WP/18/58

IMF Working Paper

Carry Trade vs. Deposit-Driven Euroization

by Nan Geng, Tiberiu Scutaru, and Johannes Wiegand

INTERNATIONAL MONETARY FUND

 WP 18/58

IMF Working Paper

Strategy, Policy and Review Department

Carry Trade vs. Deposit-Driven Euroization

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Authorized for Distribution by Tamim Bayoumi

March 2018

Abstract

Financial "euroization"—or "dollarization" outside of Central and Eastern Europe—is typically analyzed as a singular phenomenon that can be traced to a common set of factors. This paper argues that two types of euroization need to be distinguished, which have different causes, economic consequences, and policy implications: *carry trade* euroization that emerges when households and corporations seek to exploit interest rate differentials between foreign currency loans and local currency deposits, and *deposit-driven* euroization that is rooted in distrust in the local currency as a savings vehicle. We present a theoretical framework that sketches key features of both euroization types, and test it with data from 28 Emerging European and Central Asian economies.

JEL Classification Numbers: E43, G11, G21, L11

Keywords: Financial Dollarization, Euroization, Emerging Europe

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[1] We are grateful to Xavier Freixas, Alina Iancu, Divya Kirti, Tonny Lybek, seminar participants at the IMF, the National Bank of Hungary, the National Bank of Romania, and a reviewer at the National Bank of Turkey for helpful comments. We also thank Boris Vujčić, Governor of the Croatian National Bank, who—probably unbeknownst to him—inspired this paper by pointing one of the authors to the distinction between deposit-driven and carry trade euroization discussed here. The paper grew out of a policy-oriented research project on exchange rate regimes in Emerging Europe, see Belhocine et al. (2016).

Content

I. Introduction

Financial dollarization—or, in Central and Eastern Europe (CEE), euroization—has long been understood as a feature that increases macroeconomic vulnerabilities and constrains policymakers' options. Among other things, financial dollarization can inhibit exchange rate flexibility and, therefore, monetary autonomy; it can also increase macroeconomic volatility and render an economy more susceptible to financial shocks (see, e.g., Levi-Yeyati, 2006, or the articles assembled in Eichengreen and Hausman (2010). Understanding the causes of dollarization is therefore key for designing policies that either contain it or limit the harm dollarization can do to the real economy.

Most studies of financial dollarization have focused on either the loan or the deposit side of banks' balance sheets, and have taken the other side as given. Examples include Csajbók et al. (2010), Luca and Petrova (2008), or Jeanne (2003) for loans, and De Nicoló et al. (2005), Rennhack and Nozaki (2006), or Ize and Levi-Yeyati (2003) for deposits. But loans and deposits can display different patterns of dollarization (or euroization). In emerging Europe in 2006, for example—i.e., right before the outbreak of the global financial crisis (GFC)—economies broadly fell into three groups (Figure 1):

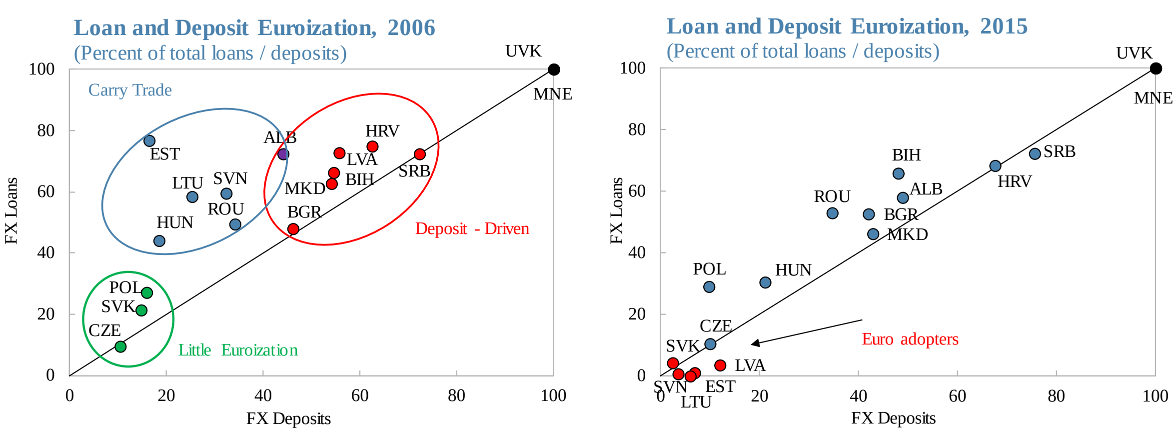
a. A large group of countries with substantial euroization on both the loan and the deposit side,

b. another large group with sizeable euroization on the loan but *not* on the deposit side, and

c. a small group of countries with little financial euroization on either side of bank's balance sheets.

This picture changed significantly in the years thereafter, however. By 2015, group (b.) had largely disappeared—either because countries adopted the euro (euro adoption 'converts' euro denominated loans from FX to domestic currency), or because loan euroization aligned more closely with deposit euroization.

Figure 1: Financial Euroization in Central and Eastern Europe, 2006 vs. 2015



Sources: See Annex I.

This paper's central hypothesis is that (a.) and (b.) are fundamentally different phenomena with different root causes.

a. is *deposit-driven euroization.* High FX deposits reflect distrust in the local currency as savings vehicle, often triggered by past hyperinflation or other traumatic events that destroyed domestic currency savings. Deposit euroization typically triggers loan euroization, as banks extend FX loans to avoid large short open FX positions.

b. is *carry-trade euroization.* With carry-trade euroization, households and corporations exploit differentials between low-interest-rate foreign currency loans and high-interest-rate local currency deposits—they engage in "carry trade" (in contrast to deposit-driven euroization, depositors are comfortable with saving in local currency). Carry trade typically generates a long open FX position in banks' balance sheets, which renders it a source of financial stability risk.[2] Carry trade euroization raises the question what causes the interest rate differential in the first place—an issue that this paper seeks to address.[3]

The remainder of this paper is organized as follows. Section II formulates a model that reproduces the stylized facts displayed in Figure 1, and provides an analytical framework for the discussion of euroization. The model is based on the Minimum Variance Portfolio model by Ize and Levy Yeyati (2003), but extended to integrate various features of banking systems in Emerging Europe: interest rate setting power by banks, parent funding, currency matching, and hedging of open FX positions with FX swaps. Section III fits the model to data for 28 economies in Central/Eastern Europe and Central Asia, and elaborates on the primary causes of euroization (or dollarization) in different economies. Section IV concludes.

The existing studies most similar to ours are Luca and Petrova (2008) and Basso et al. (2011). Luca and Petrova analyze loan euroization as the interplay between currency-matching companies and banks, but take deposit euroization—and therefore the behavior of savers—as given. By contrast, we analyze all three parties: banks, borrowers, and depositors. Basso et al. develop a model with a similar structure as ours, in particular they incorporate price setting power of banks (details below). They do not solve the model, however, and hence do not derive closed-form, interpretable expressions for the drivers of loan and deposit euroization.[4] Further, they assume that banks' on-balance sheet FX positions are balanced, with differences between the share of FX loans and deposits equilibrated by non-deposit FX funding. Our analysis removes this constraint.

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[2] Carry trade would not generate a long FX position if the gap between FX loans and FX deposits was accounted for by non-deposit FX funding—we discuss this case below. For most carry trading economies in this sample, however, FX loans in 2006 exceeded both FX deposits and overall FX funding.

[3] There are also other causes for loan euroization: for example, exporting firms may match their foreign currency income stream with foreign currency liabilities. However, these phenomena are typically not large enough to explain large-scale financial euroization as discussed in this paper.

[4] Basso et al. analyze determinants of currency composition *and* the loan/deposit volume simultaneously, which give rise to a complex, non-solvable model. We focus on currency composition only.

II. A MODEL OF EUROIZATION

A. The Minimum Variance Portfolio Model

The Ize/Levy-Yeyati Minimum Variance Portfolio (MVP) model is based on a utility function for both a representative borrower and depositor as follows:

(1) $U_i = E(r_i) - c_i * Var(r_i)/2$

where $r_i = r^i_{FX}\varphi^i_{FX} + r^i_{LC}\varphi^i_{LC}$ is the real return on a portfolio consisting of an FX and a local currency (LC) component, c is a risk aversion parameter, and $i = D$ (depositors), L (loan recipients or borrowers). The real return on local currency deposits and loans, r^i_{LC}, is affected by shocks to inflation π, while the real return on foreign currency deposits and loans, r^i_{FX}, is affected by shocks to the real exchange rate *e*. Denote $\rho = E(r)$. If the total amount of loans and deposits is given, the desired share of FX deposits and loans is

(1a) $\varphi^D_{FX} = MVP + \frac{\rho^D_{FX} - \rho^D_{LC}}{c_D * V}$ and

(1b) $\varphi^L_{FX} = MVP + \frac{\rho^L_{LC} - \rho^L_{FX}}{c_L * V}$,

with $MVP = \frac{Var(\pi) - Cov(\pi, e)}{V}$ and $V = Var(\pi) - 2Cov(\pi, e) + Var(e)$.

As can be shown, the *MVP*—the minimum variance portfolio—is strictly increasing in $Var(\pi)$ and strictly decreasing in $Var(e)$. Thus, the desired share of FX loans/deposits is a function of (i) the relative riskiness of FX and LC assets/liabilities, expressed by the MVP, and (ii) differentials between FX and LC real rates of return. If real interest rate parity holds—as assumed in Ize and Levy-Yeyati (2003)—market equilibrium is given by

(2) $\varphi^L_{FX} = \varphi^D_{FX} = MVP$

Hence, both borrowers *and* lenders hold the minimum variance portfolio. If borrowers and savers both expect high inflation volatility, for example, they both prefer FX loans and deposits, resulting in high euroization of all balance sheets, but no currency mismatch. There is no role for banks other than passively intermediating the *MVP*.

B. Currency Mismatch

Currency mismatch requires deviations from real interest rate parity. In the following, we will discuss three possible mechanisms:

a. *asymmetric interest rate setting power of domestic banks*, i.e., pricing power that exists to different degrees for different banking products;

b. *implicit subsidies for FX loans* that lower the expected cost of FX loans—for example in the form of an expected bailout or of exchange rate intervention in case the currency depreciates; and

c. *systematically different inflation and/or real exchange rate expectations* of borrowers and depositors that translate into different expected real returns—for example myopic borrowers who underestimate exchange rate risk when contracting FX loans.

C. Asymmetric Pricing Power

Interest rate setting power for banks requires (i) monopolistic market structures and (ii) the absence of competitively priced alternatives to products supplied by the domestic banking system. We argue—and later test—that banks have the largest interest rate setting power in the *local currency loan* market. For LC loans, domestic banks are quasi-monopoly suppliers, as they have exclusive access to LC refinancing from the domestic central bank (the monopoly issuer of local currency).[5] By contrast,

- *local currency deposits* compete with other LC assets such as LC government bonds. LC government bonds should be priced competitively, especially when foreign investors are present in the market, which limits banks' maneuver to manipulate LC deposit rates.[6]
- *FX deposits* offered by local banks compete with FX deposits held with banks abroad. Cross-border deposits are a prominent feature within the European Union (EU).
- Similarly, *FX loans* from domestic banks compete with FX loans contracted from foreign banks cross-border.

For illustration, we model the most extreme case: banks enjoy monopoly interest rate setting power in the LC loan market but are price takers for all other banking products. The banks' profit function then is:

$$(3) \quad E(\Pi_B) = \varphi_{FX}^L \rho_{FX}^L + (1 - \varphi_{FX}^L)\rho_{LC}^L - \varphi_{FX}^D \rho_{FX}^D - (1 - \varphi_{FX}^D)\rho_{LC}^D$$

By assumption, $\rho_{FX}^L = \rho_{FX}^D = \rho_{LC}^D = \rho$, while ρ_{LC}^L is determined by monopoly price setting. Substituting in (1a) and (1b) and taking the partial derivative for ρ_{LC}^L yields a first order condition for the *lending margin:*

[5] Theoretically, borrowers could issue LC bonds. However, in Emerging Europe, LC bond markets tend to be minuscule for corporations and non-existent for households.

[6] Recent papers for the U.S. report considerable deposit rate setting power, see Drechsler et al. (2017) or Kyrti (2017). This is consistent with our theoretical argument as long as banks' price setting power for LC loans exceeds that for LC deposits (see also footnote 6 below).

(4) $\rho_{LC}^{L} - \rho_{FX}^{L} = (1 - MVP)\frac{c_L * V}{2}$

If *MVP* = 1, borrowers do not demand LC loans, hence banks can make no use of their market position. By contrast, if c_L is large—i.e., risk aversion is high—borrowers will stick closely to *MVP* even with large interest rate differentials, which gives banks room to raise LC loan rates. Plugging (4) back into the demand function (1b) yields a *share of FX loans*:

(5) $\varphi_{FX}^{L} = \frac{1}{2}MVP + \frac{1}{2}$

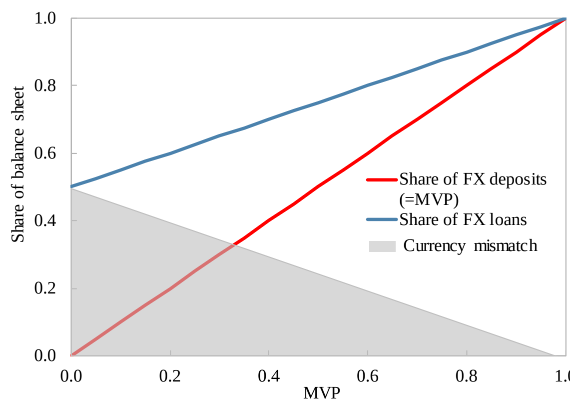
As the demand the share for FX deposits equals the *MVP*, *currency mismatch* is:

(6) $\varphi_{FX}^{L} - \varphi_{FX}^{D} = \frac{1-MVP}{2}$

The potential for currency mismatch is the larger the smaller the *MVP*, i.e., the smaller is deposit euroization (Figure 2).

More generally, writing effective interest rate setting power as a weighted average of monopoly and competitive pricing, $a_{LC}^{L} = \frac{\rho_{LC}^{L} - \rho_{LC}^{L}(competitive)}{\rho_{LC}^{L}(monopoly) - \rho_{LC}^{L}(competitive)} = \frac{\rho_{LC}^{L} - MVP}{(1-MVP)\frac{c_L * V}{2}}$, $0 < a_{LC}^{L} < 1$, yields expressions as follow for the lending margin and for currency mismatch, respectively:

Figure 2: Euroization with Monopoly Pricing of Local Currency Loans



Source: Authors' calculations.

(4a) $\rho_{LC}^{L} - \rho_{FX}^{L} = a_{LC}^{L}(1 - MVP)\frac{c_L * V}{2}$

(6a) $\varphi_{FX}^{L} - \varphi_{FX}^{D} = a_{LC}^{L}\frac{1-MVP}{2}$.[7]

In short, banks use their market power to boost profits by increasing the lending rate for LC loans. This makes borrowers switch to FX loans, and thus provokes currency mismatch.

[7] The analysis can be extended straightforwardly to other banking products:

- bank price setting power for *LC loans* and for *FX deposits* trigger a *long* FX position. Price setting power for *LC deposits* and for *FX loans* trigger a short FX position.
- symmetric price setting power for both LC loans and LC deposits triggers higher FX loans *and* higher FX deposits—and therefore higher euroization—but no currency mismatch
- symmetric price setting power for both LC and FX loans (deposits) triggers higher (lower) interest rates in both markets, but no interest rate *differential*—hence real interest rate parity still holds, and market shares remain determined by the MVP.

D. Turbulence

Macroeconomic turbulence is captured by the term $V = Var(\pi) - 2Cov(\pi, e) + Var(e)$. Provided interest rates are given, turbulence reduces demand for FX loans (eq. 1b). However, under unconstrained bank profit maximization, banks offset this effect by charging higher interest rates on LC loans, hence currency mismatch remains unchanged.

De facto, financial regulation or social conventions may place a ceiling on the interest differential that banks can charge. If that ceiling, denoted $\overline{\Delta\rho}$, is less than the profit maximizing differential, currency mismatch is:

(6b) $\varphi_{FX}^L - \varphi_{FX}^L = \frac{\overline{\Delta\rho}}{c_L * V}$.

I.e., currency mismatch relates inversely to turbulence. Similarly, an increase in risk aversion also reduces currency mismatch.

E. Parent Funding

We now expand the model to include several features typical for banking systems in CEE, starting with parent funding. Most banks in CEE are subsidiaries of Western European parent banks and carry sizeable FX denominated parent funding on their balance sheets. Suppose a fraction ψ of banks' liabilities is in the form of parent funding, and that parent funding is in FX. Then total liabilities are $\varphi_{FX}^D + \varphi_{LC}^D + \psi$. Further, with deposits priced competitively, the demanded share for foreign currency deposits in total liabilities is $\varphi_{FX}^D = MVP(1 - \psi)$. Incorporating this into the monopolistic banking model above yields *currency mismatch* of

(6c) $\varphi_{FX}^L - \varphi_{FX}^D - \psi = (a_{LC}^L - 2\psi)\frac{1-MVP}{2}$.

Thus, (i) parent funding reduces currency mismatch, and (ii) if parent funding is large and price setting power small ($2\psi > a_{LC}^L$), it can even trigger a short profit maximizing FX position. Further, parent funding drives a wedge between currency mismatch and *carry trade*, i.e., the difference between FX loans and deposits. Carry trade increases with parent funding:

(7) $\varphi_{FX}^L - \varphi_{FX}^D = a_{LC}^L \frac{1-MVP}{2} + \psi MVP$.

In addition to the long FX position due to monopolistic competition, there is now a second component reflecting the fact that parent funding implies an overhang of loans over deposits.

F. Currency Matching and Hedging

Thus far we have assumed that banks tolerate open FX positions, and the exchange rate and inflation risks they create. But banks cannot afford large open FX positions without putting solvency at risk, and regulators often demand that FX positions be closed. One way to model this is to add a risk term to banks' optimization problem akin to Luca and Petrova (2008). This reduces mismatch compared to a model with risk neutral banks, by how much depends on the degree of banks' risk aversion.[8] We choose instead to introduce real-world features and constraints into the model. As mentioned above, regulators often require balanced bank FX positions overall, but tolerate hedging open FX positions *on-balance sheet* with offsetting transactions *off-balance sheet*.

Hedging requires a counterparty. For *long* FX positions, counterparties are often non-resident investors, who need local currency to purchase domestic assets, such as LC government bonds. Bank and investor can then swap currency exposures by contracting offsetting LC and FX loans (the domestic bank extends a LC loan and receives a FX loan). By contrast, lack of a counterparty typically prevents hedging *short* FX positions, unless the central bank swaps currency exposures with commercial banks.[9]

Provided swaps are priced competitively ($\rho_{FX}^{Swap} = \rho_{LC}^{Swap} = \rho$), they allow closing long FX positions without costs. Incorporating this into the model yields a two-pronged outcome:

- *If market power is high and parent funding relatively small* ($a_{LC}^{L} > 2\psi$), banks run long open FX positions on their balance sheets as in equation (6c), and close them by contracting currency swaps.
- *If parent funding is large but market power modest* ($a_{LC}^{L} < 2\psi$), a short FX position would maximize bank profits, but this is prevented by regulation. With no counterparty to hedge, banks need to close the FX position on-balance sheet. This requires increasing the lending margin until demand for FX loans matches FX funding:

  (4b) $\rho_{LC}^{L} - \rho_{FX}^{L} = \psi(1 - MVP)(c_L * V),$

  which exceeds the profit maximizing lending margin (4a) by a factor $(2\psi/a_{LC}^{L}) > 1$.

Figure 3 illustrates the case for parameters $\alpha = 1$ (monopolistic interest rate setting), $MVP = 0.25$, and $c_L * V = 1$.

- As long as *parent funding is less than half of total bank funding*, banks set the profit maximizing interest rate for LC loans. This crowds out demand for LC loans and creates a long FX position. Banks hedge this position with currency swaps.

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[8] If banks' utility is $U_B = E(\Pi_B) - c_B * Var(\Pi_B)/2$, with $Var(\Pi_B) = (\varphi_{FX}^{L} - \varphi_{FX}^{D} - \psi)^2$, currency mismatch becomes $\varphi_{FX}^{L} - \varphi_{FX}^{D} - \psi = (a_{LC}^{L} - 2\psi)\frac{1-MVP}{2+{}^{c_B}/_{c_L}}$.

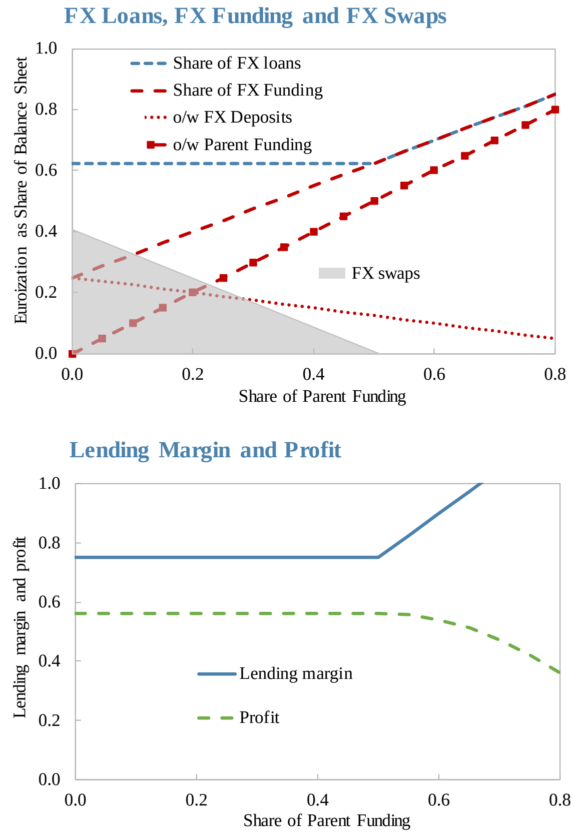
[9] The use of currency swaps to close *long* FX positions is well documented for Emerging Europe, see, e.g., Barkbu and Ong (2010). Examples for central bank currency swaps to close *short* FX positions include Turkey and, outside the region, Peru (see Everaert and Estevao, 2016). Hedging short FX positions requires a counterparty with demand for FX and excess supply of local currency—the central bank is often the only plausible candidate.

- If *more than half* of banks' funding is from parents, FX denominated funding exceeds the profit-maximizing amount of FX loans. Thus, to close the FX position, banks need to increase the lending margin of LC over FX loans beyond the profit maximizing level.

The result reproduces the stylized facts displayed in Figure 1:

- Some banking systems have long FX positions on-balance sheet that they either close off-balance sheet with currency swaps or leave open (if permitted by regulation),
- other banking systems have high euroization on both the loan and deposit side, and broadly balanced currency positions, and
- the potential for currency mismatch decreases with the degree of deposit euroization.

Figure 3: Parent Funding and Balance Sheet Euroization



Source: Authors' calculations.

G. Bailout Expectations, Myopic Borrowers, and FX Intervention

As mentioned earlier, there are other mechanisms that can provoke currency mismatch. One is a *contingent subsidy* for FX loans in case of a large currency depreciation—for example in the form of an expected government-sponsored bailout, or reflecting the expectation that (upward revalued) FX debt cannot be collected. In this case, borrowers do not internalize fully the social costs of FX loans and tend to overborrow (Ranciere et al., 2010).

To formalize these considerations, we denote the net present value of the expected subsidy per unit of FX borrowing b. Further, the expected subsidy reduces the variance of the real exchange rate for FX borrowers, $Var(e)$, possibly also $Var(\pi)$ and $Cov(\pi, e)$. Denote $MVP^{FX\ loans} = \gamma MVP$ and $V^{FX\ loans} = \delta V$, with $\gamma > 1$ and $\delta < 1$. Banks' long open on-balance sheet FX position (before swaps) is then:

$$\text{(6d)}\quad \varphi_{FX}^{L} - \varphi_{LC}^{L} - \psi = (a_{LC}^{L} - 2\psi)\frac{1-MVP}{2} + \left\{\underbrace{\frac{b}{c_L * \delta V}}_{(i)} + \underbrace{(\gamma - 1)MVP}_{(ii)}\right\}\underbrace{\left(1 - \frac{a_{LC}^{L}}{2}\right)}_{(iii)}.$$

Thus, in addition to the impact of asymmetric interest rate setting power on currency mismatch, there is a second term capturing the impact of the implicit subsidy. It has three components: (i) the direct reduction of expected FX borrowing cost, (ii) the reduction in expected real exchange rate volatility for FX loans (but not deposits), which also makes FX loans more attractive, and (iii) a weighing term that varies with the degree of interest rate setting power (with price setting power, banks absorb part of the subsidy into their profits).

The case of *myopic borrowers* is formally equivalent to an implicit subsidy, with *b* now denoting the degree of optimism of borrowers (relative to depositors) regarding expected FX borrowing cost, and γ the degree of optimism with respect to real exchange rate volatility. With borrower myopia, high *nominal* LC interest rates can be enough to induce carry trade, if borrowers underestimate the degree of nominal depreciation that inflation differentials imply.

A related case is *asymmetric exchange rate intervention* in case of depreciation pressures. Expected asymmetric intervention grants not only a contingent subsidy to FX borrowers, however, but also imposes a contingent loss on FX depositors, which provokes a move into LC deposits and thus reinforces mismatch.[10] With γ and δ defined as above, and *e* being the expected degree of intervention per borrowing unit, mismatch is:

$$\text{(6e)} \quad \varphi_{FX}^{L} - \varphi_{FX}^{D} - \psi = (a_{LC}^{L} - 2\psi)\,\frac{1-\gamma MVP}{2} + \frac{e}{\delta V}\left(\frac{1-\frac{a_{LC}^{L}}{2}}{c_L} + \frac{1-\psi}{c_D}\right).$$

III. Testing the Model

A. Empirical Strategy and Data

The framework above suggests analyzing euroization (or dollarization) in two steps: first study the determinants of deposit euroization, then the determinants of carry trade *given* the level of deposit euroization. Our analysis focuses on carry trade rather than currency mismatch, as we do have complete data on the currency composition of loans and deposits, but not for the other components of banks' balance sheets. We try to stay as close to the theoretical framework as possible. As one implication—and in contrast to other studies (e.g., Rosenberg and Tirpák, 2008, Luca and Petrova, 2008, Csajbók et al., 2010, Basso et al., 2011)—we do *not* include interest rates as covariates, as theory suggests that interest rates are endogenous and driven by the same forces as financial euroization. Where factors identified by the model are not directly observable (or data do not exist), we use proxies. Annex I summarizes the definition of variables and data sources.

Although we do have panel data from the mid-2000s until the mid-2010s, we rely on cross-sectional variation to identify the factors affecting deposit euroization and carry trade. This is for three reasons.

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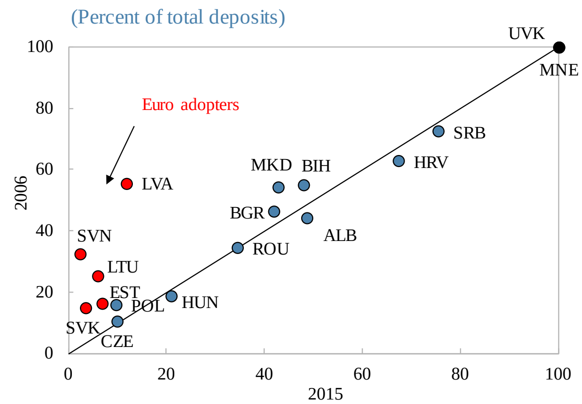
[10] Asymmetric intervention also reduces expected exchange rate volatility, but for both borrowers and lenders. This increases euroization on both the asset and liability side and does not, by itself, create currency mismatch.

- First, we seek to capture longer-term patterns of balance sheet euroization, and hence tie portfolio composition to phenomena like market structure, institutional and historical characteristics, or behavioral patterns of central banks and governments—the focus is not on short-term dynamics.

- Second, and as a result, many variables are very slow-moving: for example, in most countries deposit euroization in Emerging Europe hardly changed in the decade between 2006 and 2015 (except for those that adopted the euro, Figure 4), and covariates like the long-term *MVP* (see below) or bank concentration (a metric for price setting power) are almost constant. Hence there is little time variation to exploit.

- Third, for carry trade, the estimates below suggest that the impact of covariates is time-variant. This invalidates standard panel data techniques.

Figure 4: Deposit Euroization in Central and Eastern Europe, 2006 vs. 2015



Sources: See Annex I.

We advance the analysis in two steps. First, we run single-year cross-sectional regressions for 2006—i.e., right before the onset of the global financial crisis, and also the year for which we have the most observations, as afterwards countries drop out of the sample due to euro adoption[11]—and 2015—the latest available observation for the complete set of covariates—and do various specification tests to identify reference models for deposit euroization and carry trade. In the second step, we run the reference models for every year for which we have data, to trace how the patterns shaping euroization evolved before, during and after the GFC.

We use two samples—see Annex II for a list of countries:

- a *core* sample of 17 EU members and EU accession countries in Emerging Europe, where FX borrowing is typically in the form of euros; and

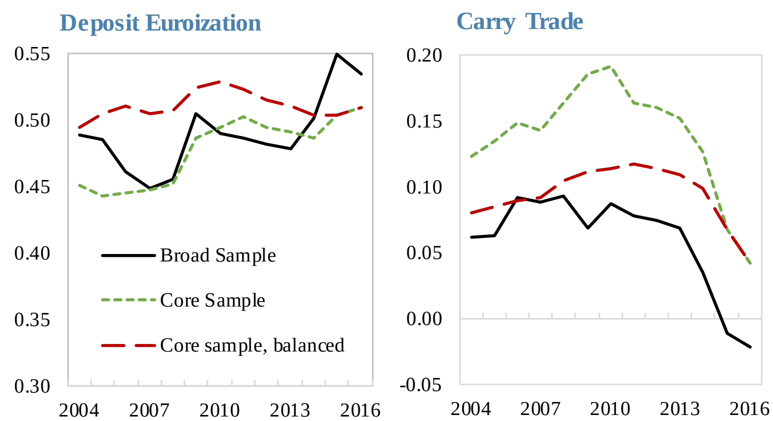
- a *broad* sample that adds another 11 Eastern European and Central Asian economies, many of them from the Commonwealth of Independent States (CIS), but also non-CIS countries such as Turkey. These economies are not necessarily part of the European integration process, and FX borrowing is typically in US dollars. This reduces cross-

[11] Euro adoption eliminates euroization by converting euro denominated loans and deposits from FX to LC. Slovenia adopted the euro in 2007, followed by the Slovak Republic in 2010 and the Baltics in 2011-15. The sample includes Montenegro and Kosovo that use the euro without being part of the euro area—hence deposit euroization is 100 percent and carry trade 0 by construction. Excluding them does not change the results.

country homogeneity in terms of institutional setting, historical legacy, and financial development, but adds statistical power.

The level of deposit euroization is similar in the broad and in the core sample (Figure 5).[12] For carry trade euroization, both samples show a pronounced boom-bust pattern, with wider carry positions in the core sample. A large part of the decline in (average) carry trade from 2011 owes to euro adoption of the Baltic countries, whose banking systems featured all sizeable long FX positions prior to adoption (and that were eliminated with euro area membership). However, also among the countries that did not join—labeled "balanced core sample" in Figure 5—average carry trade shrank by almost two-thirds between 2011 and 2016.

Figure 5: Average Financial Euroization, 2004-16



Simple cross-country averages. Sources: See Annex I.

There are issues with the broad sample in the outer years. From 2014/15, several banking systems in CIS-countries display sizeable *short* FX positions, notably in Azerbaijan, Belarus, Kazakhstan, and the Kyrgyz Republic (see Annex III). Taken at face value, this is at odds with the theory developed above. Closer inspection suggests that the short positions were triggered by sharp surges in deposit dollarization in the context of falling commodity prices that caused large currency depreciations and, in turn, inflation (see, e.g., Epstein et al., 2016). Our interpretation is that depositors in these countries reacted swiftly to inflation volatility by converting LC deposits into FX, but it takes longer for banks to adapt the currency composition of loans. Hence, the short FX positions are a transitional phenomenon.

B. Deposit-Driven Euroization

We first fit deposit euroization to the *MVP*. Conceptually the *MVP* is a function of expected inflation and exchange rate volatility; for lack of data and in line with the standard treatment in the literature we proxy expectations with past realizations. We first compute the *MVP* with inflation and real exchange rate volatility during the preceding ten years. This yields no correlation with deposit euroization (Table 1, column 1). When we extend the computation period back to the early 1990s, however, and therefore cover also the transition period from socialism, the *MVP* becomes strongly significant (column 2).

[12] In the estimation samples, fluctuations in the deposit euroization ratio are caused for the most part by countries exiting the sample due to euro adoption, except for 2014/15 in the broad sample (see the main text).

Table 1: Deposit Euroization
(Parameter estimates, t-values in parentheses)

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Broad	Broad	Broad	Broad	Core	Broad
Year	2006	2006	2006	2006	2006	2015
Observations	28	28	28	28	17	23
10-year MVP	0.035	…	…	…	…	…
	(0.35)					
Long-term MVP	…	0.425	0.232	0.267	0.212	0.280
		(3.56)***	(2.33)**	(2.23)**	(1.51)	(2.26)**
Maximum annual inflation (log)	…	…	0.012	0.012	0.011	0.010
			(4.11)***	(3.42)***	(2.55)**	(3.22)***
Institutional quality	…	…	-0.087	-0.098	-0.135	-0.148
			(-1.85)*	(-0.98)	(-1.28)	(-2.22)**
Local currency debt / GDP	…	…	…	-0.003	…	…
				(-1.01)		
EU membership	…	…	…	0.060	…	…
				(0.42)		
Calvo-Reinhart index	…	…	…	0.199	…	…
				(0.76)		
Constant	0.446	0.172	0.167	0.132	0.219	0.199
	(7.24)***	(1.92)*	(2.30)**	(0.89)	(1.71)	(2.07)*
Adjusted R-squared	-0.034	0.302	0.618	0.589	0.680	0.556

Significance at the 1 (***), 5 (**) and 10 (*) percent level , respectively.

During transition, many countries in Emerging Europe and Central Asia struggled with hyperinflation (see, for example, Belhocine et al., 2016). To check whether the *MVP* proxies for the hyperinflation experience, we add the (logarithm of the) highest annual inflation rate a covariate. Further, we include an index of perceived institutional quality (Kaufmann et al, 2006), to infer whether inflation volatility proxies for general distrust in institutions. We find that all three factors matter for deposit euroization—general inflation volatility, the hyperinflation legacy, and distrust in institutions—but between them, hyperinflation is the most important (column 3—our reference specification).

Further, there is a small degree of *autonomous deposit euroization* of about 15-20 percent of banks' balance sheets.[13]

We next add other factors suggested by theory: (i) the size of the local currency bond market, (ii) EU membership and (iii) the Calvo-Reinhart (2002) "fear of floating" index. The signs on

[13] This may reflect factors like import companies holding FX deposits as a natural hedge. Including imports as a share of GDP reduces autonomous deposit euroization to insignificance, but imports are insignificant also, and there is no discernible impact on the other covariates. To keep the reference model simple, we omitted imports. We also tested for other covariates sometimes used in the literature, notably trade openness, and tried alternative metrics for bank concentration or interventionist policies. None of these changes has a bearing on the results.

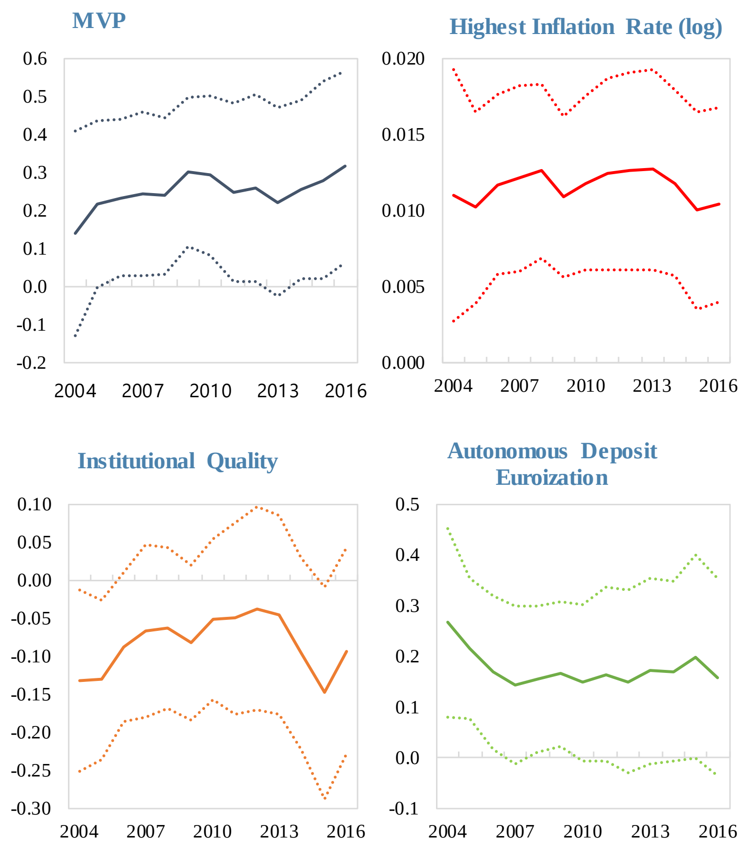
all three coefficients are in line with theory, but the estimates lack statistical significance (column 4).[14]

We run the reference model with the core sample to reduce cross-country heterogeneity not captured by the covariates (column 5), and also estimate it for 2015 (column 6). The results remain essentially un-changed: the forces driving deposit euroization (or dollarization) apply similarly to the narrow and the broader sample, and the GFC did not change the basic patterns of deposit euroization. Running the reference model for each single year from 2004 to 2016 (Figure 6) confirms that the factors accounting for deposit euroization are broadly stable over time.[15]

Our interpretation of these results is that deposit euroization is first and foremost a matter of lack of trust in the local currency as savings vehicle—and that the traumatic hyperinflation experiences in the early 1990s continue to be a key factor undermining trust. This finding is consistent with micro-level studies such as Brown and Stix (2015), who report that in CEE, hyperinflation during transition continues to shape inflation expectations to this day. It also implies that deposit-driven euroization is difficult to defeat (see Belhocine et al., 2016, for a discussion of policy options).

Figure 6: Deposit Euroization, Reference Model: Annual Estimates

(Point estimates and 95 percent confidence interval, broad sample)



Sources: Authors' calculations, for source data see Annex I.

[14] The existence of government bonds should encourage competitive pricing of LC deposits and hence tend to reduce deposit euroization; EU membership should facilitate transferring FX deposits abroad, therefore force competitive pricing of FX deposits and increase deposit euroization; a high Calvo-Reinhart index value indicates a high degree of exchange rate flexibility, which should work against expectations of asymmetric FX intervention in case of depreciation pressures and thus, at the margin, increase deposit euroization.

[15] Further, the adjusted R-squared (not displayed in Figure 5) fluctuates in a range of 0.5-0.65.

C. Carry Trade Euroization

We next test whether the mechanisms generating carry trade identified in the theoretical section are present in the data. To this end, we fit, in the first step, carry positions to pricing power, proxied by the market share of the five largest banks. In 2006, market concentration in the banking sector was indeed associated with carry positions (table 2, columns 1 and 2), in line with our prediction. By contrast, deposit euroization reduced carry trade, by (mechanically) limiting the scope for running long FX positions.

Column 3 adds the Calvo-Reinhart index as a measure for exchange rate flexibility. Flexibility should reduce borrowers' expectations of exchange rate intervention in case of currency depreciations. It should also highlight the exchange rate risk associated with FX loans, and therefore work against myopia on behalf of borrowers.

We find that in 2006, exchange rate flexibility was indeed associated with smaller carry positions. At the same time, market concentration remains significant for carry trade also after inclusion of the Calvo-Reinhart index, which suggests that both mechanisms were at work.

Further, column 3 suggests that direct cross-border borrowing by non-banks reinforced carry trade. Again, this is consistent with theory, as the availability of cross-border loans should force domestic banks to offer competitive FX lending conditions, and thus help sustain the

Table 2: Carry Trade
(Parameter estimates, t-values in parentheses)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Broad	Broad	Broad	Broad	Broad	Core	Broad	Core
Year	2006	2006	2006	2006	2006	2006	2015	2015
Observations	28	28	27	27	26	16	22	11
Deposit euroization	-0.242	-0.289	-0.430	-0.452	-0.499	-0.423	-0.303	-0.059
	(-2.04)**	(-2.59)**	(-4.22)***	(-4.60)***	(-4.72)***	(-3.42)***	(-2.40)**	(-0.44)
Market concentration	…	0.004	0.004	0.003	0.003	0.004	0.002	0.000
		(2.31)**	(2.99)***	(3.97)***	(3.05)***	(3.30)***	(1.44)	(0.22)
Calvo-Reinhart index	…	…	-0.379	-0.405	-0.564	-0.333	-0.040	0.149
			(-3.13)***	(-3.48)***	(-3.31)***	(-1.73)	(-1.06)	(1.14)
Cross-Border Borrowing	…	…	0.003	0.002	0.000	0.002	0.001	0.001
			(2.71)**	(2.57)**	(0.01)	(1.67)	(0.68)	(0.78)
External Bank Funding	…	…	…		0.003	…	…	…
					(1.56)			
General Government Debt/GDP	…	…	…		0.004	…	…	…
					(1.57)			
Constant	0.204	-0.105	-0.107	…	…	…	…	…
	(3.33)***	(-0.72)	(-0.88)					
Adjusted R-squared	0.105	0.233	0.549	0.667	0.681	0.744	0.141	0.364

Significance at the 1 (***), 5 (**) and 10 (*) percent level, respectively.

differential between LC and FX borrowing rates. There is no significant autonomous carry trade—i.e., carry trade euroization not accounted for by the factors included in the regression equation—and we therefore omit the intercept from the reference specification (column 4).

Adding more factors—external bank funding (*de facto* mostly from parent banks) and the public debt-to-GDP ratio as a proxy for an intervention-friendly fiscal policy—yields again parameters whose signs are consistent with theory but that lack statistical significance (column 5).[16] Results for the core sample are near-identical to those for the broader sample (column 6).

In contrast to deposit euroization, the factors affecting carry trade *did* change with the global financial crisis (column 7). In 2015, neither market concentration nor cross-border borrowing nor lack of exchange flexibility were any longer associated with carry trade. To check whether this result is affected by the atypical short FX positions in some Central Asian economies discussed above, we ran the base specification also for the core sample in 2015, where no short FX positions emerge. While based on very few observations, the results confirm those for the broad sample.

We interpret the evaporation of carry trade as a consequence of the market turbulence in the wake of the GFC, much in line with the theoretical argument sketched in section I.D. Turbulence brought the risks of FX borrowing to the forefront and thus curtailed demand for FX loans. To sustain demand and defend their profit maximizing carry positions, banks would have needed to increase interest rates of local currency relative to foreign currency loans further, but in the post-crisis environment, they were unable to do so.[17] Hence carry positions dwindled.

We again estimate the reference specification for each single year from 2004 to 2016 (Figure 7).[18] While the regression parameters are less stable than for deposit euroization, the same four factors—market concentration, (lack of) exchange rate flexibility, access to cross-border loans, and (lack of) deposit euroization—account well for carry trade euroization as long as carry trade persists.

After 2013, when carry trade evaporates, the empirical model collapses (shaded area).[19] Again this holds for the broad and the core sample alike (see Annex IV).

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[16] External bank funding and direct borrowing cross-border are strongly collinear, hence the impact of these two factors cannot be clearly distinguished from one another.

[17] Efforts to maintain FX lending were discouraged not least by regulators, who took various steps to dis-incentivize the origination of FX loans after 2008 (Belhocine et al. 2016).

[18] We do not have bank market concentration data for 2016, and hence proxy these with the 2015 values in the 2016 regression. As this variable is very slow-moving, the impact on the results should be minimal.

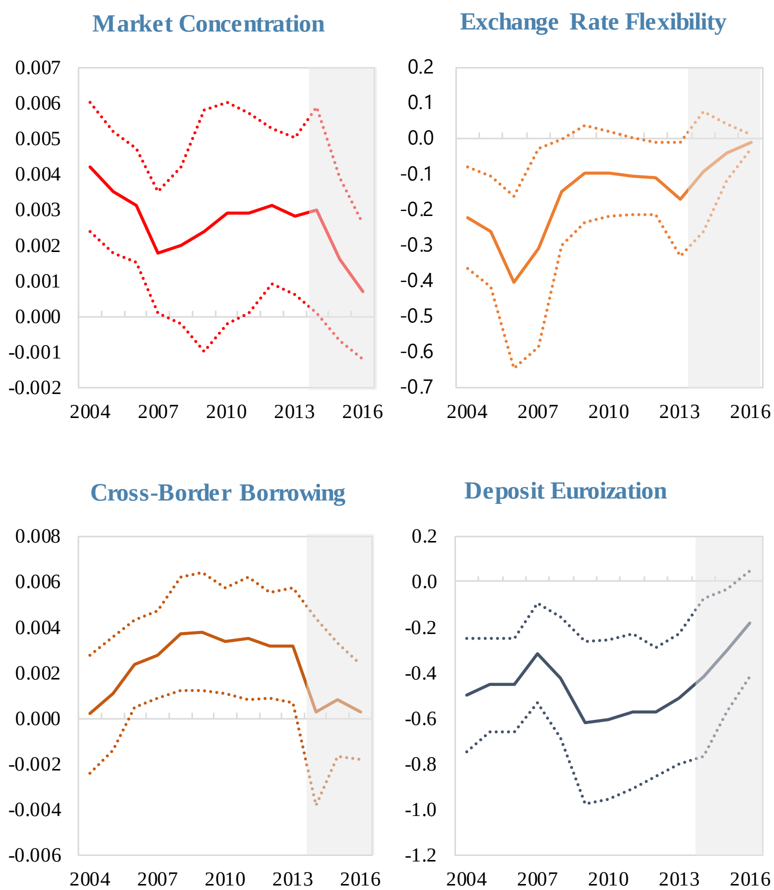
[19] The adjusted R-squared falls from 0.5-0.65 until 2013 to less than 0.2 from 2014.

The question arises why carry trade retreated markedly only from 2014, i.e., some six years after outbreak of the GFC.

A possible explanation is that the switch from a loan portfolio with one currency structure to another takes time—it is typically governed by the pace at which loans mature and originate. Further, carry positions can be affected by currency revaluation, hence changes in flows do not necessarily translate directly into changes in stocks. A case in point are the depreciations of many currencies in CEE after outbreak of the GFC that increased the local currency value of FX loans, even though demand for FX loans had, in some cases, already retreated.

Figure 7: Carry Trade, Reference Model: Annual Estimates

(Point estimates and 95 percent confidence interval, broad sample)



Sources: Authors' calculations, for source data see Annex I.

Distinguishing between these factors requires data on loan origination by currency that, for most countries in the sample, we do not have. We are thus confined to individual country cases.

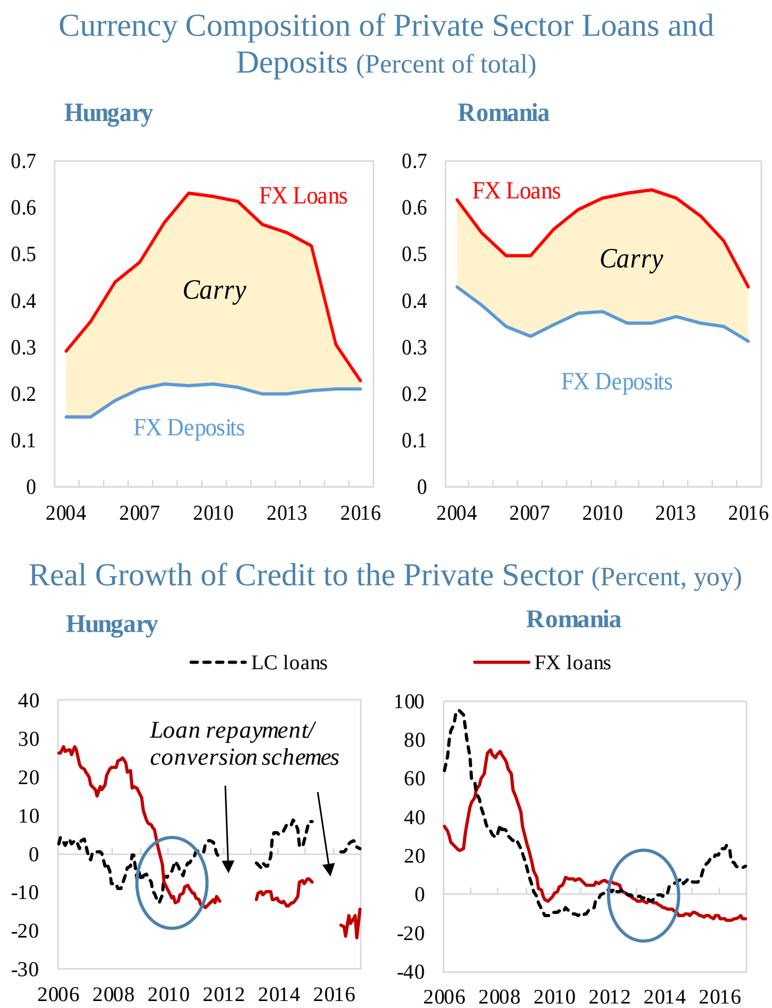
Figure 8 documents the unwinding of carry positions in two of the larger carry-trading economies, Hungary and Romania. Of these, Hungary was an example of almost pure carry trade: deposits were mostly in domestic currency, while the Hungarian banking system held, at the peak, the widest long FX position in CEE outside the Baltics. By contrast, Romania featured carry trade euroization on top of sizeable deposit euroization.[20]

[20] The choice of country cases is driven by data availability, as the Hungarian and Romanian central banks publish loan origination data by currency.

- In *Hungary*, net FX loan origination turned sharply negative in 2009.[21] However, in an environment of generally depressed credit, progress with reducing the share of FX loans was slow. Policy interventions accelerated the unwinding, notably a voluntary advance FX loan repayment scheme in 2012, and, especially, the mandatory conversion of household FX loans into domestic currency in 2015. By end-2016, carry trade euroization had been all but eliminated. [22]

- In *Romania*, by contrast, most new private sector loans continued to be denominated in FX also after 2009—hence banks' long FX positions widened further. The turning point was reached only in 2012, and coincided with the strengthening of regulations against FX lending to unhedged borrowers, as well as sizeable declines in local currency interest rates.[23] Since then, the share of FX loans has fallen rapidly, aided by the resurgence in credit growth and, correspondingly, a rapid increase in the stock of local currency loans. By end-2016, carry trade euroization had fallen to 40 percent of the 2012 peak level.

Figure 8: Unwinding of Carry Trade in Hungary and Romania



Sources: Central Banks of Hungary and Romania and authors' calculations.

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[21] In 2009, the impact of negative net FX loan origination is overcompensated by the upward revaluation of the FX loan stock due to the sharp depreciation of the forint against the euro and the Swiss Franc.

[22] See Balogh et al. (2013) for the loan repayment scheme and Koloszi et al. (2015) for the loan conversion scheme. The schemes trigger trend breaks in the credit growth time series in Figure 9, the data points relating to these schemes are therefore omitted.

[23] See National Bank of Romania (2014). Several other factors may have contributed to the slower unwinding of carry trade in Romania, including lower volatility of the leu exchange rate compared to the forint, and a loan subsidy program for home purchases that, until 2013, supported loans in both domestic currency and in FX.

The country cases provide two insights:

- While carry trade euroization eventually unwound in all of CEE, the exact circumstances and timing differed across countries. And:
- The date when carry trade became economically non-viable typically preceded the collapse in long FX positions—and the more so the weaker general credit growth was at the time when borrowers' currency preference shifted. This implies that borrowers were stuck for some time with a stock of no-longer-desired FX loans.

IV. Summary and Conclusions

This paper's main objective is to sketch the key features of two different types of bank balance sheet euroization (or dollarization):

- *Deposit-driven euroization*, whose root cause is distrust in the local currency as savings vehicle. In CEE, deposit-driven euroization is (or has been) prevalent in countries that experienced hyperinflation during transition from socialism, notably former Yugoslavia, Bulgaria, and, to some degree, the Baltics. Deposit-driven euroization is highly persistent; the only escape route in the past quarter century has been for countries to join the euro area, and thus converting the euro from foreign to local currency by administrative act.
- *Carry trade euroization*, which exists when loans are denominated in foreign but deposits are in local currency. Prior to the global financial crisis, carry trade euroization was prevalent in some Central European (notably Hungary and Slovenia), South-Eastern European (Romania, Albania), and Baltic (Estonia, Lithuania) countries. Carry trade euroization arises when households and corporations exploit interest differentials between foreign currency loans and local currency deposits. These differentials are *inter alia* triggered by price setting power of banks in the local currency loan market.

The different root causes of the two types of euroization translate into different policy implications. Combating deposit driven euroization requires restoring trust in the local currency—a difficult task. Regulatory measures tend to be of limited effectiveness as, by themselves, they cannot overcome distrust. If heavy-handed, regulation can even be counterproductive and trigger financial disintermediation and capital flight.[24] By contrast, carry trade euroization is more susceptible to corrective policies, such as allowing more exchange rate flexibility and regulatory measures that make FX loans less attractive.

The global financial crisis mostly eradicated carry trade euroization, as financial volatility highlighted the risks associated with FX borrowing and rendered it unattractive. Deposit-driven euroization persisted, however, and remains a key challenge for policy makers in Central and Eastern Europe.

[24] For a fuller discussion of policy options, see Belhocine et al. (2016).

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Annex I: Variable Definitions and Data Sources

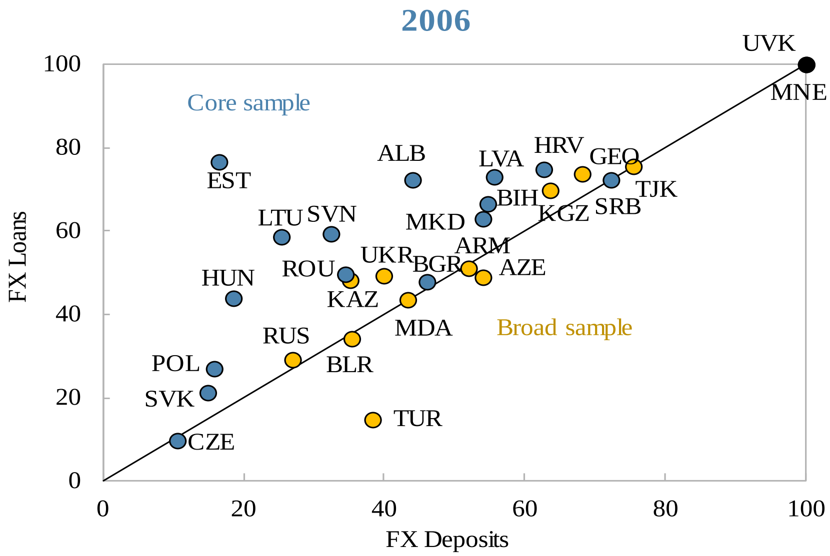
Variable	Definition / Note	Source
10-year MVP, Long-term MVP	Applied methodology of Ize and Levi-Yeyati (2003).	Monthly data on exchange rates (local currency against Euro) and inflation between 1990m1 and 2015m12 collected from central bank websites, IMF International Financial Statistics (IFS) database, the World Bank World Development Indicators database, and countries' statistical bureaus. Nominal exchange rates were adjusted to account for temporary currencies and denominations that took place during the early 1990s. Where nominal exchange rates against Euro were not available, we used cross-rates against US dollar. Monthly inflation rates were interpolated from annual series using the World Bank World Development Indicators. Additional data on inflation comes from Shleifer and Vishny (1991).
Calvo-Reinhart Index	Calvo-Reinhart 'Fear of Floating' index, calculated using Calvo and Reinhart (2002) methodology, averaged over 4 years.	Data on international reserves, nominal exchange rates and short-term interest rates are from IMF International Financial Statistics (IFS) database and central bank websites.
Cross-Border Borrowing	Ratio of other investment (liabilities) to GDP.	IMF World Economic Outlook (WEO) database.
Deposit euroization (FX deposits)	Ratio of deposits in foreign currency to total deposits.	Central bank websites, IMF International Financial Statistics (IFS), and EBRD.
External Bank Funding	Ratio of external liabilities of commercial banks to total assets of commercial banks.	Central bank websites.
General Government Debt / GDP	Ratio of general government gross debt to fiscal year GDP.	IMF World Economic Outlook (WEO) database.
Institutional Quality	Unweighted average of 6 governance indicators.	The World Bank, Worldwide Governance Indicators (WGI) dataset.

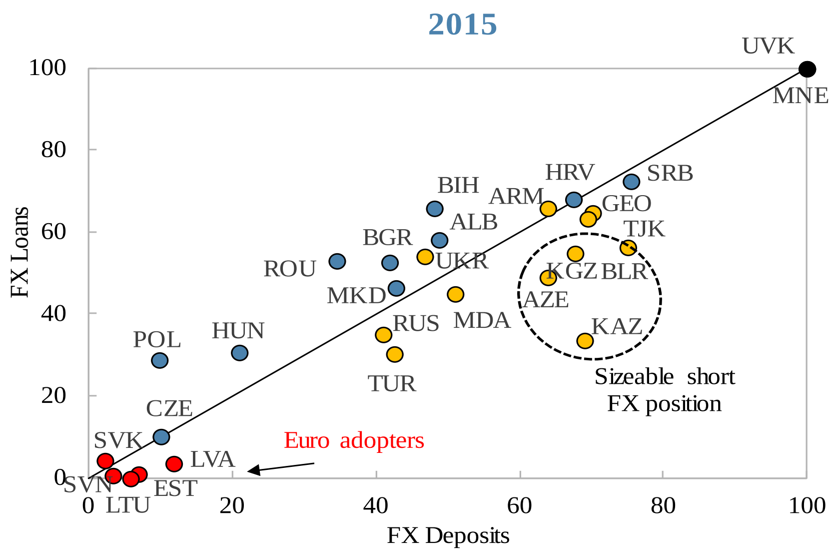
Local currency debt / GDP	Ratio of general government debt in local currency to GDP	IMF Vulnerability Exercise for Emerging Markets (VEE) data and IMF World Economic Outlook (WEO) database.
Market concentration	Assets of largest 5 commercial banks as percent of total commercial banking sector	The World Bank, Global Financial Development Database.
Maximum annual inflation	Logarithm of maximum annual inflation	Central bank websites and the World Bank World Development Indicators database. Additional data on inflation comes from Shleifer and Vishny (1991), Ghosh (1997), Gürgen et al. (1999) and Epkenhans (2016).
Loan euroization (FX loans)	Ratio of loans in foreign currency (or linked to foreign currency) to total loans.	Central bank websites, IMF International Financial Statistics (IFS), and EBRD.

Annex II: List of Countries

Country	Acronym	Core Sample	Euro Adoption (Year)
Albania	ALB	Yes	
Armenia	ARM		
Azerbaijan	AZE		
Belarus	BLR		
Bosnia and Herzegovina	BIH	Yes	
Bulgaria	BGR	Yes	
Croatia	HRV	Yes	
Czech Republic	CZE	Yes	
Estonia	EST	Yes	2011
Georgia	GEO		
Hungary	HUN	Yes	
Kazakhstan	KAZ		
Kosovo	UVK	Yes	
Kyrgyz Republic	KGZ		
Latvia	LVA	Yes	2014
Lithuania	LTU	Yes	2015
Macedonia	MKD	Yes	
Moldova	MDA		
Montenegro	MNE	Yes	
Poland	POL	Yes	
Romania	ROU	Yes	
Russia	RUS		
Serbia	SRB	Yes	
Slovakia	SVK	Yes	2009
Slovenia	SVN	Yes	2007
Tajikistan	TJK		
Turkey	TUR		
Ukraine	UKR		

Annex III: Loan and Deposit Euroization, 2006 and 2015, Broad Sample



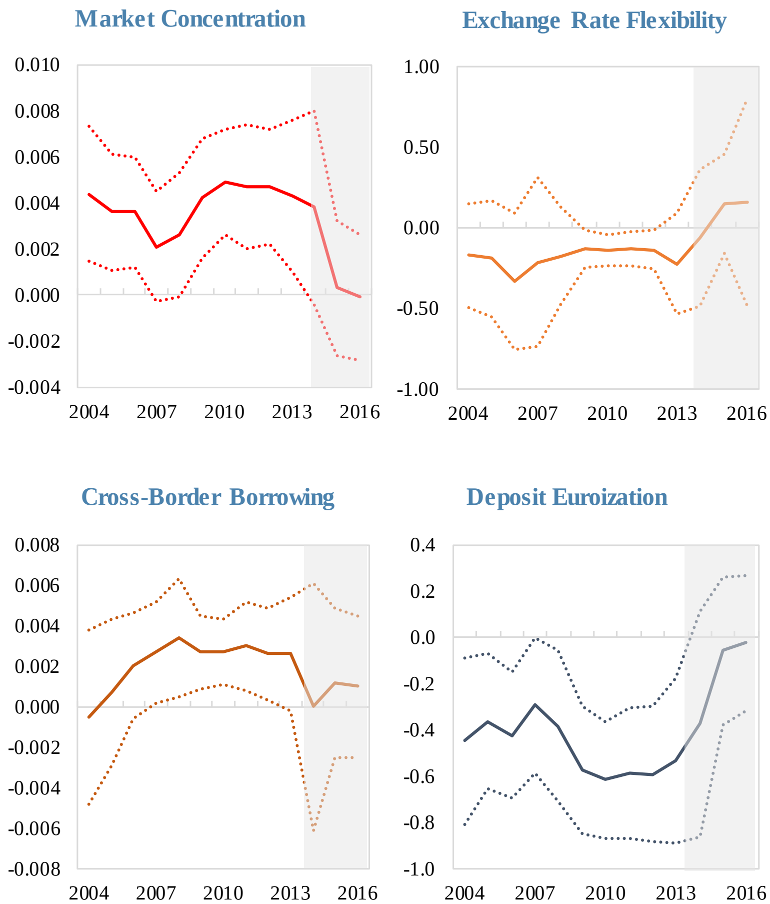


Sources: Authors' calculations, for source data see Annex I.

Note: the short FX position of the Turkish banking system in both 2006 and 2015 has been closed through currency swaps with the Central Bank.

Annex IV: Annual Carry Trade Regressions, Reference Model, Core Sample

Point estimates and 95 percent confidence interval



Sources: Authors' calculations, for source data see Annex I.