PANOECONOMICUS, 2013, 1, pp. 89-101
Received: 25 October 2011; Accepted: 13 June 2012.

UDC 338.23:336.74
DOI: 10.2298/PAN1301089T
Original scientific paper

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Monetary Determinants of Deposit Euroization in European Post-Transition Countries

Summary: This paper investigates the long-run and short-run relationship between deposit euroization in twelve European post-transition economies and two determinants of deposit euroization that are under the influence of monetary policy: the exchange rate and the interest rate differential. The link between deposit euroization, exchange rates and interest rate differentials is investigated using Johansen cointegration and error correction models for each country separately. The results suggest that changes in both monetary drivers have significant effects on deposit euroization and are therefore important for explaining and fighting deposit euroization. Differences between exchange rate regimes, fixed and managed vs. floating, seem to matter for deposit euroization.

Key words: Cointegration, Deposit euroization, Transition.

JEL: C32, E44, E58, F31, F41.

The first version of this paper was presented at the 17th Dubrovnik Economic Conference, Dubrovnik, June 2011. The author wishes to thank the participants in the Young Economist's Seminar for their valuable comments and suggestions. Special thanks also go to Maruška Vizek for extra valuable comments.

The latest economic crisis, aggravated by large currency depreciations in some European post-transition countries and massive defending of hard pegs in others, has emphasized the severity of high financial euroization (FE). FE is not just a temporary consequence of macroeconomic instability experienced in the first period of transition, but a long-lasting phenomenon in almost all European post-transition countries. For twelve countries that record very high FE levels, we investigate two monetary determinants of deposit euroization (DE): the interest rate differential and the exchange rate. We show how DE reacts to changes in those variables and how those responses differ depending on the level of DE and the exchange rate regime in the observed country.

This study provides new insights into the relationship between DE and its drivers and unveils the relationship between DE and monetary policy, more specifically central banking. We choose monetary policy because it is most closely related to financial system stability and as such to FE. In addition, this research gives insights into the correlation between the type of the exchange rate regime (fixed vs. floating) and DE, providing a good base for designing deeuroization policies. Lastly, this study considers country-specific characteristics and it includes periods after 2008 marked by strong depreciatory pressures in most countries we explore. Our study extends the research by Marijana Ivanov, Marina Tkalec, and Maruška Vizek (2011) who use similar variables and data samples but for one country only.

The remainder of the paper is organized as follows. Section 1 reviews the literature on FE in post-transition Europe, while Section 2 discusses data and methodol-

ogy. In Section 3, we present the results, while we conclude the paper and offer policy recommendations in the last section.

1. Literature

In the late nineteen eighties and early nineties, high inflation dominated European transition countries. In order to restrain inflation expectations tied to exchange rate movements, central banks preferred to use the exchange rate as the nominal anchor (Jeffrey A. Frankel 2010). Evidence that such exchange rate anchors persist throughout emerging Europe can be found in a great number of countries that run currency boards and fixed or managed exchange rate regimes. Guillermo Calvo and Carmen Reinhart (2002) use the term "fear of floating" to explain that central banks are biased to exchange rate depreciation. Namely, in countries where depreciations could induce negative balance sheet effects, central banks intervene regularly to prevent major exchange rate depreciations. Eduardo Levy-Yeyati (2003) further observes that such biases in the system create moral hazard and reduce exchange rate risks that manifest in very high levels of unofficial euroization.

Unofficial euroization is an occurrence in which the foreign currency takes over different money functions, such as the medium-of-exchange function that leads to currency substitution or the store-of-value function, leading to asset substitution. The term asset substitution has been replaced by financial euroization (FE), defined as holdings of both assets and liabilities in foreign currency (Alain Ize and Levy-Yeyati 2003). FE can be divided into deposit euroization (DE) and credit euroization (CE), with DE being the result of holding deposits in foreign currency and CE referring to the commercial banks' propensity to grant loans in foreign currency or indexed to foreign currency.

While there is no normative consensus on the effect of FE on the economy, researchers find that the relationship between the level of FE and monetary policy, trade balance and consequently output is an important one. In much of the recent literature on FE, the focus lies on detecting the determinants of euroization and the effects it has on the conduct of monetary policy. Annamaria Kokenyne, Jeremy Ley, and Romain Veyrune (2010) observe that euroization in transition Europe is still very high despite the fact that the economies stabilized and inflation subdued years ago. Levy-Yeyati (2006) summarizes this FE persistence into the currency substitution view, the portfolio view, the market failure view, and the institutional view.

The currency substitution view explains FE as an outcome of a negative relationship between demand for local currency and the rate of inflation (Miguel Savastano 1996; Tomás Baliño, Adam Bennett, and Eduardo Borensztein 1999; Gianni De Nicoló, Patrick Honohan, and Ize 2005). The portfolio view, also known as the optimal (minimum variance) portfolio, explains that high FE levels persist (even after prices stabilize) whenever the expected volatility of the inflation rate remains high in relation to that of the real exchange rate (Ize and Levy-Yeyati 2003). This theoretical explanation assumes that uncovered interest rate parity holds given the real returns on different currencies. In short, if the variance of domestic inflation increases relative to the variance of real depreciation, the local currency becomes less attractive and FE increases. The market failure view explains how central banks can create

lower foreign currency borrowing costs and eventually build up FE levels. Being biased to depreciation and maintaining a stable exchange rate, central banks mitigate exchange rate risks and increase moral hazard. The case in which institutions, namely central banks, build their credibility on a stable exchange rate instead of on strong institutions is described by the institutional view. Central banks that fail to develop all functions of the domestic currency by strongly committing to a stable exchange rate, increase FE and eventually stay trapped in a "fear of floating" (Reinhart, Kenneth Rogoff, and Savastano 2003; Jean François Goux and Charbel Cordahi 2007).

Most recent research on FE in post-transition Europe focuses on monetary determinants of FE, especially on exchange rates. Nominal and real exchange rates, exchange rate volatility and interest rate differentials are depicted as the most important FE drivers, together with more general determinants such as financial integration, foreign bank presence and the accumulation of foreign liabilities. The biggest part of those studies use pooled data analysis that does not account for country-by-country characteristics but provides conclusions for the entire sample. Such a study is Henrique S. Basso, Oscar Calvo-Gonzales, and Marius Jurgilas (2011) that shows that higher interest rate differentials tend to decrease DE, while Alina Luca and Iva Petrova (2008) prove exactly the opposite and add that rising exchange rate volatility helps to decrease DE. Similarly, Ruslan Piontkovsky (2003) shows that relative returns on assets, defined as bank deposits in the domestic currency relative to deposits in foreign currencies, have a significant effect on the level of FE. Kokenyne, Ley, and Veyrune (2010) support the findings of Luca and Petrova (2008) on exchange rate volatility, but also claim that real exchange rate depreciation increases the share of deposits in foreign currency. Another study by Luis J. Carranza, Juan M. Cayo, and José E. Galdón-Sanchez (2003) argues that the effect of exchange rate depreciation depends on the exchange rate regime and the level of FE. Namely, fixed exchange rate regimes and countries with higher levels of euroization bear stronger balance sheet effects after depreciations.

Research using time series methods country-by-country is scarce when compared to the panel data analysis results summarized above. Edgar L. Feige (2002) and Levy-Yeyati (2003) claim that underdeveloped domestic financial markets are in part responsible for high FE levels in some countries. Emre Ozsoz, Erick W. Rengifo, and Dominick Salvatore (2008) estimate the probability of foreign currency intervention in five euroized post-transition economies using a volatility measure of the local exchange rate. Thereby, they demonstrate that central bank behaviour is predetermined by the level of euroization.

To the best of our knowledge, there are no studies that model DE together with its monetary determinants and that account for country-specific characteristics. One study by Ivanov, Tkalec, and Vizek (2011) uses cointegration to show effects of different variables on DE including the exchange rate but it does so for Croatia only and does not include the interest rate differential as a possible DE driver. Ivanov, Tkalec, and Vizek (2011) prove that DE in Croatia rises after both nominal and real exchange rate depreciate.

2. Data and Methodology

In this study, we define DE as the share of foreign currency deposits in total deposits. Although the most accurate way to measure DE is by surveys that collect data on a wide range of assets and liabilities in foreign currency, the problem is that those surveys either have a very short data span or are conducted on a very small number of countries. Therefore, if one wants to study DE behaviour across time, the alternative is to use banks' aggregate balance sheet data that provide only levels of time and savings deposits in foreign currency.

Although DE is not a perfect measure of financial euroization because it incorporates only the liabilities side of bank accounts, it still reflects differences in unofficial euroization between countries. The literature also suggests building composite indexes of euroization but there is no consensus on the definition of such an index (Reinhart, Rogoff, and Savastano 2003). The main difficulty with the composite index is that the determination of the weight of a specific component is discretionary and can lead to over- or underdetermination of the real euroization level. Credit euroization, on the other hand, provides a meaningful insight into FE but, just as DE, it presents only one side of the balance sheet. However, DE provides a very useful advantage to CE. Namely, studies confirm that DE is the source and precondition for CE formation and, as such, it is defined as one of the CE drivers (Martin Brown, Karolin Kirschenmann, and Steven Ongena 2009; Brown, Ongena, and Pinar Yeşin 2009; Basso, Calvo-Gonzales, and Jurgilas 2011; Ivanov, Tkalec, and Vizek 2011). Thus, it makes sense to investigate the drivers of DE prior to CE examination.

We are interested in monetary determinants of DE, especially in the exchange rate and the interest rate differential. The literature recognizes interest rate differentials and exchange rates to have the most important impact on DE, so we model those three variables. We expect to show that exchange rates have an impact on DE when confidence in the domestic currency is eroded (i.e. in countries that record high FE levels) and that exchange rate depreciations relatively increase deposits in foreign currency. The variable we include in our model is the monthly average bilateral exchange rate of the domestic currency to the euro. However, for countries that have a fixed exchange rate regime, the real effective exchange rate is used instead. The interest rate differential is calculated as the difference between domestic and euro-area interest rates, where the domestic rate is either the 3-month money market interest rate or a short-run deposit rate and the euro-area rate is the 3-month money market interest rate. While the domestic interest rate reflects central bank activity and possibly even monetary policy stance, the interest rate differential can be a proxy for high inflation rates, foreign capital inflow and arbitrage opportunities.

We use data from twelve European post-transition countries: Belarus, Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia and Turkey. We use monthly data up to December 2010 with sample sizes varying between 72 observations for Macedonia and 185 observations for Croatia. A short description of prevailing exchange rate regimes for each country can be found in the Appendix. All data are collected from Eurostat and central bank statistics, with detailed descriptions in the Appendix. All series are seasonally adjusted and deposit euroization and the exchange rate are in logarithms. Augmented Dickey-

Fuller unit root tests on the levels and first differences of the data series up to 18 lags and constant included, indicate that all variables are integrated of order one. Additional unit root tests such as Phillips-Perron, Ng-Perron, Dickey-Fuller GLS, ERS point-optimal and Kwiatkowski-Phillips-Schmidt-Shin were conducted and shown to corroborate the augmented Dickey-Fuller test results almost entirely (the details can be obtained upon request from the author).

We use Johansen cointegration (Søren Johansen 1988, 1991) to find out whether DE and its monetary determinants are cointegrated and estimate vector error correction models to capture the long-run equilibrium relationship and the short-run adjustment. For each country separately, DE is modelled with either the nominal or the real effective exchange rate and the interest rate differential. We first estimate the model and then test for Johansen cointegration in order to investigate whether there is one or more long-run equilibrium relationships among nonstationary variables. If cointegration is found, we estimate vector error correction models that capture long-run equilibrium and short-run adjustment.

3. Estimation Results

The baseline reduced VAR model is defined as:

$$y_t = \Gamma X_t + u_t \tag{1}$$

where $y_t = (DE, ER, IRD)$, $\Gamma = \left(\Gamma_0, \Gamma_1, ..., \Gamma_j\right)$, $X_t = (1, y_{t-1}, ..., y_{t-j})'$ and DE stands for deposit euroization, ER for the exchange rate and IRD for the interest rate differential. Using different lag length selection criteria such as likelihood ratio test statistic, final prediction error, Akaike, Schwarz and Hannan-Quinn information criteria, we determine the optimal lag length for each country separately. We choose the deterministic terms according to the Akaike information criterion. The selection criteria results for lag length and deterministic terms are not presented in the paper to save space, but can be obtained upon request from the authors. All models were tested for residual serial correlation and were found to satisfy the diagnostic tests.

After defining the baseline model, we can determine the number of cointegrating relations between the series. Analysis of the cointegration rank is conducted using Johansen's likelihood ratio procedure (Johansen 1991, 1995). The deterministic term appears significant for all countries except for Poland and the Czech Republic. In the case of Latvia we also need to include a linear trend term. The results for trace and maximum eigenvalue tests are presented in Table 1. For Belarus, Macedonia, Romania and Serbia both tests reject cointegration implying that there is no relationship between the variables. For all other countries both tests show there is one cointegrating relation. The only exception is the Czech Republic for which only the trace test implies one cointegrating relation, while the max test shows no cointegrating relation. Resulting cointegrating vectors for all countries can be found in Table 2.

Table 1 Cointegration Test Results

	Number of cointegrating equations		Eigenvalue	Test statistic	Probability#		Eigenvalue	Test statistic	Probability#
Trace test	None	Belarus	0.119	19.26	0.770	Lithuania	0.195	38.07	0.004**
	At most 1		0.103	10.62	0.586		0.043	8.62	0.409
	At most 2		0.047	3.26	0.544		0.019	2.58	0.108
Maximum eigenvalue test	None		0.119	8.65	0.912		0.195	29.45	0.002**
	At most 1		0.103	7.36	0.633		0.043	6.04	0.614
	At most 2		0.047	3.26	0.543		0.019	2.58	0.108
Note		Unrestricted constant and 4 lags.				Unrestricted constant and 2 lags.			
Trace test	None	Bulgaria	0.248	38.63	0.019*	Macedonia	0.271	29.04	0.200
	At most 1		0.095	12.41	0.421		0.071	7.24	0.876
	At most 2		0.035	3.27	0.541		0.031	2.17	0.743
Maximum eigenvalue test	None		0.248	26.22	0.011*		0.271	21.80	0.057
	At most 1		0.095	9.14	0.431		0.071	5.06	0.873
	At most 2		0.035	3.27	0.540		0.031	2.17	0.742
Note		Restricted constant and 1 lag.				Restricted constant and 3 lags.			
Trace test	None	Croatia	0.137	36.54	0.034*	Poland	0.139	24.48	0.046*
	At most 1		0.039	10.56	0.591		0.027	4.20	0.675
	At most 2		0.019	3.47	0.508		0.004	0.55	0.524
Maximum eigenvalue test	None		0.137	25.98	0.012*		0.139	20.27	0.018*
	At most 1		0.039	7.10	0.663		0.027	3.65	0.684
	At most 2		0.019	3.47	0.507		0.004	0.55	0.518
Note		Restricted constant and 8 lags.				No constant and 2 lags.			
Trace test	None	Czech R.	0.133	25.74	0.031*	Romania	0.291	27.87	0.084
	At most 1		0.077	9.24	0.156		0.073	7.21	0.560
	At most 2		0.000	0.00	0.990		0.043	2.66	0.103
Maximum eigenvalue test	None		0.133	16.50	0.076		0.291	20.66	0.057
	At most 1		0.077	9.24	0.110		0.073	4.55	0.794
	At most 2		0.000	0.00	0.988		0.043	2.66	0.103
Note		No constant and 7 lags.				Unrestricted constant and 2 lags.			
Trace test	None	Hungary	0.195	38.08	0.004**	Serbia	0.164	21.57	0.333
	At most 1		0.058	8.59	0.412		0.117	9.36	0.339
	At most 2		0.004	0.53	0.468		0.013	0.91	0.339
Maximum eigenvalue test	None		0.195	29.49	0.002**		0.164	12.21	0.540
	At most 1		0.058	8.06	0.381		0.117	8.45	0.343
	At most 2		0.004	0.53	0.468		0.013	0.91	0.339
Note		Unrestricted constant and 2 lags.				Unrestricted constant and 4 lags.			
Trace test	None	Latvia	0.417	45.96	0.002**	Turkey	0.248	46.27	0.000**
	At most 1		0.157	13.61	0.208		0.067	12.40	0.140
	At most 2		0.055	3.38	0.066		0.034	4.16	0.042*
Maximum eigenvalue test	None		0.417	32.35	0.002**		0.248	33.87	0.000**
	At most 1		0.157	10.24	0.383		0.067	8.25	0.362
	At most 2		0.055	3.38	0.066		0.034	4.16	0.042*
Note		Restricted constant, unrestricted trend and 9 lags.				Restricted constant and 6 lags.			

Note: ** denotes rejection of the hypothesis at the 0.01 level; * denotes rejection of the hypothesis at the 0.05 level; # critical values for *p*-values can be found in James G. MacKinnon, Alfred A. Haug, and Leo Michelis (1999).

Source: Author's estimations.

In the case of Bulgaria, we can restrict the constant to zero because a likelihood ratio test does not reject this restriction. That final vector is given in table 2. The real effective exchange rate coefficient appears to be very small and implies that a rise in the exchange rate (depreciation) leads to a decrease in DE.

This result is neither in line with the hypothesis we make nor with the existing literature, but we must bear in mind that Bulgaria has a currency board and therefore the exchange rate does not have that much of an impact on DE. The coefficient of the interest rate differential is also very small and implies that DE increases when the

Table 2 Cointegrating Vectors

Country	Variable	Cointegration vector	Cointegrating vector with restrictions
Bulgaria	*DE*	1	1
	RER	1.335	0.107
	IRD	-0.199	-0.073
	Const.	-2.716	0
Note	Chi square = 2.5601 [0.1096]		
Croatia	*DE*	1	1
	NER	-1.371	-1
	IRD	-0.055	-1
	Const.	1.431	3.397
Note	Chi square = 3.4030 [0.1824]		
Czech R.	*DE*	1	1
	NER	0.911	1
	IRD	0.955	1
Note	Chi square = 0.0777 [0.9619]		
Hungary	*DE*	1	
	NER	-6.936	
	IRD	0.018	
Note	No restrictions accepted.		
Latvia	*DE*	1	1
	RER	0.136	0.105
	IRD	-0.001	-0.001
	Const.	-0.058	0
Note	Chi square = 0.254 [0.614]		
Lithuania	*DE*	1	1
	RER	-3.250	-1
	IRD	-0.086	-0.080
Note	Chi square = 0.7642 [0.3820]		
Poland	*DE*	1	
	NER	1.132	
	IRD	-0.001	
Note	No restrictions accepted.		
Turkey	*DE*	1	1
	NER	-0.454	-1
	IRD	-0.014	-0.026
Note	Chi square = 2.475 [0.116]		

General note: All coefficients are in vector notation; *DE* – deposit euroization; *NER* – nominal exchange rate; *RER* – real exchange rate; *IRD* – interest rate differential.

Source: Author's calculations.

spread between domestic and foreign interest rates increases. This is so because higher domestic interest rates in transition economies attract investors from abroad who then make large foreign currency inflows. Banks, in order to match their currency structure, drive foreign currency holdings.

This result is in accordance with Luca and Petrova (2008) although Basso, Calvo-Gonzales, and Jurgilas (2011) claim just the opposite. We get very similar coefficients for Latvia, that also has a currency board, and draw the same conclusions as for Bulgaria. For Croatia, Lithuania and Turkey we managed to restrict the exchange rate coefficient to -1 implying that depreciation of 1 percent drives up DE proportionately, also by 1 percent. This result is in line with previous studies such as Kokenyne, Ley, and Veyrune (2010) and Ivanov, Tkalec, and Vizek (2011) and it identifies a strong relationship between exchange rates and euroization. For the same group of countries, an increase in the interest rate spread also drives up DE. However, while the coefficients for Lithuania and Turkey are very small, the coefficient for Croatia is as high as -1. This result, although a bit unusual, emphasizes the importance of the financial sector, namely banks (Luca and Petrova 2008).

Croatia is not the only exception with a very high interest rate differential coefficient. The other is the Czech Republic, for which the coefficient is also restricted, but to 1. Therefore, an increase of 1 percent in the interest rate differential leads to a 1 percent decrease in DE. As explained in Basso, Calvo-Gonzales, and Jurgilas (2011), a rise in domestic interest rates stimulates domestic currency savings that eventually decrease DE. The nominal exchange rate coefficient for the Czech Republic implies the same relationship, a moderation in DE after exchange rate depreciation. As for Bulgaria and Latvia, this result is not in accordance with our assumptions about post-transition economies. However, these are countries in which

there is either a currency board (Bulgaria), a peg to the euro (Latvia) or a free-floating exchange rate regime (the Czech Republic) that eventually do not have such an important influence on DE.

Another country with a free-floating exchange rate regime is Poland, with results for the nominal exchange rate very similar to the ones explained earlier. A positive coefficient of more than 1 suggests that DE decreases by more than 1 percent after a depreciation of 1 percent. The interest rate differential coefficient is very small and negative, leading to a conclusion that a larger increase in local interest rates when compared to interest rates in the EMU, increases DE but very mildly.

Hungary shows completely different behaviour with the nominal exchange rate reacting similar to Croatia, Lithuania and Turkey, and interest rate differentials resembling the Czech case. Therefore, depreciation in Hungary leads to a rise in DE, and interest rate spread widening to a decrease in DE. Surprisingly, the exchange rate coefficient is extremely large, almost -7, suggesting that a depreciation of only 1 percent would increase DE by 7 percent. One must bear in mind that Hungary suffered very large depreciation episodes in 2008/2009 that were followed by an interest rate hike. For example, in the period from August 2008 (just before Lehman Brothers collapsed) to March 2009, the Hungarian exchange rate towards the euro depreciated by 28.9 percent while the interest rate spread widened by 5.3 percentage points with a one-quarter lag. When we exclude the observations for the crisis years, the exchange rate coefficient becomes much smaller.

In order to describe the short-run behaviour, we build error correction models from the restricted cointegration vectors. Error correction models for DE can be found in Table 3, while error correction models for the exchange rate and the interest rate differential can be obtained upon request from the authors. All error correction models satisfy diagnostic tests except for the RESET test in the case of Croatia and Latvia. However, since this test implies that a nonlinear specification of these two error correction models would give better specification properties, we leave it for future work. Results show there is no short-run adjustment in Bulgaria, Croatia, the Czech Republic and Turkey, while disequilibria adjust very slowly in Hungary, Latvia, Lithuania and Poland. Block exclusion restrictions on all lags of the individual variables suggest that DE responds to changes in the interest rate differential only in Latvia, while in Croatia, Hungary, Latvia and Lithuania it responds to the exchange rate. DE persistence seems very important for explaining short-run DE adjustment in Croatia, the Czech Republic, Hungary and Latvia supporting Kokenyne, Ley, and Veyrune (2010).

Table 3 Vector Error Correction Models

	Bulgaria	Croatia	Czech Republic	Hungary	Latvia	Lithuania	Poland	Turkey
Constant	-0.0005 [0.484]	-0.0001 [0.625]	0.183 [0.669]	-0.687 [0.000]**	0.008 [0.001]**	-0.050 [0.002]**	-	0.012 [0.341]
$A_1[L]\Delta DE_{-i}$	-0.052 [0.618]	0.469 [0.000]**	2.856 [0.012]*	-0.260 [0.001]**	7.963 [0.000]**	2.096 [0.104]	-0.051 [0.540]	0.784 [0.564]
$A_2[L]\Delta(R)ER_{-i}$	0.140 [0.423]	-0.155 [0.027]*	1.690 [0.130]	-0.382 [0.014]*	3.832 [0.001]**	2.773 [0.044]*	-0.011 [0.909]	1.368 [0.246]
$A_3[L]\Delta IRD_{-i}$	-0.002 [0.213]	0.0005 [0.068]	0.682 [0.665]	-0.0002 [0.925]	2.564 [0.018]*	0.756 [0.521]	0.005 [0.066]	1.966 [0.093]
ECT_{t-1}	-0.011 [0.432]	-0.0001 [0.086]	-0.0012 [0.376]	-0.040 [0.000]**	-0.062 [0.003]**	-0.017 [0.002]**	-0.051 [0.005]**	0.012 [0.252]
Number of lags	1	1	6	1	8	3	1	5
Sigma	0.0054	0.0027	0.0153	0.0136	0.0027	0.0115	0.0110	0.0089
R^2	0.03	0.27	0.22	0.17	0.61	0.24	0.07	0.18
AR test	0.403 [0.88]	1.096 [0.37]	1.070 [0.39]	1.063 [0.39]	1.375 [0.24]	1.461 [0.19]	0.510 [0.83]	0.144 [0.99]
ARCH test	1.181 [0.33]	0.980 [0.45]	0.695 [0.68]	0.942 [0.48]	0.527 [0.79]	0.831 [0.50]	0.630 [0.73]	0.511 [0.80]
RESET test	0.988 [0.38]	5.049 [0.03]*	2.014 [0.14]	1.763 [0.18]	10.881 [0.00]**	2.113 [0.13]	0.436 [0.65]	0.177 [0.84]

Notes: ECT – error correction term from the restricted cointegration vector; *p*-values in brackets; ** null hypothesis rejected at the 1 percent significance level; * null hypothesis rejected at the 5 percent significance level; in cases where number of lags is greater than 1, statistics corresponding to A_i (L) refer to F-statistics and associated *p*-value of block exclusion restriction on all lags of an individual variable.

Source: Author's estimations.

4. Conclusion

The aim of this paper was to test whether monetary determinants of DE in European post-transition economies have an influence on DE dynamics and if so, what is the direction and strength of that relationship. Using nominal or real effective exchange rates, the difference between domestic and EMU interest rates, and Johansen cointegration, we demonstrate that there is one long-run relationship among the selected variables. After imposing restrictions to the cointegration space, we conclude that monetary variables influence DE considerably and that some countries experience an increase in their DE levels after exchange rate depreciations occur. The only two countries in our sample with flexible exchange rates and inflation targeting, i.e. the Czech Republic and Poland, show the opposite and imply that depreciations do not have adverse effects on DE. Moreover, error correction models show that the short-run adjustment is characterized by DE persistence.

The results of this study help in understanding DE drivers in post-transition Europe and serve as a good foundation for designing deeuroization policies. Although a great deal of countries hoped to introduce the euro as their official currency and thereby eliminate high FE threats, that scenario is becoming less and less likely. Namely, Maastricht criteria for joining the EMU already seem unreachable for some of the countries we explore. Even countries that have already fixed their exchange rate regimes or have pegged it to the euro are far from official euroization since they lack necessary fiscal and structural reforms. In line with that, two countries with the lowest DE levels, the Czech Republic and Poland, are using policies aimed at curbing FE. Similar to Latin American countries that successfully tackled high unofficial

dollarization, these two countries have switched to floating exchange rate regimes and inflation targeting (Jeromin Zettelmeyer, Piroska M. Nagy, and Stephen Jeffrey 2010). Other countries such as Croatia, Hungary, Romania, Serbia, and to some extent even Turkey, have mostly relied on regulatory measures but have failed to decrease DE significantly. Their options are becoming scarcer and they will eventually have to decrease DE through transforming their policies and institutions, ensuring macroeconomic and institutional credibility to grow, thereby keeping the exchange rate and the interest rate differential under check. A prerequisite for that are strong institutions that differ between countries, which is why deeuroization policies should be country-specific as well.

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Appendix

Table 4 Exchange Rate Regimes

Stabilized arrangement:	Croatia Macedonia	Currency board:	Bulgaria Lithuania
Free float:	Czech Republic Poland Turkey	Managed float:	Hungary Romania Serbia
Pegged within horizontal bands:	Belarus	Pegged to euro:	Latvia

Source: IMF Annual Report on Exchange Arrangements and Exchange Restrictions.

Table 5 Data Sources and Transformations

Variable	Source	Description
Deposit euroization	National central banks and authors' calculations	Share of foreign currency deposits in total deposits. We added data for deposits linked to the foreign currency if they were available.
Nominal and real effective exchange rate	National central banks and Eurostat	Average monthly exchange rate of the domestic currency to the euro.
Interest rate differential	National central banks, Eurostat and authors' calculations	Difference between domestic interest rates and the euro rate. Where available, we used 3-month money market interest rates. Otherwise, average short-term interest rates on deposits were used. The unit of measure is a percentage point.

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