are rooted in an industrial organization approach where the market rate should reflect the marginal cost of funds. Thus, a matching and possibly longer maturity is searched for. Studies that focus on monetary policy transmission theories (the so-called monetary policy approach) typically employ a short-term market rate to avoid term structure of interest rates issues. For CEECs, most authors focus on the monetary-policy approach and use as a short-term money market rate the 1-month rate (Wróbel and Pawłowska, 2002; Kot, 2004; Crespo-Cuaresma et al., 2004; Chmielewski, 2004), whereas Horváth et al. (2004) use a 3-months rate. Opiela (1999) also uses a 3-months rate but also includes the rediscount rate as an administratively controlled rate in his PT equation. Our choice of the

1-month rates thus allows for comparability of results. Our CEEC data sources are the web-sites of the national central banks. Euro-zone data are obtained from the ECB.[3]

To account for any structural changes in the CEECs' national banking markets we conduct our analysis for 5-year rolling sub-periods from January 1993 to December 1997, January 1994 to December 1998, and so on until the last rolling period from January 1999 to December 2003.[4] This leads to a total sample of 358 observations, of which 102 are loan observations and 256 are deposit observations. In order to investigate convergence towards the incumbent euro zone we have chosen to investigate convergence towards a structural-break free "post-break" period for the aggregate euro zone and the four representative euro-zone countries. Here we determine structural breaks endogenously using a rolling Chow-test methodology described in detail in Hansen (1992).

We model the empirical PT analysis by applying the unifying approach advocated in Sander and Kleimeier (2004). This approach utilizes VAR and cointegration methodologies, allows for asymmetric and threshold adjustment and follows an automatic model selection procedure. Doing so has the advantage that the CEEC results obtained here are directly comparable with the euro-zone results obtained in that earlier study. The PT model can take one of three basic forms:

$$\mathrm{BR}_t = \beta_0 + \sum_{i=1}^{k^*} \beta_{\mathrm{BR},i} \mathrm{BR}_{t-i} + \beta_1 M_t + \sum_{i=1}^{n^*} \beta_{M,i} M_{t-i} + \varepsilon_t \tag{1}$$

$$\Delta\mathrm{BR}_t = \sum_{i=1}^{k^*} \beta_{\mathrm{BR},i} \Delta\mathrm{BR}_{t-i} + \beta_1 \Delta M_t + \sum_{i=1}^{n^*} \beta_{M,i} \Delta M_{t-i} + \varepsilon_t \tag{2}$$

$$\Delta\mathrm{BR}_t = \sum_{i=1}^{k^*} \beta_{\mathrm{BR},i} \Delta\mathrm{BR}_{t-i} + \beta_1 \Delta M_t + \sum_{i=1}^{n^*} \beta_{M,i} \Delta M_{t-i} + \beta_{\mathrm{ECT}} \mathrm{ECT}_{t-1} + \varepsilon_t \tag{3}$$

$$\mathrm{BR}_t = \theta_0 + \theta M_t + u_t \tag{4}$$

$$\mathrm{ECT}_{t-1} = u_{t-1} \tag{5}$$

where BR_t and M_t are national retail and money market rates, respectively, and k^* and n^* indicate the optimal lag lengths.[5] Eq. (1) describes the PT as a standard model in levels (STD_LL) and is chosen when interest rates are $I(0)$. When interest rates are $I(1)$, the empirical PT model is best estimated using first differences as stated in Eq. (2). This standard specification (STD) leads to a loss of information about long-run relationships, which can be recovered if BR and M are cointegrated. By estimating the long-run cointegration relationship (4), an error correction term (ECT) can be obtained as shown in Eq. (5) and Eq. (2) then needs to be augmented by a lagged

[3] A full description of the data is available from the authors upon request.

[4] We collect a total of 117 national retail interest rates. All series run until December 2003 but not all of them are already available in 1993. Whereas most Czech rates start in 1993, Latvian and Lithuanian rates generally start in 1999 only (though some Lithuanian time deposit rates are available as of 1993). Overall, of our 117 series, 25% have data for the rolling period 1993–1997, 29% for 1994–1998, 45% for 1995–1999, 59% for 1996–2000, 65% for 1997–2001, 66% for 1998–2002, and 100% for 1999–2003.

[5] Whenever an optimal lag length has to be determined, the minimum AIC criterion is used allowing for a maximum of four lags.

(ECT_{t-1}) as shown in Eq. (3). If the ECT is defined as in Eq. (5), a symmetric adjustment model (SYM) is estimated where the adjustment mechanism is independent of the state of the disequilibrium. Next to the symmetric error-correction process we also consider several asymmetric specifications. These state-dependent models all belong to the group of threshold autoregressive (TAR) models and differ with respect to the definition of the ECT:

$$\mathrm{ECT}_{t-1} = I_t\, u_{t-1} + (1 - I_t)\, u_{t-1} \quad \text{with} \quad I_t = 1 \text{ if } u_{t-1} = a_0^* \text{ and 0 otherwise} \tag{6}$$

$$\mathrm{ECT}_{t-1} = \sum_{j=1}^{3} \rho_j I_j u_{t-1} \quad \text{with} \quad I_{jt} = \begin{cases} I_{1t} = 1 & \text{if } u_{t-1} \geq a_0^* \text{ and 0 otherwise} \\ I_{2t} = 1 & \text{if } |u_{t-1}| < a_0^* \text{ and 0 otherwise} \\ I_{3t} = 1 & \text{if } u_{t-1} \leq -a_0^* \text{ and 0 otherwise} \end{cases} \tag{7}$$

$$\mathrm{ECT}_{t-1} = I_t \rho_1 \Delta u_{t-1} + (1 - I_t)\rho_2 \Delta u_{t-1} \text{ with } I_t = 1 \text{ if } \Delta u_{t-1} \geq a_0^* \text{ and 0 otherwise} \tag{8}$$

A first state-dependent adjustment mechanism allows for differing adjustment speed above or below a given threshold a_0^*. In the simplest case of the TAR^0 model this threshold is set to zero, typically implying different adjustment speed when rates are above versus below their long-run equilibrium. Thus, the ECT is defined in Eq. (6) where I_t represents a Heaviside indicator for different states of u_{t-1} and $a_0^* = 0$. The second asymmetric model, TAR^*, is a modification of the TAR^0 such that the threshold a_0^* is now allowed to deviate from zero. The third variation is a band-TAR model (B-TAR^*) defined in Eq. (7), which can reflect interest rate smoothing as well as interest rate stickiness. Finally, our fourth and fifth asymmetric models represent momentum threshold autoregressive models (M-TAR^0 and M-TAR^*) defined in Eq. (8), where the adjustment depends on the recent change in deviation from equilibrium. M-TAR adjustment can reflect behavior by banks, which attempt to smooth out large market rate changes.[6]

In order to find the empirical PT model that optimally fits the data we start with unit root testing. Based on the full sample period, we employ mean-shift, trend-shift and recursive unit root tests that are consistent even in the presence of a structural break (Banerjee et al., 1992). In case of $I(0)$ for both BR and M we choose the STD_LL model as the optimal pass-through model. Otherwise, we proceed with an (almost) automatic model selection procedure for each interest rate during each of the rolling sub-periods. Here we start with cointegration testing. We first estimate all TAR-type models and select that model which according to the AIC criterion fits the data best.[7] For this model, we conduct cointegration and asymmetry tests following Enders and Siklos (2001). If asymmetric cointegration is confirmed, the pass-through model is set as the best TAR-type model. If asymmetric cointegration is not confirmed, we continue with symmetric cointegration testing following Engle and Granger (1987). If symmetric cointegration is found, the pass-through model is estimated as SYM. However, if symmetric cointegration is not found, the pass-through model is set as STD.

We conduct this selection process for each of the rolling sub-periods. To enhance the comparability of the multipliers and to allow for a meaningful second stage analysis of the

[6] The M-TAR model might turn out to be rather important for our PT modeling. Enders and Siklos (2001) provide evidence for the US and show that conventional cointegration models such as the SYM model fail to detect cointegration whereas there is clear evidence for M-TAR adjustment. Comparing SYM, TAR and M-TAR, they conclude: "the power of the test for TAR adjustment is poor compared to that of the Engle–Granger test. However, for a plausible range of the adjustment parameters, the power of the M-TAR test can be many times that of the Engle–Granger test."

[7] The optimal threshold a_0^* is found by searching over the mid-80% of the distribution of u_t and selecting the model for which the residual sum of squares is minimized. This is in accordance with Chan (1993).

determinants of the pass-through, we want to select for each national retail rate the same PT model across all sub-periods. Thus, we need a decision rule to select one and only one PT model. Our first rule is to choose the model that occurs in the absolute majority of all rolling sub-periods. If no model has the absolute majority, we repeat the estimation and selection procedure for the full sample period and choose this model for all sub-periods.[8] For the aggregate euro zone and the four member countries this is not necessary as only one post-break period exists. Based on the selected PT model, we obtain multipliers of different time horizons (impact, 1, 3, 6, 12 months, and long run) and different interest rate shocks (−1%, −0.25%, +0.25%, +1%). β_1 is the impact multiplier. The long-run multiplier is given by θ of Eq. (4) when interest rates are cointegrated. For the STD or STD_LL models, however, the long-run multiplier has to be calculated as

$$\theta = \frac{\beta_1 + \sum_{i=1}^{n*} \beta_{M,i}}{1 - \sum_{i=1}^{k*} \beta_{\mathrm{BR},i}} \tag{9}$$

Interim multipliers are simulated based on the estimated coefficients of Eqs. (1)–(3).

The estimated PT multipliers are used to investigate heterogeneity and convergence. First, we explore country and market differences as well as structural changes over time. To do so, we use a panel regression approach to test for PT differences across countries, markets and sub-periods and regress all multipliers of a specific time horizon (h) on dummies for country (c)-, market (m)-, and time (t)-specific effect as indicated in Eq. (10):

$$h\_\mathrm{multiplier}_{c,m,t} = \alpha_0 + \sum_{c=1}^{C} \alpha_c \mathrm{dummy}_c + \sum_{m=1}^{M} \alpha_m \mathrm{dummy}_m + \sum_{t=1}^{T} \alpha_t \mathrm{dummy}_t + \varepsilon_{c,m,t} \tag{10}$$

Additionally, we use dummies for different types of monetary policy shocks to explore the existence and nature of potential asymmetries. This approach is used for both a pure CEEC panel to investigate intra-regional convergence and a panel with the euro zone as a convergence benchmark.

In a second step we explore convergence forces further. In order to analyze *intra-CEEC convergence* in more depth we replace as many dummies as possible by macro-economic control variables and financial structure variables. This strategy has been followed by Sander and Kleimeier (2004) for the euro zone and has led to the conclusion that significant legal family dummies remain significant, i.e. there are strong forces against convergence. Since we are replicating the same methodology we do not redo this exercise here for the euro zone. Concentrating on CEECs we have collected a large number of macro-controls and financial market descriptors. After some experimenting, we settled for two macro-control—money market rate volatility (*mmvol*) defined as the standard deviation of the monthly money market rates for the respective rolling period and country under consideration and *inflation* defined as the percentage change on the previous year's average annual harmonized index of consumer prices (European Commission, 2004, Table 35). With respect to financial market descriptors we have finally selected three. The data for the first two financial structure variables are collected as annual observations from the EBRD Transition Reports for 2002 and 2003 (EBRD, 2002, 2003).

[8] In 66% of all cases we have a perfect match, e.g. the selected PT model is also the one that is optimal for the specific sub-period. Only in the remaining cases do we select a different model. Looking at the different deposit and loan rates reveals that the match is especially good for mortgages, consumer loans, and time deposits. Here we perfectly match about 80%.

To obtain a measure of foreign competition, arguably the best proxy would be the share of foreign banks in total bank assets. Unfortunately, data for such a proxy are not available for the full sample period. We therefore employ a next-best proxy based on the EBRD's number for domestic and foreign-owned banks and construct *frgbankp* as the number of foreign banks as % of all banks.[9] As a measure of bank health we use *badloan* defined as non-performing loans in % of total loans.[10] Finally, our third proxy *CR3* measures the annual concentration of the national banking market and is obtained from the World Bank (2003) Financial Development and Structure Database. CR3 is defined here as assets of the three largest banks in % of assets of all commercial banks in the country. To correspond to our 5-year rolling samples, all annual structural variables are converted to 5-year averages.

To explore *convergence vis-à-vis the euro zone* we employ the concept of sigma convergence. This concept suggests that convergence be best measured as a reduction in cross-country variation over time. Our sigma (σ) variable is defined as the variation of individual country (c), market (m), and time period (t) multipliers against the corresponding multipliers of the benchmark region or country (x) in a structurally stable post-break period t^*:

$$\sigma_x = \frac{|h\_\text{multiplier}_{c,m,t} - h\_\text{multiplier}_{x,m,t^*}|}{h\_\text{multiplier}_{x,m,t^*}} \tag{11}$$

By regressing σ on a time trend, we test for a significant reduction of cross-country variation over time indicating sigma-convergence.

3. The pass-through and its convergence across CEECs

3.1. The pass-through in CEECs

From our PT regressions we obtain multipliers for all CEEC retail interest rates and seven different overlapping periods. Table 1 provides simple averages of these multipliers to illustrate our core findings.[11] First, it appears that over time the changes in the CEEC PT exhibit a V-shaped adjustment, i.e. the impact and very short-run multipliers have decreased over time, while long(er)-run multipliers have increased over time. Second, loan markets but not deposit markets show on average a full PT which stands in contrast to the results obtained for the aggregate euro zone. Nevertheless, the long-run PT tends to be more complete for loans than for deposits in the CEEC as well as in the euro zone. Third, the PT is typically most efficient with respect to lending to the corporate sector and least efficient with respect to current account and savings deposits. In

[9] The EBRD defines "number of banks (foreign-owned)" as: "number of commercial and savings banks, excluding cooperative banks. Foreign-owned banks are defined as those with foreign ownership exceeding a 50% share, end-of-year". The EBRD also reports the asset share of foreign banks for each of our CEECs but this measure is only available as of 1999. Furthermore, this measure cannot be replicated for euro-zone countries. Between 1999 and 2003, both measures are highly correlated for the CEEC (0.70) and we are thus confident that we do not lose too much information when employing the simpler proxy based on number of foreign banks.

[10] The EBRD variable "non-performing loans (in % of total loans)" is defined as: "ratio of non-performing loans to total loans. Non-performing loans include substandard, doubtful and loss classification categories for loans, but excludes loans transferred to a state rehabilitation agency or consolidation bank, end-of-year."

[11] Detailed results for this as well as all future analyses are available from the authors upon request. Due to our model selection procedure, our multipliers are statistically significant. However, in the TAR-type models it can be the case that not all of the coefficients of the ECT are significant. The insignificant coefficients tend to be small in comparison to the significant ones and thus do not unduly bias the estimated multipliers.

Table 1
The pass-through in an enlarged Europe

Country	Period	Average multiplier across all loan types		Average mortgage multiplier		Average consumer loan multiplier		Average short-term corporate loan multiplier		Average long-term corporate loan multiplier	
		Impact	Longrun	Impact	Longrun	Impact	Longrun	Impact	Longrun	Impact	Longrun
Panel A: loans											
CEEC	1993–1997	0.77	0.78	0.87	0.81	0.49	0.51	1.01	1.03	1.00	1.03
	1996–2000	0.26	0.79	0.18	1.01	0.15	0.52	0.33	0.82	0.43	1.08
	1999–2003	0.21	0.95	0.11	1.04	0.12	0.77	0.35	0.93	0.25	1.14
Euro zone	Post-break	0.23	0.62	0.21	0.69	0.10	0.40	0.34	0.75	0.26	0.64
Finland	Post-break	0.61	0.97	0.36	0.98	0.62	1.01	n.a.	n.a.	0.84	0.93
Germany	Post-break	0.23	0.42	0.34	0.61	0.17	0.22	0.20	0.33	0.21	0.52
Ireland	Post-break	0.51	0.65	0.54	0.82	0.46	0.63	0.59	0.52	0.44	0.63
Spain	Post-break	0.43	0.77	0.19	0.79	n.a.	n.a.	0.82	0.78	0.28	0.73

Country	Period	Average multiplier across all deposit types		Average time deposit multiplier		Average savings account multiplier		Average current account deposit multiplier	
		Impact	Longrun	Impact	Longrun	Impact	Longrun	Impact	Longrun
Panel B: deposits									
CEEC	1993–1997	0.49	0.44	0.52	0.45	0.36	0.38	n.a.	n.a.
	1996–2000	0.17	0.39	0.19	0.43	0.01	0.01	0.18	0.36
	1999–2003	0.17	0.66	0.18	0.70	0.00	0.15	0.10	0.41
Euro zone	Post-break	0.20	0.39	0.48	0.76	0.06	0.22	0.06	0.18
Finland	Post-break	0.07	0.14	0.01	−0.08	0.15	0.29	0.04	0.21
Germany	Post-break	0.31	0.51	0.55	0.83	n.a.	n.a.	0.06	0.18
Ireland	Post-break	0.11	0.20	n.a.	n.a.	0.11	0.20	n.a.	n.a.
Spain	Post-break	0.37	0.52	0.47	0.69	n.a.	n.a.	0.26	0.36

Note: For the CEEC the average multiplier across all available countries and rates is reported. For the euro zone and selected euro zone countries, the country-specific multiplier is reported. n.a. indicates that no multiplier could be calculated as the interest rates is missing during the (sub)-sample period.

contrast, the aggregate euro zone is characterized by a somewhat faster but clearly less complete PT. In particular, comparing the PT in CEECs with the euro-zone PT in the period 1999–2003 reveals smaller long-run multipliers for all loan rates. Furthermore, the national multipliers also illustrate the heterogeneity among euro zone countries. Finland appears to have a faster and more complete PT in the loan market but lacks behind in the deposit market. In contrast, Germany appears to have the least complete loan PT but the most complete deposit PT.

To test for statistical significance of these observations we use the second-stage regressions as defined in Eq. (10) and reported in Table 2.[12] Taking into account the

[12] For convenience we only report multipliers for a +0.25% shock as this corresponds to the size of interest rate change typically initiated by the ECB. Regarding the dummies, note that we use the following benchmark: Poland (because their multipliers are closest to the overall average), mortgage rates (because their multipliers are closest to the overall average) or time deposit rates (as it is the most frequent deposit rate), 1993–1997 (so that we can clearly see the development over time compared to the first rolling period). We however also try other benchmarks and find as expected that the coefficients change but that the relative ranking and thus the interpretation of the coefficients remains unchanged.

differences in loan and deposit markets we split the sample into two separate panels.[13] Panel A reveals that the long-run PT in the loan market differs somewhat across countries, however, only in Estonia (lower), the Slovak Republic (lower) and Slovenia (higher) we find statistically significant differences in the long-run PT. Generally, the long-run PT has improved so that loan markets are often characterized by a full PT and no significant differences across loan types are detected. It should however be noted that average long-run multiplier is 0.91 for short-term corporate and 1.07 for long-term corporate loan rates, respectively. For consumer loans the average is 0.59, but the insignificant consumer loan dummy in our panel regression is caused by a high standard deviation for consumer loan multipliers, thus revealing a high degree of heterogeneity in the consumer credit products and the corresponding data.[14] Rather than in the size, differences are more pronounced in the speed of the PT. Particularly, short-run adjustment is significantly faster in corporate loan markets. Finally, we find a significant reduction in the very short-run PT speed over time. Thus, the V-shaped change of the PT process is confirmed for the loan market. From Panel B one can observe that there is much more variation in the deposit than in the loan market. This is indicated by significant country and market dummies and points to more heterogeneity within and across national deposit markets. Again, we find statistically significant V-effects, i.e. short run multipliers have decreased and long-run multipliers have increased over the past decade.

We have also explicitly tested for asymmetries by means of constructing a large panel using all multipliers for all types of shocks (positive, negative, small large). However, we found multipliers to be very similar and independent of the size or direction of the monetary policy shock.[15] This lack of asymmetry is confirmed by Crespo-Cuaresma et al. (2004) for the Czech Republic, Hungary and Poland and by Chmielewski (2004) for Poland. For Hungary, however, Horváth et al. (2004) report asymmetries depending on the size of the changes in money market rates and the size of the deviation from long-term equilibrium.

In sum, we find a quite homogeneous PT in CEEC lending markets where also a full PT can often be observed. Both results are standing in some contrast to the on average more heterogeneous and less perfect PT in the euro zone. Finally, the V-shape time pattern of the adjustment of multipliers suggests that the monetary regime (as measured by money market rate volatility), macro-economic developments, financial reform and changes in the financial structure may have played an important role in changing the monetary transmission process in CEECs. These PT determinants are explored in more detail in the following section.

[13] When trying to explain market characteristics by variables describing financial market structures one can show – as expected – that these variables have different effects in loan and deposit markets. These can be captured by multiplying the structural variables with a loan or deposit market dummy (see Sander and Kleimeier, 2004), respectively, or by splitting the sample into two separate panels. Since we do have ample observations due to our rolling regression approach we opt here for the second alternative.

[14] Chmielewski (2004) also finds similarly high long-run multipliers for Polish corporate loan rates and a smaller long-run multiplier for consumer credit rates.

[15] This result is not surprising, since we select an asymmetric model in only about one quarter of all cases. This is partly due to the fact that asymmetry is indeed rejected but is also influenced by our decision to use only one model per country and market.

Table 2
Country, rate, and time patterns in the pass-through in CEECs

Independent variable	Dependent variable = multipliers for a +0.25% shock											
	Impact		1 month		3 months		6 months		12 months		Long-run	
Panel A: loan rates												
Intercept	0.37	(2.57)	0.42	(2.99)	0.39	(2.48)	0.36	(2.08)	0.20	(1.15)	0.14	(0.61)
Czech Republic	0.09	(0.78)	−0.08	(−0.75)	−0.27	(−2.22)	−0.40	(−2.98)	−0.33	(−2.24)	−0.27	(−1.44)
Estonia	0.01	(0.06)	−0.14	(−1.51)	−0.29	(−2.82)	−0.36	(−3.26)	−0.38	(−3.05)	−0.33	(−2.11)
Hungary	0.23	(2.71)	0.24	(2.83)	0.12	(1.25)	0.08	(0.78)	0.15	(1.26)	0.19	(1.32)
Latvia	0.14	(1.12)	0.02	(0.20)	−0.10	(−0.73)	−0.10	(−0.67)	0.08	(0.47)	0.26	(1.23)
Lithuania	0.07	(0.63)	−0.18	(−1.54)	−0.29	(−2.31)	−0.36	(−2.58)	−0.22	(−1.42)	−0.03	(−0.15)
Slovak Republic	0.04	(0.36)	−0.23	(−2.28)	−0.48	(−4.38)	−0.64	(−5.28)	−0.62	(−4.56)	−0.57	(−3.39)
Slovenia	0.36	(4.32)	0.38	(4.52)	0.43	(4.59)	0.50	(4.90)	0.68	(6.00)	0.84	(5.95)
Consumer loans	0.00	(0.07)	−0.05	(−0.69)	0.00	(0.00)	0.01	(0.13)	−0.02	(−0.25)	−0.10	(−0.84)
Short-term corporate loans	0.26	(3.66)	0.20	(3.06)	0.27	(3.40)	0.26	(3.08)	0.23	(2.46)	0.14	(1.22)
Long-term corporate loans	0.23	(3.21)	0.20	(2.78)	0.25	(3.12)	0.24	(2.76)	0.21	(2.19)	0.14	(1.15)
1994–1998	−0.05	(−0.37)	0.02	(0.15)	0.03	(0.16)	0.02	(0.14)	0.02	(0.11)	0.02	(0.09)
1995–1999	−0.34	(−2.71)	−0.10	(−0.81)	0.09	(0.66)	0.26	(1.75)	0.36	(2.16)	0.40	(1.92)
1996–2000	−0.44	(−3.58)	−0.21	(−1.72)	0.04	(0.29)	0.20	(1.36)	0.31	(1.86)	0.39	(1.88)
1997–2001	−0.38	(−3.19)	−0.14	(−1.15)	0.16	(1.18)	0.37	(2.60)	0.55	(3.42)	0.65	(3.23)
1998–2002	−0.43	(−3.61)	−0.24	(−2.04)	0.02	(0.16)	0.19	(1.35)	0.36	(2.26)	0.47	(2.35)
1999–2003	−0.40	(−3.39)	−0.24	(−2.02)	0.04	(0.31)	0.25	(1.76)	0.45	(2.82)	0.70	(3.55)
Adjusted R^2	50%		62%		65%		67%		67%		60%	
Panel B: deposit rates												
Intercept	0.42	(7.24)	0.45	(6.74)	0.62	(7.70)	0.64	(7.60)	0.54	(5.60)	0.37	(2.57)
Czech Republic	−0.03	(−0.85)	−0.19	(−4.00)	−0.37	(−6.61)	−0.42	(−7.12)	−0.38	(−5.54)	−0.29	(−2.85)
Estonia	0.17	(3.77)	0.02	(0.38)	−0.21	(−3.43)	−0.32	(−4.83)	−0.31	(−4.18)	−0.30	(−2.71)
Hungary	0.12	(2.49)	0.16	(2.74)	0.20	(3.01)	0.16	(2.18)	0.11	(1.36)	0.10	(0.83)
Latvia	0.04	(0.77)	−0.10	(−1.77)	−0.34	(−5.00)	−0.43	(−6.06)	−0.45	(−5.49)	−0.57	(−4.66)
Lithuania	−0.13	(−3.66)	−0.19	(−4.67)	−0.41	(−8.37)	−0.47	(−8.95)	−0.41	(−6.82)	−0.28	(−3.10)
Slovak Republic	−0.09	(−2.47)	−0.23	(−5.19)	−0.50	(−9.50)	−0.61	(−10.87)	−0.61	(−9.50)	−0.59	(−6.13)
Slovenia	0.22	(5.68)	0.22	(4.77)	0.12	(2.19)	0.16	(2.76)	0.30	(4.59)	0.53	(5.44)
Current account deposits	−0.12	(−2.20)	−0.24	(−3.94)	−0.50	(−6.74)	−0.57	(−7.40)	−0.55	(−6.16)	−0.46	(−3.45)
Savings accounts	−0.18	(−4.94)	−0.22	(−5.17)	−0.31	(−6.07)	−0.38	(−6.91)	−0.43	(−6.86)	−0.50	(−5.37)
1994–1998	−0.01	(−0.17)	0.13	(1.86)	0.18	(2.14)	0.19	(2.17)	0.20	(2.04)	0.22	(1.50)
1995–1999	−0.21	(−3.76)	−0.08	(−1.19)	0.06	(0.76)	0.13	(1.64)	0.20	(2.07)	0.27	(1.95)
1996–2000	−0.24	(−4.38)	−0.13	(−2.08)	−0.01	(−0.08)	0.07	(0.91)	0.15	(1.63)	0.24	(1.71)
1997–2001	−0.26	(−4.86)	−0.14	(−2.14)	0.02	(0.32)	0.13	(1.60)	0.26	(2.88)	0.38	(2.78)
1998–2002	−0.28	(−5.08)	−0.12	(−1.91)	0.00	(0.06)	0.10	(1.27)	0.23	(2.49)	0.40	(2.95)
1999–2003	0.24	(−4.40)	−0.12	(−1.86)	0.02	(0.23)	0.13	(1.63)	0.28	(3.06)	0.60	(4.43)
Adjusted R^2	51%		51%		58%		63%		60%		48%	

Note: For each independent variable, the given values are the estimated coefficient and the values within the parentheses are the *t*-statistic. All independent variables are dummies. In Panel A and B the regressions are based on samples of 102 and 256 observations, respectively. The samples include 1993 to 2003. Regarding the country, time and rate dummies note that the benchmark case is defined by Poland, mortgage rates or time deposit rates, 1993–1997.

3.2. Structural determinants of the pass-through in CEECs

We have experimented with several financial structure variables and macro-controls in second-stage regressions separated for loan, deposit, and – given the significant differences in the deposit markets – time deposit markets.[16] This not only allows us to identify the most important structural determinants but also to investigate whether and to what extent country or market characteristics are eventually precluding full convergence across CEECs. To control for differing macroeconomics conditions we have initially included GDP growth, inflation, financial development (as measured by the ratio of credit to GDP) and money market rate volatility. The financial development variable, however, does not systematically explain the PT pattern while at the same time introducing multicollinearity problems. GDP growth is found to be insignificant in all regressions and the goodness of fit is typically higher without this variable. For the subsequent analysis we therefore opt to exclude these two macro-controls. When investigating the role of inflation in an approach using macro-controls only, we find that higher inflation leads to a somewhat higher speed of the PT process after several months and also increases the long-run multipliers. These effects weaken somewhat when introducing financial market structure variables, but we find them important enough to include inflation even in a very parsimonious approach. A special role is played by money market rate volatility (mmvol). Studies have shown that money market volatility is positively correlated with interest rate margins (e.g. Saunders and Schumacher, 2000) and negatively correlated with the PT (Mojon, 2001; Sander and Kleimeier, 2004). Here we confirm these results as we find that a higher volatility has a negative impact on the size and the speed of the PT to loan rates after some 6 months. However, the positive coefficients of the impact and early interim multipliers for both loan and deposit rates show the opposite result. This may reflect the need to adjust loan and deposit rates somewhat faster under a more unstable monetary policy regime while in the longer-term high money market volatility would in fact slow down the transmission, reduce the PT and thus eventually lead to higher intermediation margins. This effect is confirmed independent of the specification of the subsequently discussed regressions, which contain alternative financial structure descriptors. As the latter variables have different effects in loan and deposit markets we analyze their role in separate panels (see Table 3).

Our final specification includes next to mmvol and inflation measures of banking market concentration (CR3), bank health (badloan), and foreign bank participation (frgbankp). The first two variables generally have the expected signs,[17] are statistically significant and help to explain around 50% of the loan market multiplier variations in CEECs. The last variable frgbankp, however, carries in a first estimate an implausible negative and significant coefficient. We hypothesize that this counterintuitive result may largely be due to the inclusion of Slovenia. From the individual country multipliers we know that the pass-through is faster and more complete in Slovenia than in other countries. However, the asset-share of Slovenia's state-owned banks remained extraordinarily high with over 40% for the whole sample period. At the same time its

[16] Our model selection process follows a stepwise approach. It starts from the dummy regression model by first adding all four potential macro-controls of which only two turned out to be more or less consistently significant. These results have also been cross-checked by running single and multiple regressions without dummies. In a second step we add financial structure variables to the macro-control augmented dummy model. The selection of these variables is informed by both theoretical and empirical considerations, again including results from simple regression, correlation and multicollinearity analyses. After adding all macro-controls and financial variables to the original dummy model all non-significant dummy variables are eliminated.

[17] There is one exemption: CR3 has a ''perverse'' positive influence on the impact deposit multiplier.

Table 3
Structural determinants of the pass-through in CEECs

Independent variable	Dependent variable = multipliers for a +0.25% shock											
	Impact		1 month		3 months		6 months		12 months		Long-run	
Panel A: loan rates												
Intercept	−0.10	(−0.37)	−0.01	(−0.02)	0.50	(1.52)	0.97	(2.60)	1.57	(3.80)	2.21	(4.28)
mmvol	5.32	(5.68)	3.37	(3.56)	0.72	(0.66)	−1.80	(−1.46)	−3.82	(−2.80)	−5.47	(−3.20)
Inflation	−1.32	(−1.79)	0.58	(0.79)	0.45	(0.53)	1.39	(1.43)	1.39	(1.30)	0.12	(0.09)
CR3	−0.23	(−1.00)	−0.44	(−1.86)	−0.77	(−2.83)	−0.98	(−3.17)	−1.28	(−3.73)	−1.47	(−3.45)
Badloan	−0.63	(−2.20)	−1.00	(−3.43)	−1.19	(−3.57)	−1.47	(−3.86)	−1.75	(−4.16)	−2.16	(−4.10)
frgbankp × (1 − Slovenia dummy)	0.50	(1.53)	0.66	(1.97)	0.49	(1.28)	0.10	(0.22)	−0.40	(−0.83)	−0.86	(−1.43)
Slovenia dummy	0.59	(3.00)	0.77	(3.85)	0.79	(3.45)	0.65	(2.50)	0.47	(1.62)	0.26	(0.73)
Short-term corporate loan dummy	0.23	(4.62)	0.23	(4.58)	0.27	(4.68)	0.28	(4.13)	0.27	(3.63)	0.23	(2.50)
Long-term corporate loan dummy	0.19	(3.48)	0.21	(3.96)	0.27	(4.43)	0.28	(4.04)	0.28	(3.55)	0.25	(2.55)
Adjusted R^2	55%		65%		65%		65%		65%		57%	
Panel B: deposit rates												
Intercept	−0.38	(−3.55)	−0.16	(−1.37)	0.22	(1.43)	0.54	(3.14)	0.82	(4.05)	1.11	(3.67)
mmvol	2.75	(9.04)	2.91	(8.67)	2.01	(4.55)	1.35	(2.75)	0.59	(1.03)	−0.21	(−0.24)
Inflation	−0.48	(−1.26)	0.25	(0.58)	2.12	(3.81)	2.36	(3.80)	2.21	(3.06)	0.96	(0.88)
CR3	0.22	(2.14)	0.01	(0.09)	−0.44	(−2.89)	−0.70	(−4.12)	−0.79	(−3.97)	−0.76	(−2.56)
Badloan	−0.73	(−6.14)	−0.94	(−7.19)	−1.32	(−7.65)	−1.33	(−6.94)	−1.36	(−6.06)	−1.35	(−4.01)
frgbankp × (1 − Slovenia dummy)	0.89	(7.64)	0.78	(6.12)	0.70	(4.16)	0.48	(2.54)	0.18	(0.81)	−0.12	(−0.36)
Slovenia dummy	0.70	(10.46)	0.69	(9.34)	0.64	(6.52)	0.59	(5.42)	0.53	(4.20)	0.54	(2.82)
Current account deposit dummy	−0.14	(−2.93)	−0.21	(−3.90)	−0.40	(−5.59)	−0.45	(−5.66)	−0.43	(−4.56)	−0.29	(−2.08)
Saving account dummy	−0.17	(−4.76)	−0.24	(−6.04)	−0.35	(−6.71)	−0.42	(−7.27)	−0.47	(−7.01)	−0.54	(−5.38)
Adjusted R^2	53%		59%		57%		57%		53%		37%	
Panel C: time deposit rates												
Intercept	−0.49	(−3.74)	−0.26	(−1.88)	0.02	(0.12)	0.37	(1.78)	0.67	(2.76)	0.97	(2.52)
mmvol	2.84	(7.96)	2.77	(7.32)	1.59	(3.24)	0.77	(1.38)	−0.18	(−0.27)	−1.37	(−1.30)
Inflation	−0.33	(−0.73)	0.81	(1.68)	3.33	(5.35)	3.57	(5.02)	3.49	(4.16)	2.76	(2.06)
CR3	0.30	(2.25)	0.08	(0.55)	−0.25	(−1.35)	−0.57	(−2.71)	−0.64	(−2.59)	−0.57	(−1.43)
Badloan	−0.78	(−5.82)	−0.99	(−6.90)	−1.41	(−7.58)	−1.42	(−6.72)	−1.46	(−5.83)	−1.56	(−3.92)
frgbankp × (1 − Slovenia dummy)	0.90	(6.51)	0.73	(4.95)	0.60	(3.16)	0.38	(1.76)	0.03	(0.12)	−0.32	(−0.78)
Slovenia dummy	0.73	(9.21)	0.68	(8.11)	0.61	(5.57)	0.57	(4.57)	0.50	(3.41)	0.49	(2.07)
Short maturity dummy	0.05	(1.28)	0.08	(1.89)	0.18	(3.28)	0.14	(2.23)	0.15	(2.03)	0.15	(1.26)
Corporate deposit dummy	0.07	(2.91)	0.09	(3.48)	0.12	(3.86)	0.15	(3.99)	0.13	(3.07)	0.13	(1.85)
Adjusted R^2	56%		63%		63%		61%		57%		39%	

Note: For each independent variable, the given values are the estimated coefficient and the values within the parentheses are the *t*-statistic. All excluded rate, country, and time dummies were found to be insignificant. In Panel A–C the regressions are based on samples of 102, 256, and 197 observations, respectively. The samples include 1993–2003.

share of foreign bank participation of about 11% is very low by CEEC standards.[18] When introducing a Slovenia dummy in combination with frgbankp, the counterintuitive result for foreign bank participation for the remaining countries in fact disappears. Our preferred specification of the loan market multiplier determinants is thus given in Panel A in Table 3. Here we show that foreign participation has the potential to speed up the PT process, particularly in the deposit market. This effect is marginally visible in the lending markets but only to a lesser extent and only in the very short run. The long-run PT is not significantly affected by this variable. It should, however, be noted that the results show that the PT to corporate loan rates according to this model is not only faster, but also more complete. Nevertheless, even then the Slovenia dummy, but only the Slovenia dummy, remains significantly positive. Finally, all time dummies are insignificant and are consequently dropped. The results therefore suggest conditional convergence. If concentration, bank health, and the monetary policy regime will converge, so will the financial part of the monetary transmission process in CEECs. This conditional convergence feature distinguishes the new EU members and potential euro-zone newcomers from the much more heterogeneous incumbents.

Turning to deposit markets as reported in Panel B of Table 3, our final regressions show that the specification reached for the loan market is also the most appealing here. Less concentration, less bad loans, and more foreign participation (in all countries but Slovenia) lead to a faster PT. The Slovenia dummy remains positive and significant. Money market rate volatility has a special impact here: The higher it is, the faster the PT in the very short run. But it has little or no impact on the longer-run multipliers or even on the completeness of the PT. Likewise, higher inflation leads to a faster PT only in the interim period. A more stable monetary policy regime with low inflation thus has the potential to slow down the medium-term PT.

Since we find current account and saving account rates reacting much slower than time deposit rates and given the large amount of data on time deposit rates we also run separate PT regressions for time deposits. Panel C in Table 3 reveals that most results of the deposit regressions can be confirmed. Additionally, we can show that the PT is faster for short maturities and time deposits from the corporate sector. In the latter case, the PT is also more complete.

In sum, the PT in CEECs is quite efficient and homogeneous, with the potential for conditional convergence depending on a unified monetary regime and integrating financial structures. Moreover, foreign bank participation has a positive effect, particularly on deposit rate flexibility in the short run.

4. CEEC convergence towards the euro zone?

Our results for the CEECs stand in sharp contrast to the pattern found in the euro zone where "legal and cultural differences may continue to preclude full convergence" (Sander and Kleimeier, 2004, p. 490). As such it is questionable what convergence towards a heterogeneous euro zone should mean. First, we will therefore explore convergence not only vis-à-vis an artificially aggregated euro zone but also vis-à-vis legal family representatives. Here in particular, Germany will stand for the German legal family, Finland for the Scandinavian legal

[18] Opiela (1999, p. 5) argues that the central bank may play the role of an oligopolistic leader and thus may try to "... reduce loan rate stickiness through signaling a desire for loan rates to change by altering the administrative rate. This practice is not only widespread, but may also have more relevance in an economy dominated by state-owned banks whose managers have been used to following administrative orders rather than subtle market signals."

family, Spain for the French legal family, and Ireland for the British legal family. A second issue is what convergence means when the region towards which convergence is measured is itself moving. Of course, when both sides are moving, convergence still makes sense. But if the PT in the euro zone is stable, it is more advisable to test for convergence against a stable post-break period. In fact, we are able to obtain post-break periods for the aggregate euro zone with breaks located between late 1997 and early 1999. These breaks are generally compatible with the individual-country breaks documented in Sander and Kleimeier (2004) and will thus be used in the subsequent convergence analysis. These post-break periods have the advantage of being longer than the rolling periods and thereby make the results of the PT analysis more reliable. Our estimates of the aggregate euro zone's as well as the individual countries' PT are in line with the findings in the literature: short-run stickiness, no long-run full PT, and large country differences. Table 1 illustrates.

For our analysis we construct a panel with the aggregate euro zone as the benchmark region. As a first step, our estimated multipliers serve as dependent variables and we conduct regressions similar to those in Table 2 but now with the euro zone as the benchmark country. Table 4 reveals that time dummies are generally not significant with exemption of very recent changes in the long-run multipliers for deposits. Second, the country dummies indicate no clear relative PT performance of CEECs vis-à-vis the aggregate euro zone: Some countries are faster, some slower, some do not differ significantly. Third, having controlled for country effects, it is remarkable that the PT speed for corporate loans are significantly higher than for mortgages or consumer loans. Similarly with respect to deposits, the negative dummies for savings and current account deposits indicate relatively more speed and size for the time deposit PT.

In a second step, we employ the concept of σ-convergence. Here our dependent variable is σ as defined in Eq. (11). We report the results in Table 5 and can make three observations: First, regarding the absolute value of the variation as shown in intercepts, second, regarding changes over time based on the trend variable, and third, regarding product-specific effects based on the loan- and deposit-type dummies. Regarding the absolute value of sigma vis-à-vis the aggregate euro zone, we find that loan markets are showing more heterogeneity than deposit markets as higher values for the intercept reveal. Moreover, heterogeneity is most pronounced in short-run adjustments. Over time, short-run heterogeneity is increasingly reduced as CEECs are ''converging'' towards the euro zone's higher loan rate stickiness. With respect to financial products, private households are typically facing more heterogeneity than the corporate sector as it is signified by the positive dummies for consumer loans as well as for current account and savings deposits.

While little evidence for convergence towards an aggregate euro-zone PT is found, will one or several representative countries then do a better job to act as a ''role model''? From the sheer numbers, the CEEC PT is furthest away from the German loan PT. This is particularly true in the long run where Germany is often far away from a full PT. Nevertheless, the reduction in short-run PT in CEECs brings these countries closer to German and Spanish lending rate stickiness. On deposit markets the evidence is more mixed given the variety of deposit models.[19]

[19] The sigma convergence results towards Finland in deposit markets should be read with reservation. They are driven by insignificant multipliers for Finish deposits markets, which are often close to zero or – at times – even negative (see Table 1). Thus, this particular panel does not allow a meaningful interpretation of the results.

Table 4
Country, rate, and time patterns in the pass-through in CEECs and the aggregate euro zone

Independent variable	Dependent variable = multipliers for a +0.25% shock											
	Impact		1 month		3 months		6 months		12 months		Long-run	
Panel A: loan rates												
Intercept	0.09	(1.14)	0.36	(4.31)	0.50	(5.21)	0.45	(4.30)	0.46	(3.84)	0.62	(4.05)
Czech Republic	0.14	(1.37)	−0.02	(−0.18)	−0.14	(−1.10)	−0.17	(−1.21)	−0.17	(−1.09)	−0.25	(−1.25)
Estonia	−0.15	(−2.02)	−0.27	(−3.30)	−0.29	(−3.10)	−0.20	(−1.91)	−0.22	(−1.91)	−0.26	(−1.72)
Hungary	0.10	(1.43)	0.14	(1.89)	0.13	(1.54)	0.22	(2.33)	0.24	(2.28)	0.18	(1.32)
Latvia	−0.01	(−0.05)	−0.10	(−0.91)	−0.10	(−0.75)	0.08	(0.52)	0.25	(1.52)	0.35	(1.69)
Lithuania	−0.08	(−0.84)	−0.31	(−3.06)	−0.30	(−2.55)	−0.19	(−1.44)	−0.06	(−0.40)	0.06	(0.32)
Poland	−0.16	(−2.06)	−0.12	(−1.44)	0.01	(0.15)	0.17	(1.67)	0.16	(1.36)	0.07	(0.47)
Slovak Republic	−0.09	(−1.01)	−0.30	(−3.25)	−0.44	(−4.02)	−0.44	(−3.71)	−0.45	(−3.36)	−0.52	(−3.05)
Slovenia	0.11	(1.53)	0.17	(2.24)	0.36	(4.16)	0.65	(6.92)	0.86	(8.11)	0.94	(6.85)
Consumer loans	−0.02	(−0.33)	−0.11	(−1.68)	−0.11	(−1.44)	−0.05	(−0.59)	−0.07	(−0.71)	−0.16	(−1.31)
Short-term corporate loans	0.24	(3.93)	0.18	(2.68)	0.17	(2.23)	0.22	(2.59)	0.20	(2.15)	0.11	(0.93)
Long-term corporate loans	0.24	(3.72)	0.16	(2.40)	0.17	(2.17)	0.20	(2.30)	0.19	(1.92)	0.08	(0.66)
1997–2001	0.06	(0.89)	0.07	(1.01)	0.09	(1.13)	0.13	(1.42)	0.17	(1.70)	0.14	(1.06)
1998–2002	0.02	(0.36)	0.00	(−0.04)	0.00	(0.01)	−0.01	(−0.13)	0.00	(0.05)	−0.03	(−0.22)
1999–2003	0.04	(0.54)	0.00	(−0.07)	0.00	(0.00)	0.02	(0.19)	0.07	(0.75)	0.17	(1.33)
Adjusted R^2	33%		50%		56%		62%		64%		56%	
Panel B: deposit rates												
Intercept	0.33	(7.12)	0.49	(8.90)	0.64	(8.85)	0.67	(8.70)	0.66	(7.34)	0.60	(4.22)
Czech Republic	−0.09	(−1.72)	−0.24	(−3.94)	−0.27	(−3.50)	−0.28	(−3.34)	−0.25	(−2.63)	−0.21	(−1.35)
Estonia	0.01	(0.18)	−0.16	(−2.57)	−0.25	(−3.06)	−0.27	(−3.15)	−0.27	(−2.74)	−0.28	(−1.75)
Hungary	0.00	(−0.02)	0.03	(0.49)	0.17	(1.96)	0.19	(2.04)	0.16	(1.52)	0.12	(0.71)
Latvia	−0.12	(−2.23)	−0.28	(−4.33)	−0.38	(−4.46)	−0.39	(−4.34)	−0.42	(−3.93)	−0.54	(−3.24)
Lithuania	−0.29	(−6.26)	−0.41	(−7.27)	−0.50	(−6.85)	−0.49	(−6.22)	−0.44	(−4.88)	−0.32	(−2.25)
Poland	−0.15	(−3.36)	−0.17	(−3.16)	−0.04	(−0.54)	0.04	(0.51)	0.04	(0.45)	0.03	(0.24)
Slovak Republic	−0.24	(−5.04)	−0.38	(−6.76)	−0.50	(−6.80)	−0.53	(−6.71)	−0.55	(−5.96)	−0.56	(−3.84)
Slovenia	−0.05	(−1.01)	−0.04	(−0.63)	0.07	(0.94)	0.25	(3.06)	0.43	(4.56)	0.71	(4.78)
Current account deposits	−0.15	(−3.60)	−0.27	(−5.62)	−0.47	(−7.43)	−0.54	(−7.91)	−0.55	(−6.91)	−0.48	(−3.86)
Savings accounts	−0.19	(−5.34)	−0.29	(−6.77)	−0.42	(−7.60)	−0.50	(−8.39)	−0.56	(−8.21)	−0.66	(−6.04)
1997–2001	−0.01	(−0.48)	0.01	(0.15)	0.04	(0.78)	0.05	(1.05)	0.10	(1.81)	0.12	(1.38)
1998–2002	−0.02	(−0.85)	0.02	(0.57)	0.02	(0.37)	0.03	(0.55)	0.07	(1.22)	0.15	(1.64)
1999–2003	0.01	(0.43)	0.03	(0.83)	0.04	(0.89)	0.07	(1.38)	0.13	(2.35)	0.35	(3.97)
Adjusted R^2	41%		48%		59%		65%		63%		49%	

Note: For each independent variable, the given values are the estimated coefficient and the values within the parentheses are the *t*-statistic. All independent variables are dummies. In Panel A and B the regressions are based on samples of 96 and 210 observations, respectively. The samples include 1996 to 2003. Regarding the country, time and rate dummies note that the benchmark case is defined by euro zone, mortgage rates or time deposit rates, 1996–2000 period.

In sum, we find little evidence for convergence, neither towards an aggregate euro-zone PT nor towards a role-model PT. At the current moment it would thus be premature to talk of convergence. However, two observations already made in the previous section remain relevant. The short-run price flexibility in CEECs is getting lower, while there is a trend towards a more complete PT in the long run.

Table 5
Sigma convergence of the pass-through in CEECs towards the euro zone

Independent variable	Dependent variable = sigma for a +0.25% shock to loan rates												Dependent variable = sigma for a +0.25% shock to deposit rates											
	Impact		1 month		3 months		6 months		12 months		Long-run		Impact		1 month		3 months		6 months		12 months		Long-run	
Panel A: convergence of CEECs towards the aggregate euro zone																								
Intercept	1.64	(7.36)	0.77	(4.32)	0.73	(3.19)	0.79	(2.76)	0.75	(2.21)	0.64	(1.59)	0.78	(10.59)	0.64	(15.67)	0.54	(14.87)	0.51	(13.13)	0.65	(5.58)	0.48	(8.31)
Consumer loans	0.16	(0.65)	0.77	(3.91)	0.94	(3.72)	1.11	(3.53)	1.27	(3.35)	1.43	(3.21)												
Short-term corporate loans	−0.56	(−2.15)	0.00	(−0.01)	−0.02	(−0.09)	−0.10	(−0.31)	−0.14	(−0.36)	−0.13	(−0.28)												
Long-term corporate loans	−0.30	(−1.13)	−0.03	(−0.13)	0.14	(0.51)	0.03	(0.08)	0.00	(0.00)	0.02	(0.04)												
Current account deposits													0.24	(1.02)	−0.05	(−0.40)	0.18	(1.56)	0.34	(2.73)	0.64	(1.74)	0.83	(4.59)
Savings accounts													1.04	(5.90)	0.62	(6.34)	0.55	(6.27)	0.64	(6.86)	2.07	(7.39)	0.67	(4.86)
Time trend	−0.23	(−4.85)	−0.11	(−2.97)	−0.12	(−2.42)	−0.10	(−1.61)	−0.05	(−0.69)	0.03	(0.30)	−0.05	(−1.93)	−0.01	(−0.75)	−0.00	(−0.29)	−0.01	(−0.48)	−0.08	(−1.84)	0.01	(0.36)
Adjusted R^2 (observations)	25%	(102)	27%	(102)	22%	(102)	20%	(102)	17%	(102)	15%	(102)	13%	(256)	14%	(256)	13%	(256)	17%	(256)	19%	(256)	13%	(256)
Panel B: convergence of CEECs towards Finland																								
Intercept	0.81	(8.22)	0.42	(5.40)	0.51	(6.30)	0.80	(8.52)	0.76	(7.07)	0.33	(3.05)	18.57	(14.05)	25.09	(15.01)	36.63	(14.58)	104.51	(14.57)	51.13	(13.83)	6.97	(11.94)
Consumer loans	−0.02	(−0.17)	0.24	(2.89)	0.15	(1.79)	−0.12	(−1.20)	−0.11	(−0.93)	0.27	(2.28)												
Long-term corporate loans	−0.30	(−2.59)	−0.16	(−1.80)	−0.25	(−2.67)	−0.55	(−5.06)	−0.54	(−4.37)	−0.10	(−0.80)												
Current account deposits													−11.44	(−2.74)	−19.52	(−3.70)	−32.84	(−4.14)	−101.24	(−4.47)	−52.86	(−4.52)	−7.15	(−3.88)
Savings accounts													−14.29	(−4.52)	−21.25	(−5.31)	−33.89	(−5.63)	−102.16	(−5.95)	−51.66	(−5.84)	−6.68	(−4.78)
Time trend	0.01	(0.59)	0.06	(3.14)	0.02	(0.96)	−0.01	(−0.35)	0.01	(0.45)	0.03	(1.02)	−2.22	(−4.68)	−2.00	(−3.34)	−1.26	(−1.39)	−0.99	(−0.39)	1.05	(0.79)	0.51	(2.45)
Adjusted R^2 (observations)	9%	(75)	31%	(75)	23%	(75)	28%	(75)	22%	(75)	12%	(75)	15%	(256)	15%	(256)	15%	(256)	16%	(256)	16%	(256)	14%	(256)
Panel C: convergence of CEECs towards Germany																								
Intercept	1.40	(5.34)	0.85	(3.90)	0.77	(2.99)	1.14	(3.50)	1.10	(2.80)	0.82	(1.79)	0.65	(21.49)	0.60	(20.58)	0.51	(14.55)	0.47	(13.37)	0.46	(12.07)	0.45	(8.28)
Consumer loans	0.48	(1.64)	0.79	(3.29)	0.98	(3.44)	0.90	(2.50)	1.04	(2.39)	1.30	(2.58)												
Short-term corporate loans	0.41	(1.35)	0.61	(2.43)	0.88	(2.98)	0.79	(2.10)	0.88	(1.95)	1.05	(1.99)												
Long-term corporate loans	0.25	(0.80)	−0.06	(−0.24)	−0.04	(−0.12)	0.17	(0.45)	0.38	(0.82)	0.19	(0.35)												
Current account deposits													0.18	(1.97)	−0.11	(−1.19)	0.18	(1.65)	0.33	(3.00)	0.60	(5.09)	0.83	(4.92)
Time trend	−0.26	(−4.65)	−0.15	(−3.20)	−0.14	(−2.57)	−0.14	(−2.09)	−0.08	(−1.00)	0.03	(0.27)	0.02	(1.75)	0.03	(2.46)	0.01	(0.57)	0.01	(1.02)	0.01	(1.04)	0.02	(0.75)
Adjusted R^2 (observations)	17%	(102)	22%	(102)	21%	(102)	9%	(102)	4%	(102)	6%	(102)	2%	(236)	2%	(236)	0%	(236)	3%	(236)	10%	(236)	9%	(236)

Panel D: convergence of CEECs towards Ireland																						
Intercept	0.76	(8.22)	0.54	(7.19)	0.63	(7.20)	0.66	(5.67)	0.56	(4.01)	0.47	(2.66)	1.63	(5.49)	1.35	(7.40)	1.43	(7.35)	1.25	(9.11)	1.29	(8.79)	1.36	(7.86)
Consumer loans	0.11	(1.09)	0.25	(2.97)	0.12	(1.28)	0.16	(1.20)	0.23	(1.48)	0.28	(1.40)												
Short-term corporate loans	−0.26	(−2.45)	−0.06	(−0.68)	0.07	(0.72)	0.22	(1.66)	0.35	(2.20)	0.51	(2.48)												
Long-term corporate loans	−0.23	(−2.13)	−0.17	(−1.89)	−0.15	(−1.46)	0.04	(0.31)	0.17	(1.04)	0.22	(1.05)												
Time trend	−0.01	(−0.29)	0.01	(0.44)	−0.03	(−1.51)	−0.05	(−2.19)	−0.02	(−0.70)	0.02	(0.47)	−0.26	(−2.09)	−0.16	(−2.10)	−0.19	(−2.37)	−0.13	(−2.27)	−0.15	(−2.43)	−0.12	(−1.66)
Adjusted R^2 (observations)	16%	(102)	23%	(102)	8%	(102)	5%	(102)	1%	(102)	3%	(102)	15%	(20)	15%	(20)	20%	(20)	18%	(20)	21%	(20)	8%	(20)
Panel E: convergence of CEECs towards Spain																						
Intercept	1.68	(9.68)	0.85	(9.97)	0.41	(5.16)	0.45	(4.92)	0.49	(4.41)	0.47	(3.26)	0.66	(22.50)	0.60	(20.71)	0.51	(14.98)	0.48	(13.95)	0.47	(12.36)	0.47	(7.82)
Short-term corporate loans	−0.72	(−3.78)	−0.21	(−2.25)	−0.13	(−1.48)	−0.02	(−0.18)	−0.02	(−0.20)	−0.04	(−0.24)												
Long-term corporate loans	−0.48	(−2.42)	−0.30	(−3.13)	−0.25	(−2.74)	−0.05	(−0.46)	−0.08	(−0.59)	−0.03	(−0.16)												
Current account deposits													−0.08	(−0.86)	−0.15	(−1.74)	−0.08	(−0.79)	−0.08	(−0.80)	−0.03	(−0.22)	0.01	(0.08)
Time trend	−0.19	(−4.47)	−0.06	(−2.65)	0.04	(2.09)	−0.01	(−0.24)	0.00	(0.13)	0.04	(1.01)	0.01	(0.68)	0.03	(2.69)	0.01	(0.60)	0.01	(1.04)	0.02	(1.37)	0.02	(0.99)
Adjusted R^2 (observations)	32%	(68)	18%	(68)	11%	(68)	−4%	(68)	−4%	(68)	−3%	(68)	0%	(236)	3%	(236)	0%	(236)	0%	(236)	0%	(236)	0%	(236)

Note: For each independent variable, the given values are the estimated coefficient and the values within the parentheses are the *t*-statistic. Regarding the rate dummies note that the benchmark case is defined by mortgage rates or time deposit rates. Conditional upon the missing values for some national interest rate series (see Table 1), all possible rate dummies are included.

5. Conclusions

The messages from our analyses are straightforward: First, on average, the PT in CEECs is more complete and faster than in the aggregate euro zone. Second, most PT differences within the CEECs can be explained by a handful of financial structure variables and macro-controls. To put it in a nutshell, there may be a high potential for an emerging homogeneous transmission process across CEECs. Convergence across CEECs can be predicted with market concentration, bank health, foreign bank participation and monetary policy regime as conditioning factors. Third, financial structure and macro-economic convergence can thus be expected to ''produce'' monetary transmission convergence. Consequently, with the help of a more competitive market structure, a healthier banking system, higher foreign bank participation – the ultimate objectives of the internal market project – and membership in the euro zone, the newcomers may develop a quite homogeneous monetary transmission region. This may, fourth, lead to a situation where a relatively homogenous monetary transmission region may join a much more heterogeneous incumbent euro zone. Fifth, we do not find much evidence for convergence towards the euro zone. While the reduction of short-term multipliers has led to some convergence, the trend towards a full PT has increased divergence. Consequently, demand for convergence does not necessarily mean that newcomers should become like the incumbents! The limitations of the PT in the euro zone are indeed a policy issue. Convergence in euro-zone PT is not an end in itself. The goal should rather be that banking markets work efficiently and competitively in both the CEECs and the incumbent euro zone. Financial and PT convergence will then follow suit.

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