Interest Rate Pass-Through in Central and Eastern Europe: Reborn from Ashes Merely to Pass Away?

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In this study, we seek to better understand the interest rate pass-through in five Central and Eastern European countries – the Czech Republic, Hungary, Poland, Slovakia and Slovenia, the CEE-5 – and compare it with the pass-through in selected euro area countries – Austria, Germany and Spain. We find that the pass-through is not operational for long-term market rates because of the unstable yield curve. We find evidence that the pass-through from policy rates even transits through short-term market rates to long-term retail rates. Although nearly complete pass-through is detected for corporate lending rates in a majority of the CEE-5, pass-through estimates for several retail rates are generally lower than those reported in the literature, given the absence of cointegration between policy rates and long- or even short-term market rates. Although the pass-through is usually higher in the CEE-5 than in Austria and Germany, it has been declining over time in particular in Hungary and (with respect to lending rates) in Poland. The adoption of the euro seems to have slightly increased the pass-through in Spain and Austria but not in Germany.

1 Introduction

The introduction of direct inflation targeting in a number of Central and Eastern European (CEE) countries has made it necessary to rely more heavily on the interest rate and the credit channel, while diminishing the prominent role of the exchange rate in the monetary transmission mechanism.

It is essential for central banks to have a genuine and precise understanding of how fast and to what extent a change in their interest instrument modifies inflation. In particular, it is crucial to assess whether or not the pass-through from monetary policy rates to long-term market and retail rates is complete, as this is the first building block for the monetary transmission mechanism. If the interest rate pass-through is not complete, the impact of monetary policy actions through the credit, interest rate or exchange rate channels will be considerably attenuated. Against this backdrop, a large amount of research has been dedicated to the interest rate pass-through in industrialized countries: it is generally found to be incomplete and to react sluggishly to changes in the policy rate.[2]

More recently, researchers have turned their attention to the CEE countries and showed a strengthening of the pass-through over time.[3] In this paper, we contribute to this subject for the Czech Republic, Hungary, Poland, Slovakia and Slovenia by not only looking at the relationship between monetary policy rate on the one hand, and market and retail rates on the other hand, but also by studying the whole chain of transmission running from the

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[2] *See e.g. DeBondt (2005) and Sander and Kleimeier (2004a) for euro area results.*

[3] *See e.g. Horváth, Krekó and Naszódi (2004) for Hungary; Opiela (1999), Chmielewski (2003) and Wróbel and Pawlowska (2002) for Poland; Crespo-Cuaresma, Égert and Reininger (2004), Sander and Kleimeier (2004b) and Tieman (2004) for a number of CEE countries.*

policy rate via market rates to bank retail (deposit and lending) rates in a multivariate Vector Autoregression (VAR) setting.

With a view to the future adoption of the euro in the CEE-5, it is important to find out more about whether or not the euro area will grow more inhomogeneous with respect to the monetary transmission mechanism. For this reason, the empirical analysis is also carried out for selected euro area countries: Austria, Germany and Spain.[4] Another reason for us to include these countries was the need to check the validity of the general finding in the literature which suggests that the interest rate pass-through is larger and also quicker in CEE countries than in established industrialized countries.

The remainder of this paper is structured as follows: Section 2 deals with theoretical and empirical issues related to the interest rate pass-through. Section 3 describes the dataset, Section 4 outlines the estimation techniques and Section 5 presents the results. Finally, Section 6 gives some concluding remarks.

2 Interest Rate Pass-Through

The interest rate pass-through can be decomposed into two stages. The first stage measures how changes in the monetary policy rate are transmitted to short- and long-term market rates, while the second stage describes how changes in the market rates influence bank deposit and lending rates.

2.1 Pass-Through to Market Rates and the Yield Curve

The first stage is to a large extent influenced by the stability of the yield curve: If the term structure, whatever its form may be (negative or positive sloping), remains stable over time, the pass-through from policy rates to market rates is said to be proportionate.[5] However, any twist in the yield curve can change the size of the pass-through.

The form of the yield curve is essentially determined by four factors. First, the liquidity structure of different maturities implies that longer-term investments are generally less liquid. Consequently, investors demand a higher liquidity premium, which leads to higher long-term rates. Second, it is possible that short-term and long-term interest rates are determined independently in segmented markets (market segmentation). Third, long-term interest rates can be computed as the average of expected future short-term interest rates (expectation channel), which are closely related to inflation expectations. A change in any of the aforementioned three factors modifies the slope and the specific shape of the yield curve, thus possibly dampening or strengthening the interest rate pass-through. Especially expectations are viewed to be a major factor in causing changes in the yield curve.[6] Finally, expectations of future exchange rate changes may influence the shape and dynamics of the yield

[4] *In this paper, Austria, Germany and Spain represent small open economies, large core countries and catching-up countries, respectively.*

[5] *In this case, changes in the policy rate will lead to a shift in the yield curve.*

[6] *The impact of a given rise in the monetary policy rate on the longer end of the maturity spectrum depends on whether or not the policy rate hike is in line with market expectations with respect to future inflation. If this rise is smaller than anticipated, long-term rates will increase owing to higher expected future short-term rates. Conversely, if it is above expectations, long-term rates will drop. Finally, long-term rates will remain unchanged, if inflation is expected not to change in the aftermath of the interest rate hike.*

curve, in particular in a setting with strong participation of foreign portfolio investors in the domestic capital markets, which may vary across the maturity segments.

2.2 Pass-Through to Retail Rates: Cost of Funds and Monetary Policy Approach

The *cost of funds approach* (DeBondt, 2005) is the best way to describe the second stage of the interest rate pass-through, i.e. the connection between market rates on the one hand, and bank deposit and lending rates of comparable maturity on the other hand.

In general, several factors make sure that market rates are passed on to retail rates. For loan rates, the link to market rates is secured by the fact that banks rely on the money market to fund (short-term) lending. This is in the same vein that deposit rates, which represent the cost of loans, should be reflected in loan rates.[7] At the same time, yields on government securities can be viewed as opportunity costs for banks. This helps maintain the link between, for instance, government bond yields and loan rates of longer maturity.

The connection between market rates and deposit rates is warranted by the possibility that households and the nonfinancial corporate sector can hold their financial assets not only in bank deposits, but also in government securities of comparable maturity. In addition, banks can rely on the money market instead of deposits for funding loans, which can also lead to an equalization of deposit and money market rates.

The pass-through from market rates to retail rates is, however, not necessarily proportionate. If the elasticity of demand for deposits and for loans to the deposit and the lending rate, respectively, is lower than 1, the pass-through may become disproportionate. Imperfect substitution between bank deposits and other money market instruments of the same maturity (e.g. money market funds or T-bills) and between bank lending and other types of external finance (equity or bond markets) may cause demand elasticity to be lower than unity. Weak competition within the banking sector (i.e. among banks) and in the financial sector (i.e. between banks and nonbank financial intermediaries) reduces the sensitivity of the demand for deposits and loans to the interest rate.[8] High switching costs may also lead to lower demand elasticity.[9]

Macroeconomic conditions influence the size of the pass-through, too. It is generally observed that during periods of rapid economic growth, it is easier for banks to pass on changes in the interest rate to their lending and deposit rates faster. Higher inflation rates also favor more complete and more rapid

[7] *Provided that the volatility of the credit risk premium embedded in loan rates is stable over time.*

[8] *The competition effect is more important for deposit rates than for lending rates, given that the former are less affected by asymmetric information problems (Sander and Kleimeier, 2004a).*

[9] *The pass-through can also be amplified, i.e. be higher than unity, if banks charge higher interest rates in an attempt to offset the higher risks resulting from asymmetric information (adverse selection and moral hazard) rather than reducing the supply of loans (DeBondt, 2005). An increase in the general interest rate level raises the average burden of interest payments and thus necessitates an upward adjustment of the risk premium for asymmetric information. The same argument applies to small banks: they find it more difficult to obtain external financing owing to asymmetric information problems. This is why they have to pay a risk premium on their deposit rates to attract sufficient amounts of deposits; consequently, they also require a premium on their lending rates (Gambacorta, 2004).*

interest rate pass-through, given that prices may be adjusted more frequently in a double-digit or high inflation environment. By contrast, higher interest rate volatility (mirroring higher macroeconomic instability and uncertainty) weakens the interest rate pass-through, given that banks wait longer before changing their rates.

The pass-through can be not only incomplete in the long run, but also sluggish in the short run. The reasons for this are manifold: First, adjustment or menu costs can cause banks to react sluggishly to changes in the market rates. Second, the maturity mismatch of banks' loan and deposit portfolios influences the way in which they adjusts their lending rates.[10] The more long-term loans are covered by long-term deposits, the less pressure banks feel to adjust their lending rates, since their liabilities are less sensitive to market rates (Weth, 2002). Finally, given the long-term relationships of banks (especially universal banks) with their customers, they may want to smooth interest rate changes.

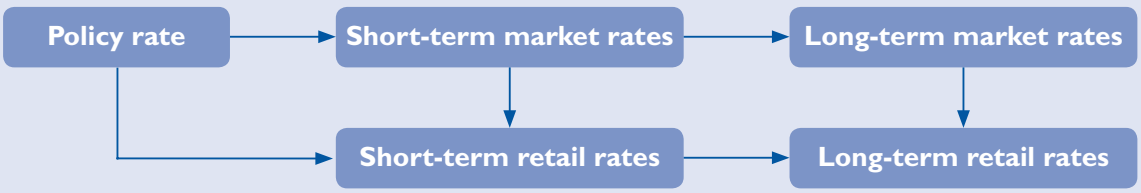
The assumption of a stable yield curve makes it possible to take a shortcut by looking directly at the relationship between policy rates and retail (deposit and loan) rates. This approach is referred to as the monetary policy approach (Sander and Kleimeier, 2004a).

2.3 Testable Relationships

The alternative transmission routes from policy rates to retail rates and the ensuing empirically testable relationships are shown in chart 1 and table 1 below.

Chart 1

The Transmission between Policy and Retail Interest Rates



Source: Authors.

We set out to answer an array of questions relating to the interest rate pass-through on the basis of the testable relationships shown in table 1. First, is the transmission from the monetary policy rate via market rates to retail rates proportionate in the long run? That is, is there a one-to-one reaction of market rates and, consequently, retail rates to changes in key policy rates? Second, is the pass-through different in different segments of the same economy (households vs. nonfinancial corporate sector or short term vs. long term)? Third, is there evidence of convergence or divergence across countries and over time?

[10] *Note that maturity in this context refers to the period of interest rate fixation (i.e. the interval between the adjustment dates of interest rates of a loan or deposit contract), not to the duration of the loan or deposit contract between initial payment and full repayment.*

In particular, how does the pass-through in the CEE-5 compare with that in the euro area? Finally, does the direction of a change in the monetary policy rate (increase or decrease) have an impact on the short-term adjustment?

Table 1

Testable Relationships

Monetary Policy Approach
Policy rate → short-term/long-term deposit rate
Policy rate → short-term/long-term lending rate

Cost of Funds Approach
1st stage: yield curve
policy rate → 1m MMR → 12m MMR/T-bill rate → government bond rate
2nd stage: cost of funds
a) 1m MMR / 12m T-bill/MMR → short-term deposit rate → short-term loans (long- term loan rate)
b) 1m MMR / 12m T-bill/MMR → short-term loan rate (long-term loan rate)
c) government bond rate → long-term deposit rate → long-term loan rate
d) government bond rate → long-term loan rate

Source: Authors.

3 Data Issues

Our dataset covers the CEE-5 (the Czech Republic, Hungary, Poland, Slovakia and Slovenia) and three euro area countries (Austria, Germany and Spain). The monthly data series include short-term market rates, i.e. (annualized) 1-month money market rates (MMR), and 12-month T-bill rates (if not available, 12-month MMR), long-term market rates, i.e. 3- to 5-year government bond yields, as well as economy-wide and sectoral retail rates (households and nonfinancial corporate sector) of different maturity (overnight rates, short- and long-term rates). For the Czech Republic, Hungary, Poland, Austria and Germany, these data are primarily obtained from the national central banks and the ministries of finance. For Slovakia, Slovenia and Spain, the main data source is NewCronos (Eurostat). Some of the market rates are drawn from Datastream and Bloomberg, if they were not available from national sources or from Eurostat. Whenever possible, the lending rate series for households are split into housing and consumer loans. The time series start in January 1994 at the earliest for the CEE-5 and usually end in end-2005. Appendix 1 provides a detailed description of the data and data sources.

Furthermore, we distinguished between retail rates on the stock of deposits/loans and those applied to newly collected deposits/newly extended loans. This is important because the (weighted) average interest rates on outstanding deposits and loans (which include contracts with fixed rates and contracts with variable rates that are adjusted at a later stage) may react more slowly than the interest rates of new deposits and loans. The maturity of the series is another important issue. In conventional interest rate statistics, maturity refers to the duration of the loan or deposit contract, not to the period of interest rate fixation. In the new harmonized interest statistics developed in the euro area and in new EU Member States, however, maturity refers to the period of interest

rate fixation. However, most of those series start as late as 2003, with the exception of the lending rate time series for Austria.[11]

We constructed another database that includes interest rate series obtained from the International Monetary Fund's International Financial Statistics (IFS): discount rates (line 60), money market rates (line 60b), T-bill rates (line 60c), deposit rates (line 60l), lending rates (line 60p) and government bond yields (line 61). The series usually cover the period 1991–2005. They are constructed using data series compiled on the basis of different methodologies (which explains their length for transition economies) and do not distinguish between different maturities.[12] Hence, it is interesting to see whether or not the results differ for our two datasets.

4 Estimation Techniques

4.1 Single-Equation Approach

The empirical literature concerned with analyzing the interest rate pass-through usually relies on generalizations of the following error correction model:

$$\Delta i_t^R = \mu + \rho(i_{t-1}^R - \mu - \beta i_{t-1}^P) + \delta \Delta i_t^P + \varepsilon_t \quad (1)$$

where i_t^R and i_t^P are the retail (or market) rate and the monetary policy rate, respectively. μ and ε_t denote the constant term and the residuals, respectively. β stands for the long-run pass-through, which can be obtained by means of a simple Ordinary Least Squares (OLS) estimate or a Dynamic Ordinary Least Squares (DOLS) estimate as proposed by Stock and Watson (1993), which accounts for the potential endogeneity of the monetary policy rate by incorporating leads and lags in first differences of the regressor. The DOLS estimate is thus obtained from the regression

$$i_t^R = \mu + \beta \cdot i_t^P + \sum_{j=-k_1}^{k_2} \gamma_j \Delta i_{t-j}^P + \varepsilon_t \quad (2)$$

where k_1 and k_2 denote leads and lags, respectively. Equation (1) can be

[11] *The following abbreviations were used for market rates: mp – monetary policy rate, mmr – 1-month money market rate; T-bill – 12-month treasury bill rate, mmr12 – 12-month money market rate if no T-bill rate is available, gbond – government bond rate.*
The information on retail rates is composed of three main blocks (e.g. lhh_l1y_s). The first block indicates the type of interest rate: l – lending rate, d – deposit rate, f – nonfinancial corporate sector (firms) (lf or df), h – aggregate household loans (dh, lh), hh – housing loan to households, hc – consumer credit to households. The second block denotes the maturity of the series: on – overnight, l1y – less than one year, m1y – more than one year, 1m, 3m – one month, three months; 1y, 3y, 4y – one year, three years, four years, 1y5y – 1 to 5 years, st – short-term, lt – long-term (if the source does not specify the precise maturity). No indication of maturity means that the series covers all maturities. The third block covers two types of information: (1) It may be n or s (n – new loans or deposits; s – stock of deposits or loans). A missing n or s at the end of the label indicates aggregated data for new and old loans (deposits) or simply reflects the lack of specification by the data source. (2) For German deposit rates, a difference is made between interest rates for low-, medium- and high-amount deposits: la, ma, ha (e.g. d_1m_la, d_1m_ma, d_1m_ha). For Austria, similar information is included in the second block: e.g. lf_l1y1M_n refers to the rates for corporate loans exceeding EUR 1 million, while lf_l1y_n stands for the same type of loan below or equal to EUR 1 million.

[12] *The IFS manual remains very vague about the exact definition of the series e.g. regarding maturity.*

extended to the error correction form of a general Autoregressive Distributed Lag (ARDL) model to account for more short-term dynamics:

$$\Delta i_t^R = \mu + \rho(i_{t-1}^R - \mu - \beta i_{t-1}^P) + \sum_{j=0}^{l} \delta_j \Delta i_{t-j}^P + \sum_{j=1}^{m} \phi_j \Delta i_{t-j}^R + \varepsilon_t \quad (3)$$

The long-term parameter β in equation (3) can be derived by estimating a standard ARDL model as suggested by Wickens and Breusch (1988),

$$i_t^R = \mu + \sum_{j=0}^{p} \delta_j i_{t-j}^P + \sum_{j=1}^{q} \phi_j i_{t-j}^R + \varepsilon_t \quad (4)$$

where the long-run elasticity can be obtained as $\beta = \sum_{j=0}^{l} \delta_j / (1 - \sum_{j=1}^{l} \phi_j)$.

The cointegration of the monetary policy rate (i^P) with retail rates (i^R), i.e. whether or not they are linked in the long run, can be assessed by relying either on residual-based cointegration tests (Engle and Granger, 1987) or on the bounds testing approach (Pesaran, Shin and Smith, 2001).

According to residual-based cointegration tests, the two variables are cointegrated if the residuals from the long-run relationship

$$i_t^R = \mu + \beta i_t^P + \varepsilon_t \quad (5)$$

are stationary, where β is obtained as described above (OLS, DOLS and/or ARDL).

The bounds testing approach uses F-tests for the parameters in equation (3): the null given by $H_0 : \rho = \beta = 0$ is tested against the alternative of $H_1 : \rho \neq \beta \neq 0$. Two sets of critical values are provided: one for the case when all variables are I(1), i.e. upper-bound critical values, and another one for when all variables are I(0), i.e. lower-bound critical values. If the test statistic is higher than the upper-bound critical value, the null of no cointegration is rejected, whereas an F-statistic lower than the lower-bound critical value does not permit the rejection of the null of no cointegration.

One can hypothesize that a) the speed of adjustment (ρ) to the long-run relationship and b) the short-term dynamics (δ_j and ϕ_j) in equation (3) are different depending on whether the monetary policy rate increases or decreases, which leads to the following specification:

$$\begin{aligned} \Delta i_t^R = {} & I(\Delta i_{t-1}^P < 0)\left[\mu_1 + \rho_1(i_{t-1}^R - \mu - \beta i_{t-1}^P) + \sum_{j=0}^{l} \delta_j \Delta i_{t-j}^P + \sum_{j=1}^{m} \phi_j \Delta i_{t-j}^R\right] + \\ & + [1 - I(\Delta i_{t-1}^P < 0)]\left[\mu_2 + \rho_2(i_{t-1}^R - \mu - \beta i_{t-1}^P) + \sum_{j=0}^{l} \psi_j \Delta i_{t-j}^P + \sum_{j=1}^{m} \zeta_j \Delta i_{t-j}^R\right] + \varepsilon_t. \end{aligned} \quad (6)$$

where $I(\bullet)$ is an indicator function taking the value 1 if the argument is true and zero otherwise. A simple test for symmetry is then given by the F-test for the following restrictions: $\rho_1 = \rho_2$; $\delta_j = \psi_j$; $\phi_j = \zeta_j$ for all j. A rejection of the null indicates that there is asymmetry in the speed of adjustment and/or in the

short-term dynamics depending on the direction of the change in the policy rate. We test both separately and jointly for the two types of asymmetries.[13]

4.2 Multivariate Approach

Having established the direct link between the policy rate and diverse market and retail rates with the single-equation approaches described above, we study the chains of this transmission. From this perspective, the interest rate pass-through can be viewed as a chain of pairwise links: policy rate – 1m MMR; 1m MMR – 12m T-bill/MMR rate;12m T-bill/MMR rate – government bond yield – long-term deposit rate – long-term lending rate (see table 1). Using a cointegrated VAR framework (Johansen, 1995) makes it possible to analyze the many pairwise relationships in a single system. Considering vector Y_t to contain a set of interest rates (e.g. $Y_t = \left[i^P, i^{MS}, i^{ML}, i^D, i^L\right]$, with P, MS, ML, D and L referring to monetary policy rate, short-term market rate, long-term market rate, deposit rate and lending rate, respectively), we estimate the following system:

$$\Delta Y_t = \sum_{i=1}^{k-1} \phi_i \Delta Y_{t-i} + (\mu_0 + \alpha\beta' \cdot Y_{t-1}) + \varepsilon_t \tag{7}$$

where α and β are $n \times r$ matrices, r denotes the cointegration rank of the system and n represents the number of endogenous variables. α stands for the adjustment matrix, β is a matrix that contains the cointegrating vectors and k denotes the lag length. We assume that the cointegration space contains only a constant term (μ_0) but no trend.

Full-fledged transmission from policy to retail rates would imply that there would be 4 cointegration relationships in the presence of 5 interest rate series, so that the cointegrating space is given by:

$$\begin{array}{c} \\ i^P \\ i^{MS} \\ i^{ML} \\ i^D \\ i^L \\ const \end{array} \begin{array}{c} \begin{array}{cccc} i^{MS} & i^{ML} & i^D & i^L \end{array} \\ \begin{bmatrix} \beta_1 & 0 & 0 & 0 \\ 1 & \beta_2 & 0 & 0 \\ 0 & 1 & \beta_3 & 0 \\ 0 & 0 & 1 & \beta_4 \\ 0 & 0 & 0 & 1 \\ c_1 & c_2 & c_3 & c_4 \end{bmatrix} \end{array} \quad implying \quad \begin{aligned} i^{MS} &= c_1 + \beta_1 i^P + \varepsilon \\ i^{ML} &= c_2 + \beta_2 i^{MS} + \varepsilon \\ i^D &= c_3 + \beta_3 i^{ML} + \varepsilon \\ i^L &= c_4 + \beta_4 i^D + \varepsilon \end{aligned} \tag{8}$$

In other words, i^P would be connected to i^L via the four pairwise long-term cointegration relationships. However, whether or not there is a propor-

[13] *Whether the asymmetric behavior of the market rate is attributable to the deviation from the long-run equilibrium or to the direction of change in the policy rate depends on the definition of asymmetry one wants to test for. In line with the cost of funds approach (DeBondt 2005), we interpret changes in the policy rate as cost shocks to private banks. Thus, it is, inter alia, the degree of competition among banks which determines whether a change in costs can be passed on to the corresponding price (the retail interest rate) and whether or not that response will be symmetric with respect to the direction of the change in the policy rate. The latter (i.e. the existence of a negative or positive cost shock) seems to be the relevant variable for this interpretation, since the deviation from the long-run equilibrium need not be a valid proxy for cost of funds-related shocks.*

tionate pass-through from i^P to i^L largely depends on the size of the long-term beta coefficients ($pass - through = \beta_1 \cdot \beta_2 \cdot \beta_3 \cdot \beta_4$).

However, in practice, the pass-through may be incomplete in system (8), because the pass-through from the long-term market rate to retail rates may be ineffective, if the yield curve is not stable and/or because the funding of bank lending relies on shorter-term market rates[14] instead of bank deposits/long-term market rates. For instance, if we find 3 cointegrating vectors instead of the 4 required for full pass-through, we estimate a system in which the following cointegrating vectors are assumed $(i^P, i^{MS});(i^{MS}, i^D);(i^D, i^L)$. If the relationship between deposit and lending rates is not robust, we assume that both deposit and lending rates are connected to short-term market rates: $(i^P, i^{MS});(i^{MS}, i^D);(i^{MS}, i^L)$.

5 Results

5.1 Cointegration Results

The fact that all interest rate series turn out to be well-represented by I(1) processes for the periods under review[15] justifies the use of the cointegration techniques to determine the size of, and the mechanism underlying, the interest rate pass-through.

In a first step, all market and retail interest rate series are regressed on the monetary policy rate for the whole period and for two subperiods.[16] For the CEE-5, the first subperiod ends in 2000:12 and the second subperiod starts in 2001:01,[17] while for Germany and Spain, the dividing line is 1998:12 and 1999:01.[18] The rationale behind splitting the sample into subsamples is to check for major changes in the pass-through over time. Dividing the sample period in 1998–1999 for Germany and Spain kills two birds with one stone: we are able to study not only the time effect, but also the impact of the launch of the euro.[19]

[14] *E.g. as a result of interest rate swaps.*

[15] *Standard unit root and stationarity tests, such as the augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and the Elliott-Rothenberg-Stock (ERS) point optimal unit root tests as well as the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test, are employed for level data and for first and second differences. While most test results show unanimously that the series are I(1) processes, some tests provide conflicting results for level data. However, since they never indicate unambiguously that the series are stationary in level, we conclude that these series are I(1). The test results are available from the authors upon request.*

[16] *We use the Schwarz information criterion to select the lag length in the DOLS and ARDL approaches, setting the maximum number of lags to 6.*

[17] *We split the sample period in 2000:12 and 2001:01, because interest rate series disaggregated by sectors (households, nonfinancial corporate sector) for the Czech Republic are available from 2001:01. Dividing the series at the same point in time for the other countries secures a higher level of cross-country comparability.*

[18] *For Austria, we considered only two periods (1996–2005 and 1999–2005), given that the series start in 1996.*

[19] *At first glance, the subperiods might seem too short for cointegration analysis. However, contrary e.g. to business cycle analysis (which requires data spanning at least 10 years to cover the whole cycle), interest rate data adjustment in the pass-through context tends to take place much faster. We have 50–60 observations for the subperiods; from an econometric viewpoint, 100–120 observations would be required. Still, the fact that we could not establish cointegration does not necessarily reflect the low power of the tests. Instead, it suggests that such cointegrating vectors are actually absent, given that it is sometimes difficult to find cointegration even for the whole sample. An alternative approach in these cases would be to use panel cointegration. Even though these tests might have some advantages over time series analysis, they are clearly inappropriate to study the cross-country differences in the interest rate pass-through we are interested in.*

We carry out four cointegration tests: two residual-based tests for the OLS/DOLS estimates,[20] one residual-based test and the bounds testing approach for the long-term relationship obtained from with the ARDL model. If at least three of the four test statistics support the presence of cointegration, we will consider that to be robust evidence for cointegration between the policy rate and any given interest rate series.[21]

The most remarkable feature of the results is the absence of cointegration for a large number of interest rate series. The most striking case is that of Germany, where cointegration could be established only for three series (1-month MMR and two 1-month deposit series). In Spain, the short-term money market rate as well as the rates on aggregate household loans and on housing loans appear to have a stable long-run relationship with the policy rate in all three periods.[22] In addition, the short- and long-term corporate lending rates become cointegrated with the policy rate after 1998, while the relationship for deposit rates breaks down over time. In Austria, the stability of the long-run relationship improves markedly after the introduction of the euro. In the second subperiod, the short-term money market rate, the overnight (household and corporate) deposit rates, the long-term household deposit rates and the long-term consumer lending rates become cointegrated with the policy rate, while only long-term corporate deposit rates are cointegrated during the whole period.

The picture is not much rosier for the CEE-5. The results for 1-month MMR and 12-month MMR/T-bill rates suggest stable cointegration with the policy rate in the Czech Republic and Hungary over the entire period under review, and in Slovakia for the subperiod 2001–2005. While short-term money market rates are linked via a cointegrating vector to the policy rate in Poland in all periods, long-term market rates are linked only in the Czech Republic and perhaps also in Hungary.

Regarding retail rates, the number of cointegrating relationships for retail rates decreases from the first to the second subperiod in Hungary, whereas it increases significantly in Poland and Slovenia. The number of statistically significant long-run relationships is relatively stable over time in the Czech Republic and Slovakia. The difficulty of establishing cointegrating relationships is also supported by estimation results obtained for the IFS dataset.[23]

Addressing asymmetries in the adjustment to the long-run relationship and in short-run dynamics is only meaningful when cointegration is detected. The results summarized in tables 2a and 2b indicate some common features. First, asymmetry is detected for the 1-month MMR in six out of eight countries in the second subperiod. Second, more asymmetries are observed in the second subperiod. Third, asymmetry is usually present both for the adjustment to the long-run relationship and in short-run dynamics. However, there is no com-

[20] *Stationarity of the residuals is checked for the long-run coefficients obtained from a simple OLS regression and from DOLS estimations.*

[21] *These results are not explicitly reported in the paper owing to space constraints. However, they are available from the authors upon request. The shaded cells in tables 2a and 2b indicate the presence of cointegration, while white cells show that the tests failed to establish cointegration.*

[22] *It should be noted that the error correction terms are always statistically significant and have the expected negative sign when cointegration could be established. This is in line with Granger's representation theorem. However, in a number of cases, no cointegration was found despite a significantly negative error correction term.*

[23] *These data are not reported here, but are available from the authors upon request.*

mon pattern in the type of retail rates affected by asymmetry. While it only concerns deposit rates in the Czech Republic, Poland and Germany, asymmetry is characteristic of lending rates in Spain and occurs both for deposit and lending rates in Hungary and Slovakia. Slovenia and especially Austria stand out as the most "symmetric" countries in our sample.

5.2 Size of the Pass-Through

In the analysis of the size of the interest rate pass-through, we consider the long-run pass-through coefficient (β) for cases when cointegration could be established with confidence. In these cases, the size of the pass-through is obtained using the DOLS and ARDL models presented in equations (2) and (4). Otherwise, we used coefficient estimates from a simple OLS run for first-differenced variables (see tables 2a and 2b). It turns out that, even though the cointegration tests failed to detect long-run relationships between the policy rate and a number of interest rates, the coefficient estimates obtained for series taken in first differences provided us with an opportunity to estimate the pass-through coefficient after all, as they are very often significant and have the expected positive sign.

Let us start with the connection between the policy rate and short- to long-term market rates. It comes as no real surprise that the pass-through from the policy rate to 1-month MMR is not significantly different from 1 for practically all countries and periods. The only exception is Slovakia with an insignificant pass-through coefficient in the first subperiod turning into a significant coefficient of 0.9. In the Czech Republic, the pass-through to 12-month MMR/T-bill rates is nearly complete and in Hungary it is high (albeit declining) with around 85%. A similarly high pass-through emerges for Slovakia for the period 2001–2005. In Poland and Germany, the pass-through drops considerably from about 70% to nearly 40% and 35%, respectively. In Austria and Spain, the size of the pass-through is modest between 30% and 40%.

The pass-through to the long-term market rate (government bonds) drops from high levels in the first subperiod to between 40% and 50% in the second subperiod in the Czech Republic and Hungary and becomes insignificant for Poland and the three euro area countries. For transition economies, this is to be expected, since the yield curve at the longer end changed considerably for these economies owing to successful attempts to decrease in inflation rates.[24]

With regard to deposit rates, our results demonstrate that the pass-through for overnight (O/N) deposit rates ranges from 10% in Hungary to between 15% and 25% in the Czech Republic, Austria, Germany and Spain, while coming to between 35% and 55% in Poland and Slovakia in the second subperiod. In those countries where sectoral data for O/N deposit rates are available (the Czech Republic, Poland and Austria), a major difference is found only in Poland (higher pass-through for households).

[24] *For countries which embarked on a prolonged period of disinflation (e.g. Hungary and Poland), the long-term market rates declined below the level of short-term rates once the market participants were convinced of the steady decrease in inflation rates. However, the negative slope of the yield curve decreased substantially toward the end of disinflation, given the limited room for large drops in future inflation rates. Thus, further cuts in monetary policy rates could not cause long-term market rates to drop to the same extent. As inflation rates stabilized, with disinflation reaching an end, the yield curve eventually flattened out or its slope even became positive.*

These figures for the O/N deposit rates are considerably lower than the pass-through coefficients of short- to long-term deposit rates in all countries, except for Slovakia and Slovenia, where the pass-through coefficients for the latter are not significantly different from zero. The pass-through is typically high for short-term deposits in Germany and for both short- and long-term deposits in the Czech Republic, Hungary and Poland. It is almost complete for corporate deposits in Hungary. In the Czech Republic and in Hungary, the pass-through in this segment of the corporate sector is found to be usually higher than that for households, while the results are mixed for Poland. In addition, and not astonishingly, changes in the policy rate feed into new deposit rates to a larger extent than into the rates on outstanding deposits (Hungary). Deposit rates for large amounts are more responsive to policy rates than those for small amounts (Germany). In Austria and Spain, the pass-through to short- and long-term rates reaches 60% and 40%, respectively, with the coefficients being higher for households than for the corporate sector in Austria. Regarding the development of the pass-through to deposit rates over time, the results reveal that it remained fairly stable for most countries, with the notable exceptions of Hungary, Poland and Spain, where the pass-through increased for O/N deposit rates (all three countries), for short-term deposit rates (Spain) and for household rates (Poland). In Austria, the coefficients for O/N deposit rates and for long-term household deposit rates became higher over time.

Finally, it is worthwhile taking a closer look at lending rates, which seem to offer us a so far unseen colorful picture. In general, lending rates for households turn out to react less, if at all, to monetary policy rates as compared with lending rates for the corporate sector. No significant or economically meaningful pass-through could be detected for the interest rates on aggregate household lending in the Czech Republic and Slovakia, on consumer lending in Slovakia, on new long-term consumer loans and new housing loans in Hungary, and on housing loans (all maturities) in Germany. Moreover, the pass-through for rates on outstanding housing loans in Hungary and on new housing loans in Austria is only around 20%. The insensitivity of housing loan rates may reflect the impact of public subsidy schemes in Austria, Germany and Hungary. By contrast, the pass-through for housing loan rates in Slovenia and in Spain is almost complete, although it has declined in Spain.

In Germany, consumer loan rates react little to monetary policy rates (15%). In Austria, the pass-through is small for new short-term consumer loan rates (25%–30%) but complete for new long-term consumer loan rates, while in Slovenia, it amounts to above 70% for consumer loan rates. In Hungary, it comes to almost 60% for new short-term consumer loans and to roughly 40% for the stock of these loans. This is in sharp contrast with the finding that the pass-through is zero for new long-term consumer loans in Hungary. Regarding the development of the pass-through to household lending rates over time, the long-run coefficients in the second subperiod were partly (Austria, Germany, Hungary) similar to and partly (Poland, Spain) lower than the coefficients in the first subperiod and/or the whole period. Only in Slovenia did the size of the coefficient increase.

In the CEE-5 and in Spain, corporate loan rates are generally very responsive to monetary policy rate changes, with the pass-through estimate ranging

from 50% for Poland to 100% for the Czech Republic, Hungary, Slovakia, Slovenia (with the exception of short-term rates) and Spain. In Germany, by contrast, a 1% change in the policy rate generates only a 0.2% to 0.3% change or even no significant reaction in corporate loan rates. Austria is located between the two extremes.

Table 2a

Interest Rate Pass-Through – Market Rates

	Whole period			1st subperiod			2nd subperiod		
	DOLS/1st d	ARDL	AS	DOLS/1st d	ARDL	AS	DOLS/1st d	ARDL	AS
CEE-5									
Czech Republic	1995:12 – 2005:12			1995:12 – 2000:12			2001:1 – 2005:12		
MMR	1.08**	1.07**		1.11**	1.08**		1.01**	1.01**	C
MMR 12	0.95**	0.91**	C	0.89**	0.82**	C	1.01**	0.95**	C
G-bond	0.78**	0.64**	C	0.65**	0.55**		0.43**		
Hungary	1995:9 / 1997:3 – 2005:12			1995:9 / 1997:3 – 2000:12			2001:1 – 2005:12		
MMR	0.99**	1.01**	C	1.01**	1.01**		1.03**	1.04**	C
T-bill	0.99**	0.95**	C	1.01***			0.88**	0.85**	
G-bond	0.61***			0.84**	0.97**	C	0.48***		
Poland	1996:12 / 1998:7 – 2005:12			1996:12 – 2000:12			2001:1 – 2005:12		
MMR	1.05**	1.05**	C	1.06**	1.06**	B	1.02**	1.02**	C
T-bill	0.93**	0.90**		0.66***			0.40***		
G-bond	0.37***			0.46**			0,15		
Slovakia	1994:1 – 2002:12			1998:7 – 2004:12			2001:1 – 2004:12		
MMR	0.04			0.02			0.84**	0.89**	C
MMR 12	0.28			−0.14			0.95**	0.94**	C
Euro area									
Austria	1996:6 – 2005:11						1999:1 / 1999:6 – 2005:11		
MMR	0.66***			NA	NA	NA	1.01**	0.99**	C
MMR 12	0.44***			NA	NA	NA	0.36***		
G-bond	0.20*			NA	NA	NA	0.14		
Germany	1992:11 – 2003:6			1992:11 – 1998:12			1999:1 – 2003:6		
MMR	1.01**	1.00**		1.00**	1.00**	C	1.00**	0.98**	C
MMR 12	0.49***			0.68***			0.35***		
G-bond	0.18*			0.31*			0.87		
Spain	1992:11 – 2003:6			1992:11 – 1998:6			1999:1 – 2003:6		
MMR	1.03**	1.02**	C	1.04**	1.01**	C	0.98**	0.96**	
MMR 12	0.38***			0.35**			0.31*		
Swap 5y	0.31**			0.29*			0.07		

Source: Authors.

*Note: Shaded cells refer to the existence of cointegrating relationships and contain the estimated long-run elasticities (DOLS and ARDL). Nonshaded cells in the "DOLS/1st d" column report the coefficients obtained from first-differenced specifications. The AS column shows the type of asymmetry. A: asymmetry in the adjustment to the long-run equilibrium, B: asymmetry in short-run dynamics, C: both A and B. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. NA = data not available for the period under review.*

These results should be regarded with some qualification. First, the pass-through for short-term corporate loan rates in Hungary, Austria and Spain seems to be more pronounced than for long-term corporate loan rates. At the same time, no similar pattern emerges for Germany, and the opposite holds true in Slovakia and to some extent also in the Czech Republic and in Slovenia. Second, while pass-through is complete for the rates on new loans, it vanishes completely for the rates on the outstanding stock of loans in Slovakia. Third, the rates on large amount loans exhibit higher pass-through in Austria, similar

Table 2b

Interest Rate Pass-Through – Deposit Rates

	Whole period			1st subperiod			2nd subperiod		
	DOLS/1st d	ARDL	AS	DOLS/1st d	ARDL	AS	DOLS/1st d	ARDL	AS
Overall deposits									
CEE-5									
Czech Republic	1995:12 – 2005:12			1995:12 – 2000:12			2001:1 – 2005:12		
d_on_s	0			0			0.20***		
d_l1y_s	0.79**	0.74**	C	0.74**	0.66**		0.80**	0.79**	C
d_lt_s	0.71**	0.6**	C	0.68**	0.57**	C	0.59***		
Poland	1996:12 / 1998:7 – 2005:12			1996:12 – 2000:12			2001:1 – 2005:12		
d_on_n	0.39***			NA	NA	NA	0.40***		
Slovakia	1994:1 – 2002:12			1998:7 – 2004:12			2001:1 – 2004:12		
d_on_s	NA	NA	NA	0.06			0.33**	0.33**	B
d_l1y	0.14			0.22			0.3		
Slovenia	1994:1 – 2002:8			1998:7 – 2005:11			2001:1 – 2005:11		
d_on_n	NA	NA	NA	0			0		
d_l1y	2.32**	1.57*							
d_m1y	NA	NA	NA	0.00			0.1		
Euro area									
Germany	1992:11 – 2003:6			1992:11 – 1998:12			1999:1 – 2003:6		
d_1m_la	0.42***			0.75**	0.73**		0.43***		
d_1m_ma	0.46***			0.81**	0.80**		0.80**	0.79**	C
d_1m_ha	0.90**	0.91**	C	0.90**	0.89**	B	0.88**	0.87**	
d_3m	NA	NA	NA	NA	NA	NA	0.46***		
d_l1y	0.83**	0.83**	C	0.83**	0.83**		0.46***		
d_4y	0.29***			0.27**			0.29***		
Spain	1992:11 – 2003:6			1992:11 – 1998:6			1999:1 – 2003:6		
d_on	0.14**			0.09**			0.20***		
d_l1y	0.97**	0.91**		0.32***			0.41***		
d_other	0.74**	0.69**	C	0.75**	0.77**	C	0.32***		
Household deposits									
CEE-5									
Czech Republic	1995:12 – 2005:12			1995:12 – 2000:12			2001:1 – 2005:12		
dh_on_s	NA	NA	NA	NA	NA	NA	0.16***		
dh_lt_s	NA	NA	NA	NA	NA	NA	0.50**	0.42**	C
Hungary	1995:1 – 2005:12			1995:1 – 2000:12			2001:1 / 2001:5 – 2005:12		
dh_on_n	0,1			0,0			0.11**		
dh_on_s	0.16***			0.08*			0.12**		
dh_l1y_n	0.77**	0.81**	C	0.90**	0.85**		0.73***		
dh_l1y_s	NA	NA	NA	NA	NA	NA	0.53***		
dh_m1y_n	0.92**	0.91**	C	0.95**	0.93**		0.52***		
dh_m2y_n	NA	NA	NA	NA	NA	NA	0.59***		
dh_m2y_s	NA	NA	NA	NA	NA	NA	0.33***		
dh_lt_n	0.78**	0.81**	C	0.90**	0.86**		0.72***		
dh_lt_s	0.78**	0.81**	C	0.92**	0.86**		0.52***		
Poland	1996:12 / 1998:7 – 2005:12			1996:12 – 2000:12			2001:1 – 2005:12		
dh_on_s	0.34***			0.32***			0.57**	0.46**	C
dh_1y_s	0.74***			0.70***			0.82**	0.77**	C
dh_m1y_s	0.92**	0.92**		0.74***			0.77***		
dh_lt_s	0.71***			0.70***			0.82**	0.77**	
Euro area									
Austria	1996:6 – 2005:11						1999:1/ 1999:6 – 2005:11		
dh_on_s	0.13***			NA	NA	NA	0.23**	0.21**	
dh_l1y_n	0.33***			NA	NA	NA	0.36***		
dh_m2y_n	0.30***			NA	NA	NA	0.58**	0.61**	

Germany	1992:11 – 2003:6			1992:11 – 1998:12			1999:1 – 2003:6		
dh_on	NA	NA	NA	NA	NA	NA	0.22***		
Corporate deposits									
CEE-5									
Czech Republic	1995:12 – 2005:12			1995:12 – 2000:12			2001:1 – 2005:12		
df_on_s	NA	NA	NA	NA	NA	NA	0.15**		
df_lt_s	NA	NA	NA	NA	NA	NA	0.61***		
Hungary	1995:1 – 2005:12			1995:1 – 2000:12			2001:1 / 2001:5 – 2005:12		
df_l1y_n	0.81**	0.80**		0.89**	0.87**		0.95***		
df_m1y_n	0.91**	0.90**	A	0.95**	0.92**		0.81**	0.81**	C
df_lt_n	NA	NA	NA	NA	NA	NA	0.95***		
Poland	1996:12 / 1998:7 – 2005:12			1996:12 – 2000:12			2001:1 – 2005:12		
df_on_s	0.22***			0.17***			0.33***		
df_1y_s	0.71***			0.72***			0.69***		
df_m1y_s	0.89**	0.90**		0.62***			0.61***		
df_lt_s	0.87**	0.87**	A	0.69***			0.88**	0.79**	
Euro area									
Austria	1996:6 – 2005:11						1999:1/ 1999:6 – 2005:11		
df_on_s	0.15***			NA	NA	NA	0.25**	0.22**	
df_l1y_n	0.23***			NA	NA	NA	0.24***		
df_m2y_n	0.42**	0.43**		NA	NA	NA	0.39**	0.39**	

Source: Authors.

Note: See Table 2a.

to the behavior of deposit rates observed in Germany. Finally, no clear-cut statement can be made about the temporal evolution of the pass-through for corporate rates. For instance, the pass-through increased in the second subperiod for long-term lending rates in Spain, while it diminished for the very same rates in Hungary. At the same time, the coefficient for short-term lending rates rose in both countries. In Slovakia and Slovenia, the pass-through for long-term rates became significant in the second subperiod. By contrast, the pass-through coefficients of corporate lending rates (all maturities) in Poland and Germany were lower in the second period compared with the first and/or the whole period.

The estimations for the IFS dataset yield lower pass-through coefficients for the lending and deposit rates in most countries. This may be attributable to the fact that the data series are aggregated by sectors and maturity, which may have dampened the effect of monetary policy changes on the retail rates.[25]

[25] *The results are not reported here, but are available from the authors upon request.*

Table 2c

Interest Rate Pass-Through – Lending Rates

		Whole period			1st subperiod			2nd subperiod		
		DOLS/1st d	ARDL	AS	DOLS/1st d	ARDL	AS	DOLS/1st d	ARDL	AS
Overall lending rates										
Czech Republic		1995:12 – 2005:12			1995:12 – 2000:12			2001:1 – 2005:12		
	l_l1y_s	−0.07**			−0.07			0.66***		
	l_1y5y_s	NA	NA	NA	NA	NA	NA	0.25		
Lending rates for households										
CEE-5										
Czech Republic	lh_l1y_s	NA	NA	NA	NA	NA	NA	0.75		
	lh_1y5y_s	NA	NA	NA	NA	NA	NA	0.7		
	lh_m5y_s	NA	NA	NA	NA	NA	NA	0.8		
Hungary		1995:1 / 1997:1 – 2005:12			1995:1 / 1997:1 – 2000:12			2001:1 – 2005:12		
	lhc_l1y_n	0.42**	0.42**	C	0.55**	0.55**		0.57**	0.66**	C
	lhc_l1y_s	NA	NA	NA	NA	NA	NA	0.38***		
	lhc_m1y_n	0.24			0.60**	0.57**		0.29		
	lhc_m1y_s	NA	NA	NA	NA	NA	NA	0.24***		
	lhh_n	0.07			1.00**	1.11**		0.16		
	lhh_s	NA	NA	NA	NA	NA	NA	0.16**		
Poland		1996:12 / 1998:7 – 2005:12			1996:12 – 2000:12			2001:1 – 2005:12		
	lh_n	0.63***			NA	NA	NA	0.43***		
Slovakia		1994:1 – 2002:12			1998:7 – 2004:12			2001:1 – 2004:12		
	lh_s	NA	NA	NA	−0.06**	−0.06		−0.03		
	lh_n	NA	NA	NA	−0.57**	−0.60**		−0.55**	−0.57**	
	lhc_s	NA	NA	NA	−0.41			−0.53		
	lhc_n	NA	NA	NA	−0.29**	−0.24		−0.25*	−0.26	
	lhc	NA	NA	NA	−0.53			−1.39**	−1.50**	
Slovenia		1994:1 – 2002:8			1998:7 – 2005:11			2001:1 – 2005:11		
	lhc	0.92*			0.13			0.76**	0.72**	
	lhh	0.86*			0.25			1.14**	1.12**	B
Euro area										
Austria		1996:6 – 2005:11						1999:1 / 1999:6 – 2005:11		
	lhc_l1y_n	NA	NA	NA	NA	NA	NA	0.25***		
	lhc_1y5y_n	NA	NA	NA	NA	NA	NA	1.02**	1.04**	
	lhh_l1y_n	0.20***			NA	NA	NA	0.19***		
	lhh_5yn	0.20***			NA	NA	NA	0.20***		
Germany		1992:11 – 2003:6			1992:11 – 1998:12			1999:1 – 2003:6		
	lh_st	NA	NA	NA	NA	NA	NA	0.18***		
	lh_lt	0.19***			0.19***			0.14***		
	lhc	0.19***			0.19***			0.14***		
	lhh	0.18**			0.22			0.14		
	lhh_5y	0.18**			0.22			0.14		
	lhh_10y	0.07			0.02			0.06		
Spain		1992:11 – 2003:6			1992:11 – 1998:6			1999:1 – 2003:6		
	lh	1.24**	1.19**		1.29**	1.26**		0.60**	0.60**	
	lhh	1.19**	0.95**		1.24**	1.41**		0.65**	0.68**	C
Lending rates for the nonfinancial corporate sector										
Czech Republic		1995:12 – 2005:12			1995:12 – 2000:12			2001:1 – 2005:12		
	lf_l1y_s	NA	NA	NA	NA	NA	NA	0.87**	0.86**	
	lf_1y5y_s	NA	NA	NA	NA	NA	NA	0.98**	1.02**	
	lf_m5y_s	NA	NA	NA	NA	NA	NA	0.25		
Hungary		1995:1 – 2005:12			1995:1 – 2000:12			2001:1 – 2005:12		
	lf_l1y_n	1.01**	1.00**	C	0.35***			0.96**	0.96**	C
	lf_m1y_n	1.01**	0.97**		1.09**	1.07**	A	0.72**	0.72**	

Poland		1996:12 / 1998:7 – 2005:12			1996:12 – 2000:12			2001:1 – 2005:12			
	lf_l1y_n	0.83***			NA	NA	NA	0.50***			
	lf_m1y_n	0.78***			NA	NA	NA	0.45***			
	lf_3y_s	0.74***			0.87***			0.47***			
	lf_n	0.79***			NA	NA	NA	0.54***			
Slovakia		1994:1 – 2002:12			1998:7 – 2004:12			2001:1 – 2004:12			
	lf_l1y	0.28			1.04**	0.93**		0.73**	0.82**		
	lf_m1y	0.49			0,9			0.99**	1.03**		B
	lf_s	NA	NA	NA	0.72**	0.89**		0.15			
	lf_n	NA	NA	NA	0.56			1.01**	1.03**		
Slovenia		1994:1 – 2002:8			1998:7 – 2005:11			2001:1 – 2005:11			
	lf_l1y	0.91*			0.13			0.15			
	lf_m1y	0.96*			0.25			1.27**	1.28**		
Austria		1996:6 – 2005:11						1999:1 / 1999:6 – 2005:11			
	lf_l1y_n	NA	NA	NA	NA	NA	NA	0.42***			
	lf_1y5y_n	NA	NA	NA	NA	NA	NA	0.27**			
	lf_l1y1M_n	NA	NA	NA	NA	NA	NA	0.55***			
Germany		1992:11 – 2003:6			1992:11 – 1998:12			1999:1 – 2003:6			
	lf_la	NA	NA	NA	NA	NA	NA	0.14			
	lf_ha	NA	NA	NA	NA	NA	NA	0.13			
	lf_st_1	NA	NA	NA	NA	NA	NA	0.19***			
	lf_st_5	0.28***			0.27***			0.24***			
	lf_st_25	0.28***			0.33***			0.20***			
	lf_l1y	0.28***			0.33***			0.20***			
	lf_2y	0.30***			0.39***			0.22**			
	lf_m1y	NA	NA	NA	NA	NA	NA	0.13			
Spain		1992:11 – 2003:6			1992:11 – 1998:6			1999:1 – 2003:6			
	lf_l1y	0.68***			0.70***			0.88**	0.76**		C
	lf_m1y	0.37***			0.36***			0.73**	0.70**		C

Source: Authors.
Note: See Table 2a.

5.3 The Pass-Through to Retail Rates via Market Rates

For the multivariate VAR approach, we select countries in accordance with a twofold criterion. First, at least 12-month MMR/T-bill rates and retail rates should be connected to the policy rate through a cointegrating vector obtained from the single-equation analysis. Second, both deposit and lending rates of comparable maturity should pass the cointegration criterion with positive and statistically significant coefficient estimates. The two countries which qualify in terms of these two criteria are the Czech Republic and Hungary.

For the Czech Republic, only the second subperiod is analyzed, given that cointegration for lending rates is found only in the period 2001–2005. The selected retail rates are lending rates for the nonfinancial corporate sector with a maturity of less than 1 year and 1–5 years and an aggregate deposit rate with a maturity of less than 1 year and household deposit rates for maturities longer than overnight. This leads us to build a system for short-term deposit and lending rates (mp→ 1mMMR→ 12mMMR→ dep (d_l1y_s)→ len(lf_l1y)) and for long-term deposit and lending rates (mp→ 1mMMR→ 12mMMR → gbond→ dep(dh_lt_s)→ len(lf_1y5y)).

For the short-term system,[26] the trace statistics identify four cointegration vectors. This indicates a full-fledged pass-through from the monetary policy rate to deposit and lending rates. The long-term coefficient, shown in table 3, is close to unity for market rates (1.01 and 1.05). It is 0.73 for the relation 12-month MMR – deposit rate, which is in line with the findings of the single-equation approach if accounting for the previous chains (0.75 versus 1.01*1.05*0.73=0.77). The long-run coefficient between deposit and lending rates is as high as 1.16. Therefore, we think that this coefficient does not capture the relationship between deposit and lending rates, but rather reflects the relative size of the pass-through from 12-month MMR rates to those rates. Indeed, if we specify the fourth cointegration vector as linking 12-month MMR rates to the lending rates, the estimated coefficient will be 0.85, which is higher than the coefficient for the relation 12-month MMR – deposit rate, thus confirming our earlier results from the direct monetary policy approach (0.86–0.87 versus 1.01*1.05*0.85=0.90).

Table 3

Multivariate Analysis – Results

	COINT	MP →1mMMR	1mMMR →12mMMR	12mMMR →GBOND	12mMMR →DEP	DEP →LEN	12mMMR →LEN
Czech Republic							
MP→1m MMR→12m MMR→DEP (D_L1Y_S)→LEN (LF_L1Y)							
2001:1 – 2005:12	4**	1.01**	1.05**		0.73**	1.16**	
K=1	4**	1.01**	1.05**		0.73**		0.85**
MP→1m MMR→12m MMR→GBOND→DEP (DH_LT_S)→LEN (LF_1Y5Y)							
2001:1 – 2005:12	4**	1.01**	0.92**	..	0.56**	1.84**	
K=1	4**	1.01**	0.92**	..	0.56**		1.03**
Hungary							
MP→1m MMR→12m TBILL→DEP (DF_M1Y_N)→LEN (LHC_L1Y_N)							
1997:3 – 2005:12	4**	1.02**	0.98**		0.93**	0.42**	
K=1	4**	1.01**	0.98**		0.93**		0.39**
2001:1 – 2005:12	4**	1.02**	0.85**		0.99**	0.72**	
K=1	4**	1.02**	0.85**		0.99**		0.72**
MP→1m MMR→12m TBILL→DEP (DF_M1Y_N)→LEN (LF_M1Y_N)							
1997:3 – 2005:12	4**	1.01**	0.98**		0.93**	1.06**	
K=2	4**	1.02**	0.98**		0.94**		0.99*
2001:1 – 2005:12	4**	1.02**	0.85**		0.99**	0.84**	
K=2	4**	1.02**	0.85**		0.99**		0.83**

Source: Authors.

*Note: k=1 or k=2 indicates the lag length chosen by the Schwarz information criterion. COINT shows the number of cointegrating vectors detected by the trace statistic. * and ** indicate statistical significance at the 10% and 5% levels, respectively.*

In the system of long-term rates with six variables, we detected four cointegration relationships. Given that one more variable is included (government bond rates), one chain link is not functional. Our earlier results from the single-equation approach implicitly indicate the absence of cointegration for

[26] *The lag length in the VAR is selected using the Schwarz information criterion by setting the maximum number of lags to six as in the single-equation approach.*

the link 12-month MMR – government bond yield.[27] The long-run coefficients of this system reported in table 3 confirm an almost one-to-one reaction of the lending rates to 12-month MMR.

For Hungary, only a five-variable system excluding government bond rates is estimated, since we did not find cointegration between the policy rate and government bond yields. The two systems estimated for consumer loan rates and corporate lending rates provide evidence of a full-fledged transmission from the policy rate through 1-month MMR and 12-month T-bill rates to deposit rates (new long-term corporate deposit rates) and lending rates (new short-term consumer lending rates and new long-term corporate lending rates). The results furthermore confirm the findings of the single-equation estimations which show a very strong pass-through to long-term deposit rates and indicate that the pass-through is higher for (long-term) corporate loan rates than for (short-term) consumer loan rates, even though the former becomes weaker, while the latter rises slightly over time.

5.4 Comparison with the Literature

Whenever a researcher carries out an empirical analysis, the question arises how the new results compare with those provided in the already existing literature. Table 4 provides an answer to this question by summarizing the findings reported in other studies regarding the size of the long-run pass-through to different retail rates for the Czech Republic, Hungary, Poland and Slovakia. Despite some similarities, we discovered several prominent differences between our results and the existing estimates: (1) Our estimates indicate a lower pass-through for overnight and long-term household deposit rates in Hungary and a moderately lower pass-through for all kinds of deposit rates in Poland. (2) Our results show a moderately lower pass-through for long-term corporate loan rates in Hungary and for short- and long-term corporate loan rates in Poland. (3) Our estimations fail to establish any significant relationship between monetary policy rates on the one hand, and deposit rates in Slovakia, as well as aggregate household loan rates (and consumer loan rates) in the Czech Republic and Slovakia, on the other hand.

One key reason for the differences between our results and those obtained by other researchers is that most of them estimate error correction models without having checked the existence of a valid cointegration relationship. However, a number of series are not cointegrated with policy rates. The estimated coefficients we derived by using regressions applied to first differenced series tend to be lower than those resulting from the cointegration analysis (which was inappropriate in the given context). Another possible explanation for our lower estimates is a possible decrease in the pass-through over time, given that our data sample covers more recent periods.

[27] *The pass-through from the policy rate to the 12-month MMR is almost complete, while no cointegration could be detected between the monetary policy rate and government bond yields for the second subperiod. This implies a lack of cointegration between the 12-month MMR and government bond yields.*

Table 4

Overview of the Literature

		Author	Time	LR PT
Rates on short-term deposits				
CZ	ALL	T (2004)	1995:1 – 2004:2	0.79
CZ	ALL, 1M-12M	CER (2004)	1997:2 – 2002:12	0.84
CZ	HH	SK (2004)	1993:1 – 2003:12	0.07
HU	ALL	T (2004)	1995:1 – 2004:2	0.82
HU	HH, O/N	CER (2004)	1994 / 1997 – 2002:12	0.49
HU	HH, 1Y	CER (2004)	1994 / 1997 – 2002:12	0.92
HU	HH, 1Y	SK (2004)	1995:1 – 2003:12	0.36 – 0.82
PL	ALL	T (2004)	1995:1 – 2004:2	0.98
PL	HH, O/N	CER (2004)	1994:1 – 2002:12	0.77 c
PL	HH, 1M	WP (2002)	1995 – 2002	0.80
PL	HH, 3M,6M,12M	WP (2002)	1995 – 2002	0.91 c
PL	HH, 1M-12M	SK (2004)	1996:12 – 2003:12	0.82 – 0.91
PL	HH, 1Y	CER (2004)	1994:1 – 2002:12	0.98 c
PL	COR, 1M-12M	SK (2004)	1996:12 – 2003:12	0.82-0.93
SK	ALL	T (2004)	1995:1 – 2004:2	1.26
SK	ALL, 1M-12M	SK (2004)	1995:1 – 2003:12	0.28 – 0.71
Rates on long-term deposits				
CZ	ALL	T (2004)	1995:1 – 2004:2	0.49
CZ	ALL, 1Y-4Y	CER (2004)	1997:2 – 2002:12	0.85
CZ	HH	SK (2004)	1993:1 – 2003:12	0.28-0.62
HU	ALL	T (2004)	1995:1 – 2004:2	0.90
HU	HH	HKN (2004)	2001:1 – 2004:1	0.86
HU	HH, >1Y	CER (2004)	1994 / 1997 – 2002:12	0.91
HU	HH, >1Y	SK (2004)	1995:1 – 2003:12	0.90
HU	COR	HKN (2004)	2001:1 – 2004:1	0.87
HU	COR, panel	HKN (2004)	2001:1 – 2004:1	0.87
PL	ALL	T (2004)	1995:1 – 2004:2	0.91
PL	HH, >1Y	CER (2004)	1994:1 – 2002:12	0.96 c
PL	HH, 2Y	SK (2004)	1996:12 – 2003:12	0.91
PL	COR, 2Y	SK (2004)	1996:12 – 2003:12	0.88
PL	COR, 3Y	SK (2004)	1996:12 – 2003:12	0.83
SK	ALL	T (2004)	1995:1 – 2004:2	1.01
SK	ALL, 2Y	SK (2004)	1995:1 – 2003:12	0.24
SK	ALL, 5Y	SK (2004)	1995:1 – 2003:12	0.20
SK	ALL, >5Y	SK (2004)	1995:1 – 2003:12	0.06
Short-term loans				
CZ	ALL	T (2004)	1995:1 – 2004:2	0.76
CZ	ALL, NEW	T (2004)	1995:1 – 2004:2	1.04
CZ	ALL, <1Y	CER (2004)	1997:2 – 2002:12	0.76
CZ	COR	SK (2004)	2001:1 – 2003:12	0.95
HU	ALL	T (2004)	1995:1 – 2004:2	1.09
HU	COR	SK (2004)	1995:1 – 2003:12	1.01
HU	COR, <1Y	CER (2004)	1994 / 1997 – 2002:12	1.01 c
PL	COR, 1Y	CER (2004)	1994:1 – 2002:12	1.02 c
PL	COR, 1Y	WP (2002)	1995 – 2002	1.03 c
SK	ALL	T (2004)	1995:1 – 2004:2	1.62
SK	ALL, NEW	T (2004)	1995:1 – 2004:2	1.21
SK	COR	SK (2004)	1995:1 – 2003:12	0.65
Long-term loans				
CZ	ALL	T (2004)	1995:1 – 2004:2	0.65
CZ	ALL, NEW	T (2004)	1995:1 – 2004:2	0.83
CZ	ALL, 1Y-4Y	CER (2004)	1997:2 – 2002:12	0.64
HU	ALL	T (2004)	1995:1 – 2004:2	0.67
HU	COR	SK (2004)	1995:1 – 2003:12	1.11
HU	COR	HKN (2004)	2001:1 – 2004:1	0.98 c
HU	COR, panel	HKN (2004)	2001:1 – 2004:1	0.95
HU	COR, >1Y	CER (2004)	1994 / 1997 – 2002:12	1.02 c

PL	ALL	T (2004)	1995:1 – 2004:2	0.85
PL	COR	SK (2004)	1996:12 – 2003:12	0.99
PL	COR, 3Y	CER (2004)	1994:1 – 2002:12	0.98 c
SK	ALL	T (2004)	1995:1 – 2004:2	0.79
SK	ALL, NEW	T (2004)	1995:1 – 2004:2	0.93
Consumer loans				
CZ		Kot (2004)	1996:1 – 2004:1	0.42
CZ		SK (2004)	1993:1 – 2003:12	0.26
HU		Kot (2004)	1998:1 – 2004:4	0.36
HU		SK (2004)	1995:1 – 2003:12	0.51
HU		HKN. (2004)	2001:1 – 2004:1	0.81
PL		Kot (2004)	1997:1 – 2004:4	0.59
PL		WP (2002)	1997 – 2002	0.85
PL		SK (2004)	1996:12 – 2003:12	0.60
SK		SK (2004)	1995:1 – 2003:12	0.02

Source: Authors.

Note: CZ, HU, PL and SK refer to the Czech Republic, Hungary, Poland and Slovakia. HH and COR stand for data series for households and for the corporate sector, while ALL is the aggregated series. NEW indicates interest rate series for new loans/deposits, and the figures after ALL, HH and COR indicate the precise maturity. CER(2004), HKN (2004), N(2005), SK(2004), T(2004) and WP(2002) are Crespo-Cuaresma et al. (2004), Horváth et al. (2004), Sander and Kleimeier (2004b), Tieman (2004) and Wróbel and Pawlowska (2002), respectively. (c) indicates that complete pass-through cannot be rejected.

6 Concluding Remarks

In this study, we analyzed the size of the interest rate pass-through for five CEE countries and three euro area benchmark countries. Our results confirm earlier findings in the literature that the pass-through is generally very low for overnight deposit rates, but becomes substantially higher for short- to long-term deposit rates. At the same time, corporate lending rates are much more responsive to changes in the policy rate than deposit or household loan rates. Remarkably, the pass-through is almost complete for corporate lending rates in the Czech Republic, Hungary, Slovakia, Slovenia and, to a slightly lesser extent, in Spain.

However, given the broad range of results with regard to country-specific pass-through estimates, these findings should be generalized only with appropriate caution. Not only corporate loan rates, but also housing loan rates in Slovenia and in Spain and corporate deposit rates in Hungary exhibit (almost) complete pass-through. In Poland and Germany, the pass-through to deposit rates is stronger than that to lending rates. Just to mention a few findings at the other extreme, no significant pass-through could be established for long-term corporate lending rates in Slovakia, for some corporate lending rates in Germany and for new housing loan rates in Hungary. The pass-through to household (and consumer) lending rates in the Czech Republic and Slovakia and to deposit rates in Slovenia appears to be nonexistent.

We found little empirical support for a functioning pass-through to long-term market rates, presumably owing to the instability of the yield curve at the longer end of the curve. Instead, we found evidence that the effect of changes in the key policy rate even transits through money market and T-bill rates to long-term deposit and lending rates. In most cases, it is not possible to use a cointegrated VAR framework to track down the whole mechanism of pass-through because it is difficult to detect solid cointegration relationships. Indeed, this framework is capable of describing the interrelated chains of the whole mechanism only for the Czech Republic and Hungary.

While other papers identify no major asymmetries for the CEE-5, our results indicate that the reaction of retail and market rates becomes increasingly asymmetric depending on the direction of changes in the policy rate. However, it was not possible to make out a general pattern for this asymmetric behavior for specific interest rates (except, perhaps, for short-term money market rates).

More importantly, our pass-through estimates for the CEE-5 tend to be lower for a number of retail rates than those of previous estimates, and we failed to detect significant pass-through effects in a number of cases both for the CEE-5 and the euro area countries. This is, among others, attributable to the fact that previous studies have chiefly relied on error correction models without explicitly checking the presence of cointegrating relationships between the policy and retail rates. We show that cointegration can be established only for a fraction of the bivariate relationships and that pass-through estimates obtained for first differenced stationary series are lower and sometimes insignificant. Furthermore, our lower pass-through estimates could also indicate that pass-through is declining over time, as our data is from a more recent period. This hypothesis is backed by direct evidence.

While the interest rate pass-through is on average higher in the CEE-5 than in Austria and Germany, it tends to decline in the CEE-5, in particular in Hungary and (with respect to lending rates) in Poland. In some cases, however, the evolution of the pass-through over time is not homogeneous even in one country. The substantial slowdown in inflation rates (and in real GDP growth for a few years in some countries) could be elements of an explanation for the weakening of the pass-through on the macro side. Moreover, our finding of a declining pass-through calls into question the general belief that competition among banks has increased in recent years.

At the same time, the interest rate pass-through in the CEE-5 is more comparable with that in Spain than with that in the other euro area countries. This implies that the euro area will probably not become more heterogeneous with respect to the interest rate pass-through in the event that the CEE-5 adopt the euro. In addition, the interest rate pass-through improved slightly in Spain and in Austria, while remaining stable and weak in Germany after the introduction of the euro. This observation casts doubt on the universality of the much-advocated pass-through-improving effect of the euro owing to an increased integration of, and a higher level of competition on, the euro area financial markets.

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Data Appendix

Czech Republic: Data series are obtained from Česká národní banka if not indicated otherwise (in parentheses).

1995:12 – 2005:12 mp (2-week repo rate), mmr (Datastream 1995:12-96:12, Bloomberg thereafter), mmr12 (Datastream, PRIBK1Y), d_on_s, d_lt_s, d_l1y_s, l_l1y_s

1997:2 – 2005:12 gbond (Bloomberg)

2001:1 – 2005:12 dh_on_s, dh_lt_s, df_on_s, df_lt_s, l_1y5y_s, lh_l1y_s, lh_1y5y_s, lh_m5y_s, lf_l1y_s, lf_1y5y_s, lf_m5y_s.

Hungary: Data series are obtained from Magyar Nemzeti Bank if not indicated otherwise (in parentheses).

1995:1 – 2005:12 mp (active overnight repo rate until 1995:12, passive 1-month repo rate from 1996:12 to 1999:2, 2-week deposit rate thereafter), dh_on_n, dh_on_s, dh_lt_n, dh_lt_s, dh_l1y_n, dh_m1y_n, df_l1y_n, df_m1y_n, lhh_n, lf_l1y_n, lf_m1y_n

1995:9 – 2005:12 mmr (Datastream 1995:9–1996:7, Bloomberg thereafter)

1997:1 – 2005:12 lhc_l1y_n, lhc_m1y_n

1997:3 – 2005:12 tbill, gbond

2000:1 – 2005:12 df_lt_n, lhc_l1y_s, lhc_m1y_s, lhh_s

2001:5 – 2005:12 dh_l1y_s, dh_m2y_n, dh_m2y_s

Poland: Data series are obtained from Narodowy Bank Polski if not indicated otherwise (in parentheses).

1994:2 – 2005:11 mp (1994:2–1994:3 rediscount rate; thereafter short-term NBP bills: "intervention rate"), mmr (Datastream 1994:2–1996:8, Bloomberg thereafter), tbill (Ministry of Finance), gbond (Ministry of Finance, Bloomberg thereafter)

1996:12 – 2005:11 dh_on_s, dh_lt_s, dh_1y_s, dh_m1y_s, df_on_s, df_lt_s, df_1y_s, df_m1y_s, lf_3y_s

Data series are obtained from NewCronos/Eurostat:

1998:07 – 2005:11 lh_n, lf_l1y_n, lf_m1y_n, lf_n, d_on_n

Slovakia: The data series are obtained from NewCronos/Eurostat if not indicated otherwise (in parentheses).

1994:1 – 2005:12 mp (NewCronos: other official rates until 2000:1; official refinancing operation rate thereafter; cross-checked with Národná banka Slovenska data), mmr (Národná banka Slovenska via Datastream: SXIBK1M; cross-checked with NewCronos data)

1994:9 – 2005:12 mmr12 (Národná banka Slovenska via Datastream: SXIBK1Y)

1994:1 – 2002:12 d_l1y, d_m1y, lf_l1y, lf_m1y

1998:7 – 2004:12 lf_l1y_s, lf_l1y_n, lf_m1y_s, lf_s, lf_n, lhc_s, lhc_n, lhc, lh_s, lh_n, d_on_s

Slovenia: The data series are obtained from NewCronos/Eurostat if not indicated otherwise (in parentheses).

1994:1 – 2005:11 mp (NewCronos: official lending rate)

1994:1 – 2002:08 lf_l1y, lf_m1y, lhc, lhh, d_l1y,

1998:7 – 2005:11 lf_l1y_n, lf_m1y_n. lhc_n. lhh_n. d_on_n. d_m1y.

Germany: The data series are obtained from the Deutsche Bundesbank if not indicated otherwise (in parentheses).

1992:11 – 2005:12 mp (NewCronos: official refinancing operation rates, Deutsche Bundesbank until 1998:12, European Central Bank after 1999:1), mmr, mmr12, gbond (4-5-year government bond)

1991:1 – 2003:6 lh_lt, lhh_5y, lhh_10y, lhh, lhc, lhh, lf_st_5, lf_st_25, lf_2y, lf_l1y, d_1m_la, _1m_ma, d_1m_ha, d_4y, d_l1y,

1996:11 – 2003:6 lf_st_1, lh_st, lf_m1y, dh_on, d_3m, lf_la, lf_ha, lh_st

Spain: The data series are obtained from NewCronos/Eurostat if not indicated otherwise (in parentheses).

1992:11 – 2003:6 mp (NewCronos: official refinancing operation rates, Banco de España until 1998:12, European Central Bank after 1999:1), mmr (Datastream: ESMIB1M), mmr12 (Datastream: ESMIB1Y), gbond (5-year swap, Datastream: ICESP5Y), lf_l1y, lf_m1y, lh, lhh, d_on, d_l1y, d_other,

Austria: The data series are obtained from the Oesterreichische Nationalbank if not indicated otherwise (in parentheses).

1995:12 – 2005:11 mp (NewCronos: official refinancing operation rates, Oesterreichische Nationalbank until 1998:12, European Central Bank after 1999:1), mmr (Bloomberg), mmr12 (Bloomberg), gbond (Bloomberg), dh_on_s, dh_l1y_n, dh_m2y_n, df_on_s, df_l1y_n, df_m2y_n, lhh_l1y_n, lhh_1y5y_n

1999:6 – 2005:11 lf_l1y_n, lf_1y5y_n, lf_l1y1M_n, lhc_l1y_n, lhc_1y5y_n