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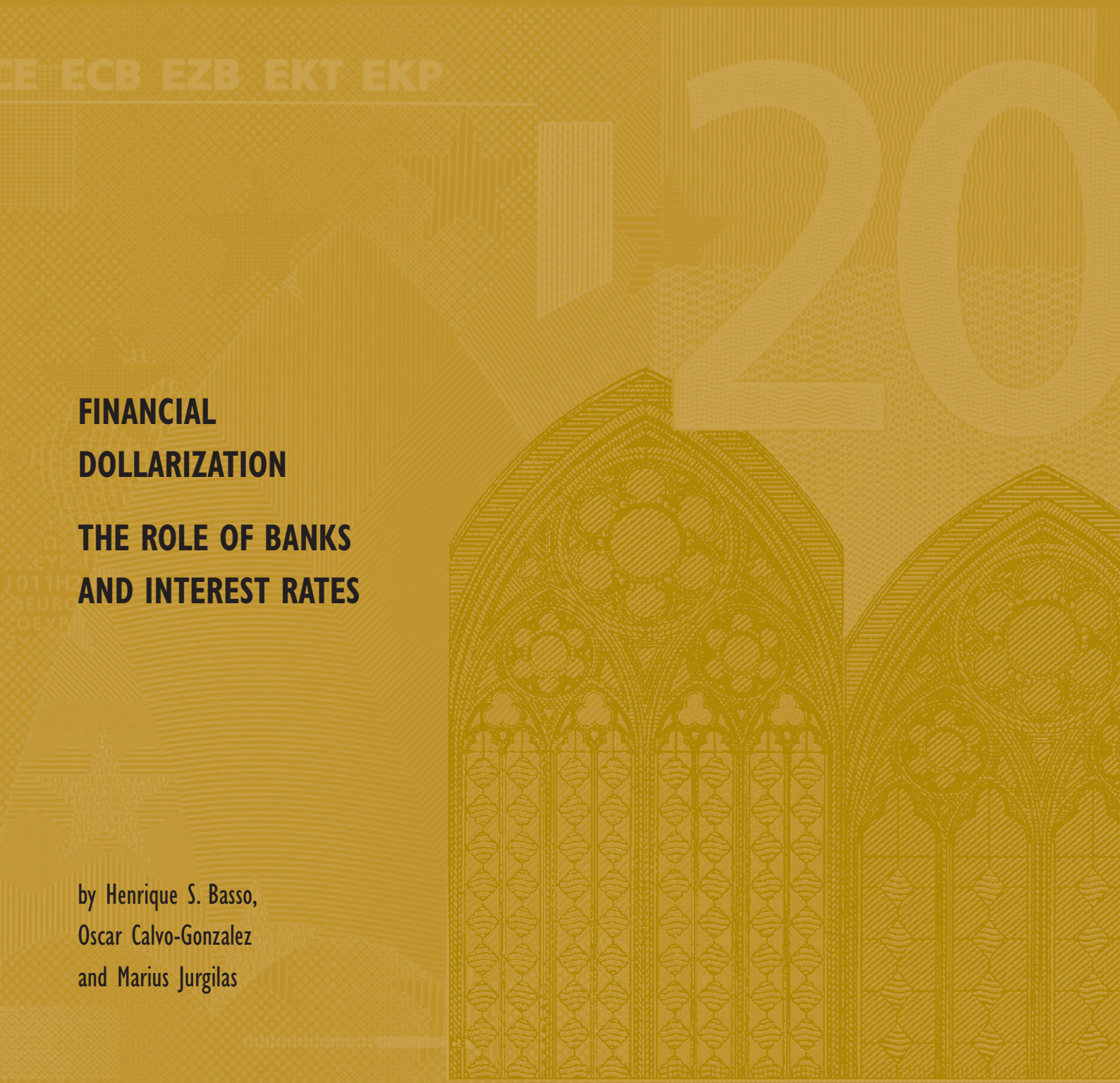

FINANCIAL DOLLARIZATION

THE ROLE OF BANKS AND INTEREST RATES

by Henrique S. Basso,
Oscar Calvo-Gonzalez
and Marius Jurgilas

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Abstract

This paper develops a model to explain the determinants of financial dollarization. Expanding on the existing literature, our framework allows interest rate differentials to play a role in explaining financial dollarization. It also accounts for the increasing presence of foreign banks in the local financial sector. Using a newly compiled data set on transition economies we find that increasing access to foreign funds leads to higher credit dollarization, while it decreases deposit dollarization. Interest rate differentials matter for the dollarization of both loans and deposits. Overall, the empirical results lend support to the predictions of our theoretical model.

JEL classification: E44, G21
Keywords: Financial Dollarization; Foreign Banks; Interest Rate Differentials; Transition Economies

Non-technical summary

Why do households and firms in many countries borrow in foreign currencies? Why do they hold deposits in foreign currencies? This paper addresses these questions theoretically and empirically using a newly compiled data set on transition economies, a region which has not been traditionally the focus of the so-called "financial dollarization" literature. This lack of attention by the literature is all the more surprising given that financial dollarization is indeed prevalent, and in some cases growing, among the formerly planned economies. Financial dollarization increases the exposure of agents to exchange rate risk and can therefore become a potential source of macroeconomic and financial instability. Hence, understanding the determinants of financial dollarization is of great interest not only to researchers but also to policy-makers. Data availability and the lack of an overall theoretical framework have hitherto been the main constraints to improving our understanding of financial dollarization. In this paper we contribute to the literature both theoretically and empirically.

On the theory of financial dollarization, we expand on the existing literature by modeling explicitly how competition among banks, and the fact that banks often have an open facility to increase funds by accumulating foreign liabilities, may affect local currency and foreign currency interest rate differentials. The feature that banks can accumulate foreign liabilities is motivated by the widespread experience in the transition countries, where many banks are now subsidiaries of foreign banks and have ample access to foreign sources of funding from their parent banks. Introducing imperfect competition in the banking market and letting banks borrow abroad to fund domestic credit growth allows us to incorporate a departure from uncovered interest rate parity. We are therefore able to address the common argument that interest rate differentials between loans in foreign and local currency are a key factor behind credit dollarization. This is an argument which cannot be addressed within theoretical frameworks such as the so-called minimum variance portfolio approach, which assumes that the uncovered interest rate parity holds and explains financial dollarization as a portfolio choice problem in which agents choose the currency composition of their portfolio that minimizes the variance of returns (local currency assets have uncertain returns due to domestic inflation and foreign currency assets have uncertain due to real exchange rate risk). Recognizing the important insights from the minimum variance portfolio approach our modeling strategy is to nest the minimum variance portfolio approach and expand on it.

Our second contribution to the literature is empirical. We compile a new data set on financial dollarization in transition economies and use it to test the main predictions of our model. Our data set shows that dollarization of deposits is not generally matched by the dollarization of credit - a result which is difficult to square with some of the existing theories of financial dollarization but is consistent with our framework. In particular, it fits with the argument that foreign borrowing by banks is being used to fund domestic credit growth. As banks have to keep net open positions under a limit, they go on to lend in foreign currency to domestic borrowers and we observe a rise in credit dollarization without deposit dollarization being necessarily affected. Our data set is also particularly rich in terms of the availability of data split on credit and deposit dollarization split for households and firms. The main predictions of the model are confirmed in our empirical analysis as follows:

First, access to foreign funds increases credit dollarization but it decreases the dollarization of deposits. The underlying intuition is the access of banks to foreign borrowing, often from their parent banks, as already mentioned. This implies that the accumulation of foreign liabilities seen in transition countries results in currency mismatches in the agents' portfolios in these countries.

Second, interest rate differentials matter. As expected in our model, a wider interest rate differential on loans in domestic currency compared to loans in foreign currency increases loan dollarization. A wider interest rate differential on deposits (again local currency interest rate minus foreign currency interest rate) has a negative effect on the extent of deposit dollarization.

Third, in line with the literature on the minimum variance portfolio approach, the trade off between inflation and real exchange rate variability is found to be a significant factor explaining financial dollarization.

Fourth, a higher degree of openness of an economy contributes to loan dollarization - but it appears to do so only in the case of firms and not households. In general the explanatory power of our model is lower for household dollarization, calling for more research efforts particularly in that area.

Overall, our analysis provides both a theoretical motivation as well as empirical validation that the access of banks to foreign funds and interest rate differentials between local and foreign currency instruments affect the extent of financial dollarization in transition economies.

1 Introduction

Why do households and firms in many countries borrow in foreign currencies? Why do they hold deposits in foreign currencies? This paper addresses these questions theoretically and empirically using a newly compiled data set on transition economies, a region which has not been traditionally the focus of the so-called "financial dollarization" (FD) literature. As noted in a recent survey, this lack of attention by the literature is all the more surprising given that FD is indeed prevalent, and in some cases growing, among the formerly planned economies (Levy-Yeyati (2006)). Moreover, high exchange rate exposure has been recently highlighted as a potential source of macroeconomic and financial instability in a number of central and southeast European economies (Winkler and Beck (2006), Standard and Poor's - RatingsDirect (2006)).

Until recently, the literature on FD (defined as the holding by residents of a share of their assets and/or liabilities denominated in foreign currency) has lacked both an overall encompassing framework as well as a broad empirical basis. Lack of data has led to the literature often focusing on either deposit or credit dollarization but typically not both (e.g. Nicolo, Honohan, and Ize (2005)). Having a broader view is important because theoretical explanations can often help to explain the dollarization of deposits but not credit, or the other way around. If, for example, agents perceived the currency to be overvalued, assumption that the literature usually does, then the safe heaven portfolio approach can only explain why households hold deposits in foreign currency but not why they are borrowing in foreign currency.

In a recent survey of the literature, Ize and Levy-Yeyati (2005) divide the main contributions to the theoretical analysis of FD into three main paradigms: (a) the price risk-portfolio choice; (b) credit risk; and, (c) financial environment. The portfolio choice approach, as its name suggests, explains FD as the result of a portfolio choice by which agents minimize the variance of the portfolio returns. Returns of local currency assets are uncertain due to domestic inflation while returns of foreign currency assets are uncertain due to real exchange rate risk. This approach focuses on variances since any interest rate differentials are assumed to be cancelled out by expected exchange rate movements, thus the uncovered interest rate parity (UIP) holds. The credit risk paradigm explains FD as the result of optimal decisions by risk neutral agents in the presence of default risk (enhanced by moral hazard/asymmetric information) while the financial environment

paradigm explains FD as the result of domestic market and legal imperfections.

It is, however, difficult to find unequivocal empirical support for any of the above paradigms as the three explanations overlap to some extent (a significant variable in explaining FD could be linked to two or even all theories). This calls for a unified analytical framework. Ize (2005) provides one such approach based on an investor/household sector that decides on its deposits based on the minimum variance portfolio choice paradigm, while risk neutral firms choose the currency composition of their borrowing in the presence of default risk. The results are obtained based on the assumption that there might exist an overvaluation overhang due to the fact that governments do not adjust the exchange rate within a specific interval.

Two key aspects of Ize (2005) should be highlighted. Firstly, contrary to most other contributions, which look at FD only from the depositors side,[1] Ize's model explains both deposit and credit dollarization. Depositors (households) choose foreign currency denominated assets motivated by the "safe heaven" portfolio (dollar denominated assets are one sided bets) while borrowers (firms) choose foreign currency denominated loans to maximize their objective function in the presence of default risk. Secondly, despite this separation of the motives of investors and firms, the model requires the equilibrium to be defined as a point where depositors and borrowers choose the same currency composition. This implies that banks are mere intermediaries without any influence in the final outcome and interest rates are fully determined by the interaction between investors and firms.

However, the assumption that credit and deposit dollarization are always matched is not broadly supported by our data. In transition economies, on which we focus our empirical analysis, the shares of foreign currency loans and foreign currency deposits are often negatively correlated (see Table 5 below). Credit dollarization has increased in these economies as banks in the region, often foreign-owned, have been able to borrow abroad to fund a substantial growth of domestic credit which - to keep the banks' exposures matched - is granted in foreign currencies (see also Arcalean and Calvo-Gonzalez (2006)). Subsidiaries of foreign owned banks are often seen as driving the fast credit growth in their attempt to capture market shares

[1] A relevant exception is Barajas and Morales (2003) who analysed, empirically, Dollarization of Liabilities (DL) in Latin America finding that Central Bank Foreign Exchange Market interventions and interest rate differential (interpreted as representing borrowers market power) are also important factors driving DL.

in yet undeveloped credit markets that are not only highly profitable but are also expected to grow substantially in the medium term.[2] Therefore, in explaining FD it is important to model explicitly two key features: (i) the different extent to which dollarization affects credit and deposits; (ii) the role that competition among banks is playing in driving foreign currency lending in these countries.

The latter has been addressed empirically in transition economies only by Luca and Petrova (2003), who concluded that banks, in attempting to match currency composition of their assets and liabilities, drive FD in these economies. To our knowledge only Catao and Terrones (2000) provide a theoretical model of FD focused on the banking side. However, the loans and deposits decisions are not explicitly modeled, ad hoc loan demand functions are assumed while deposits are in infinite supply given a deposit rate. Moreover, foreign and local currency loans are not considered as substitutes. In their model FD is determined not only by the interest rate set by the banks but mostly by the assumption that investors have different collateral capabilities. Therefore, despite its novelty, the model does not allow one to isolate the impact of market and legal imperfections and banking activity on FD. Finally, their framework does not provide simple testable implications, limiting its use in empirical work.

As in Ize (2005) we model depositors and borrowers separately. In our basic framework, we do so by assuming that households have different discount factors, one being a borrower and one a lender. This contrasts to Ize's approach in which he assumes that firms are borrowers and households are lenders. However, in one extension to our model we also include firms that borrow funds to finance investment opportunities.

Our main contribution to the literature is to model explicitly how competition among banks, and the fact that banks have an open facility to increase funds by accumulating foreign liabilities, may affect local currency and foreign currency interest rate differentials. Crucially, we introduce imperfect competition in the banking market and allow foreign liabilities to be used in

[2]For evidence of the importance of targets for future market shares for foreign-owned banks active in the region such as ING and Raiffeisen see de Haas and Naaborg (2005). Recently, the high price at which a 62 percent stake in the Romanian bank BCR was sold (EUR 3.75 billion - the largest amount ever paid for a central and eastern European bank) was interpreted by market commentators as driven by the fact that BCR represented the last big state-owned bank in the region giving at once a large market share for the buyer (The Banker (2006)).

the loan market. This also allows us to incorporate a departure from uncovered interest rate parity. We would therefore be able to address the common argument that interest rate differentials between loans in foreign and local currency are a key factor behind credit dollarization - an argument which by construction cannot be addressed within the minimum variance portfolio approach alone.

The main predictions of the model, which are indeed confirmed in our empirical results, are as follows. First, access to foreign funds increases credit dollarization but it decreases dollarization of deposits. Hence the increasing foreign presence in the banking sector coupled with accumulation of banking foreign liabilities experienced in transition economies results in currency mismatches in the agents' portfolios in these countries. Second, interest rate differentials matters. A wider interest rate differencial on loans positively affects loan dollarization. Interest rate differential on deposits has a negative effect on deposit dollarization. Third, our results confirm the relevance of the minimum variance portfolio theory of dollarization. Fourth, higher degree of openness leads to higher corporate loan dollarization.

The remainder of the paper is organized as follows. Section 2 presents a model of the currency choice while section 3 provides solutions and model implications. An overview of the data and methodology is presented in section 4, section 5 presents the estimation results and section 6 concludes. Auxiliary regression results and an alternative model specification are presented in the appendix.

2 Model

Assume the economy is populated by an infinite number of banks $i \in [0, 1]$, two representative households and a deposits and loans Dixit-Stiglitz CES "aggregator". We assume that all economic agents live for two periods. As an extension to our basic framework (see section 2.5) we also include firms in the model.

2.1 Households

Each representative household has a specific discount factor, household H has β_H and household L has $\beta_L < \beta_H$. Both households have identical endowments in both periods (Y)[3], hence the relationship between the interest rate charged by banks and their implicit interest rate $(1/\beta_j)$ determines whether the household $j = H, L$ decides to take a loan or make a deposit.

In equilibrium (formally stated below) the economies' gross interest rates will be between $1/\beta_H$ and $1/\beta_L$. Note that due to imperfect competition in the banking market there will be two rates, one for deposits and another for loans, for each currency. We will assume a set of parameter values for which all four equilibrium rates will be inside that interval. Hence the household with low discount factor will find it better to borrow and consume more today and the other will find it better to save and consume more tomorrow. That way a household that makes deposits (loans) does not take loans (deposits).

Households maximize utility given a stream of income choosing the amount of deposits and loans in local and foreign currency (implicitly determining consumption in each period). Both local and foreign currency denominated assets are risky. While the first might fluctuate due to inflation, the second will fluctuate due to changes in the real exchange rate.

In order to incorporate competition among banks having only two representative households we assume that households (indirectly through the "aggregator") choose CES deposits and loans indexes, which are a composite of all banks deposits and loans given a constant elasticity of substitution[4]. That way the banking sector will be characterized by monopolistic competition. Although we do not model why banks exist and where they derive their market power from, banks may be providing liquidity and hence reducing the cost of credit (Freixas, Parigi, and Rochet 2000). The assumption that banks have market power is supported by empirical evidence (Simons and Stavins 1998).

Each household is split into two units: (i) the investor, responsible for deciding demand for loans and deposits[5] or the set (D, L), where D = total deposits, L = total loans and (ii) the fund manager, responsible for deciding

[3]Endowments, as consumption, total deposits and loans, are in real terms. This does not affect the results of the model. Households may actually have unlimited access to an exchange rate spot market in each period.

[4]We assume the same elasticity of substitution for loans and deposits. Allowing for different elasticity of substitution would not change the results of the model.

[5]Throughout the paper we state that households demand loans and deposits, consid-

the portfolio compositions (α_d, α_l), where α_d = portion of deposits in foreign currency (deposit dollarization) and α_l = portion of loans in foreign currency (loan dollarization). This specification integrates the Minimum Variance Portfolio framework developed by Ize and Levy-Yeyati (2003). An alternative specification where households make their decisions at once, rather than first about the demand for loans and deposits and then about their currency composition, is presented in Appendix A. As it is shown there the results are very similar.

The investor part of the household solves a certainty equivalent problem given the expected returns, defined as $E[\bar{R}_d] = (1-\alpha_d)R_d + \alpha_d R_d^*$ for deposits and $E[\bar{R}_l] = (1-\alpha_l)R_l + \alpha_l R_l^*$ for loans. Note that the certainty equivalence assumption allows us to solve this problem independently of the portfolio composition decision. Hence the variance of returns does not affect the total deposit or loan decisions[6]. The investor's $j = H, L$ problem is

$$\max_{\{D,L\}} \frac{(Y - D + L)^{1-1/\sigma}}{1 - 1/\sigma} + \beta_j \frac{(Y + E[\bar{R}_d]D - E[\bar{R}_l]L)^{1-1/\sigma}}{1 - 1/\sigma}$$

The fund manager allocates the deposits (D) and loans (L) determined by the investor into foreign currency denominated deposits and loans (d^*, l^*) and local currency denominated deposits and loans (d, l) to maximize expected return and minimize the variance of the resulting portfolio, where

$$\begin{aligned} D &= d + d^*, \quad d = (1-\alpha_d)D \quad \text{and} \quad d^* = \alpha_d D \\ L &= l + l^*, \quad l = (1-\alpha_l)L \quad \text{and} \quad l^* = \alpha_l L \end{aligned}$$

Hence for deposits

$$\max_{\alpha_d} E[\bar{R}_d] - q\frac{VAR[\bar{R}_d]}{2} \tag{1}$$

where

$$\begin{aligned} \bar{R}_d &= (1-\alpha_d)\hat{R}_d + \alpha_d \hat{R}_d^* \\ \hat{R}_d &= R_d - \mu_\pi \\ \hat{R}_d^* &= R_d^* + \mu_S \end{aligned}$$

ering that both are products that banks sell to households. However, deposit "demand" is upward sloping as it represents a supply of funds.

[6] In the alternative specification shown in Appendix A these two decisions are made together and therefore the total demand decisions are affected negatively by the variance.

and μ_π and μ_S are the risk component due to inflation and real exchange rate respectively by which the rate indexes need to be adjusted to get the actual returns ($\hat{R}_d$,$\hat{R}^*_d$) in period 2. These have zero mean, variances given by $S_{\pi,\pi}$, $S_{S,S}$ and covariance by $S_{\pi,S}$. Finally, q indicates the weight of the variance term in the fund manager's objective function.

The portfolio choice is therefore given by

$$\begin{aligned} \alpha_d &= \frac{R^*_d - R_d}{q(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} + \frac{S_{\pi,\pi} + S_{\pi,S}}{(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} \\ &= \frac{R^*_d - R_d}{q(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} + \lambda_{MVP} \end{aligned} \tag{2}$$

where, as in Ize and Levy-Yeyati (2003), λ_{MVP} affects dollarization positively and is defined as

$$\lambda_{MVP} = \frac{S_{\pi,\pi} + S_{\pi,S}}{(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})}$$

The loans decision problem is similar to (1), though now fund managers minimize the payment and the variance.

$$\max_{\alpha_l} -E[\bar{R}_l] - q\frac{VAR[\bar{R}_l]}{2} \tag{3}$$

where

$$\begin{aligned} \bar{R}_l &= (1-\alpha_l)\hat{R}_l + \alpha_l \hat{R}^*_l \\ \hat{R}_l &= R_l - \mu_\pi \\ \hat{R}^*_l &= R^*_l + \mu_S \end{aligned}$$

The loans portfolio choice is given by

$$\begin{aligned} \alpha_l &= \frac{R_l - R^*_l}{q(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} + \frac{S_{\pi,\pi} + S_{\pi,S}}{(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} \\ &= \frac{R_l - R^*_l}{q(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} + \lambda_{MVP} \end{aligned} \tag{4}$$

The equations determining the portfolio choice are the same as in Ize and Levy-Yeyati (2003). However, in their case $\alpha_d = \alpha_l = \lambda_{MVP}$ as they assume UIP holds. In our case banks choose interest rates such that households find it optimal to increase α_l if loan differential $(R_l - R^*_l)$ increases and to decrease α_d if deposit differential $(R_d - R^*_d)$ increases.

2.2 Deposits and Loans Aggregator

The aggregator sells deposit and loan indexes to households and buys individual banks' deposits and loans from each bank in order to minimize the cost for loans[7] and maximize the gains for deposits[8]. We assume perfect competition so the aggregator makes no profits. The introduction of a deposits and loans aggregator facilitates the exposition of the model without changing its results. The aggregator solves the following problems.

Local Currency Deposits

$$\min_{\{d_i\}} \left[\int_0^1 \frac{1}{rd_i} d_i \; di \right]$$

subject to total deposits in local currency, which is a CES index of all deposits in each bank $i \in [0,1]$

$$d = \left[\int_0^1 (d_i)^{\frac{\theta-1}{\theta}} \; di \right]^{\frac{\theta}{\theta-1}}$$

That implies the following demand for local currency deposits from bank i (d_i):

$$d_i = \left[\frac{R_d}{rd_i} \right]^{-\theta} d \tag{5}$$

where rd_i is the deposit rate given by bank i and the local currency deposit rate index R_d is defined as

$$\frac{1}{R_d} = \left[\int_0^1 \left(\frac{1}{rd_i} \right)^{1-\theta} di \right]^{\frac{1}{1-\theta}}.$$

Note that profits are indeed zero since $\int_0^1 \frac{1}{rd_i} d_i \; di = \frac{1}{R_d} d$.

Local Currency Loans

$$\min_{\{l_i\}} \left[\int_0^1 rl_i l_i di \right]$$

[7] The household promises to pay an interest rate for the loans (l), thus the aggregator wants to pay as little as possible for the individual loans made in each bank i.

[8] The aggregator promises to pay a deposit rate to the household, thus he/she will want to maximize the deposit rate on each individual deposit or minimize the present value of each deposit.

subject to total loans in local currency which is a CES index of all loans done in each bank $i \in [0,1]$

$$l = \left[\int_0^1 (l_i)^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}}$$

That implies the following demand for local currency loans from bank i (l_i):

$$l_i = \left[\frac{rl_i}{R_l} \right]^{-\theta} l \tag{6}$$

where rl_i is the loan rate set by bank i and the local currency loan rate index R_l is defined as

$$R_l = \left[\int_0^1 (rl_i)^{1-\theta} di \right]^{\frac{1}{1-\theta}}.$$

Note that, again, profits are zero since $\int_0^1 rl_i l_i di = R_l l$.

Similarly for foreign currency loans and deposits:

$$d_i^* = \left[\frac{R_d^*}{rd_i^*} \right]^{-\theta} d^* \tag{7}$$

$$\text{where} \quad \frac{1}{R_d^*} = \left[\int_0^1 \left(\frac{1}{rd_i^*} \right)^{1-\theta} di \right]^{\frac{1}{1-\theta}}$$

$$l_i^* = \left[\frac{rl_i^*}{R_l^*} \right]^{-\theta} l^* \tag{8}$$

$$\text{where} \quad R_l^* = \left[\int_0^1 (rl_i^*)^{1-\theta} di \right]^{\frac{1}{1-\theta}}$$

where rd_i^* and rl_i^* are bank i's foreign currency deposit and loan rates and d_i^* and l_i^* are the demand for bank i's foreign currency deposits and loans. R_d^* and R_l^* are the respective interest rate indexes.

2.3 Banks

Each bank i chooses deposit and loan interest rates for foreign and local currency $(rd_i^*, rl_i^*, rd_i, rl_i)$ to maximize its expected second period profits and its loan market shares.

Banks start with an amount of funds (F), comprised of the banks' capital and its foreign liabilities, of which some are denominated in foreign currency and some in local currency. Banks can use F to offset loans, hence we do not force the market of loans and deposits to match but allow banks to use these funds to close the gap. The parameter ϕ indicates the portion of funds that are denominated in foreign currency.

As foreign banks have greater facility to acquire funds in foreign currency from their parent banks, greater foreign bank penetration can be expected to result in a higher share of funds denominated in foreign currency. Therefore foreign bank penetration is implicitly modelled here as ϕ. This link is supported by our data (see section 4).

Banks are assumed to have balanced currency positions thus loans must be equal to funds plus deposits for each currency.[9] Given prudential regulations limiting net open foreign exchange positions this assumption is not unreasonable.

Bank i solves the following problem[10]:

$$\max_{\{rl_i, rl_i^*, rd_i, rd_i^*\}} \quad E\Bigg[(rl_i - 1)\, l_i + (rl_i^* - 1) l_i^* - (rd_i - 1)\, d_i - (rd_i^* - 1) d_i^* + \gamma \left(\frac{l_i}{l} + \frac{l_i^*}{l^*} \right) \Bigg] \tag{9}$$

subject to demand functions (5)-(8) and

$$l_i = d_i + (1 - \phi) F \tag{10}$$

$$l_i^* = d_i^* + \phi F \tag{11}$$

where γ reflects how much the bank cares about loan shares. We include loan market shares in the banks' objective function for two main reasons. Firstly, as shown by de Haas and Naaborg (2005), foreign banks do set targets for future market share for their subsidiaries in transition economies. Secondly, given that we solve a two period model, loan market shares will

[9] If banks are not assumed to hold balanced currency positions but some limit is imposed on currency exposures, the main qualitative results of the model remain unchanged as long as this limit eventually binds given the sizes of F and ϕ.

[10] The second period realization of individual bank rates have the same risk components defined in the household problem, μ_π and μ_S (e.g. $rl_i = E[rl_i] - \mu_\pi$). As banks are risk neutral and these have zero mean, they do not affect bank i's problem.

also serve as a proxy for future profits. Alternatively one could solve an infinite period model, assuming banks maximize the future stream of profits. However, that would increase the complexity of the problem and since the banking sector is growing considerably in these economies there is a premium for first entrants that is not necessarily present in infinite period profit functions. In any case, the main qualitative results of our model do not change when loan market shares are dropped from the banks' objective function.

The first order condition of the bank problem, incorporating the equilibrium conditions (individual bank rates are equal to rate indexes, explained below) are: (10), (11) and

$$\gamma\theta - L\alpha_l(R_d(1+\theta) + R_l(1-\theta)) = 0$$

$$\gamma\theta - L(1-\alpha_l)(R_d^*(1+\theta) + R_l^*(1-\theta)) = 0$$

2.4 Equilibrium

The equilibrium is defined as a set of individual banks' interest rates $\{rd_i, rd_i^*, rl_i, rl_i^*\}_{i=0}^1$, interest rate indexes $\{R_d, R_d^*, R_l, R_l^*\}$ and loan and deposit demands $\{d, d^*, l, l^*\}$ such that given interest rates, aggregate demand solves the households' problem, given aggregate demand and interest rate indexes, the set $\{rd_i, rd_i^*, rl_i, rl_i^*\}$ maximises bank i objective function for all $i \in [0,1]$ and the following conditions hold[11].

$$\frac{1}{R_d} = \left[\int_0^1 \left(\frac{1}{rd_i}\right)^{1-\theta} di\right]^{\frac{1}{1-\theta}}$$

$$R_l = \left[\int_0^1 (rl_i)^{1-\theta} di\right]^{\frac{1}{1-\theta}}$$

$$\frac{1}{R_d^*} = \left[\int_0^1 \left(\frac{1}{rd_i^*}\right)^{1-\theta} di\right]^{\frac{1}{1-\theta}}$$

$$R_l^* = \left[\int_0^1 (rl_i^*)^{1-\theta} di\right]^{\frac{1}{1-\theta}}$$

[11] One can easily show that ensuring these, together with the individual bank demand equations used as constraints to bank i's problem guarantees that the equations for d, d^*, l, l^* used in the aggregator problem hold.

As all banks are equal these conditions in fact imply that bank rates and rate indexes are equal.

2.5 Extensions

2.5.1 Endogenous Foreign Funds

An extension to our basic model is to allow banks to choose the required amount of foreign denominated funds given a pre-determined interest rate. This is important since it allows us to verify if exogeneity of funds is driving the results.

In addition this model extension is relevant because most foreign banks have that facility open from their parent banks. Profits in transition economies have generally been greater than in mature markets making this flow of funds a profitable strategy for the parent bank.

Hence bank i now starts with an amount of funds in local currency F_{LC} but can choose funds in foreign currency F_{FC} given an interest rate (EIB)[12]. The problem is

$$\max_{\{rl_i, rl_i^*, rd_i, rd_i^*, F_{FC}\}} E\Bigg[(rl_i - 1)\, l_i + (rl_i^* - 1) l_i^* - (rd_i - 1)\, d_i - (rd_i^* - 1) d_i^* - (EIB - 1) F_{FC} + \gamma \left(\frac{l_i}{l} + \frac{l_i^*}{l^*} \right) \Bigg]$$

subject to demand equations (5)-(8) and

$$\begin{aligned} l_i &= d_i + F_{LC} \\ l_i^* &= d_i^* + F_{FC} \end{aligned}$$

As we will show in the next section, allowing for endogeneity of foreign funds does not alter our main results.

[12] We implicitly assume that all external funds are denominated in foreign currency, following the "original sin" literature.

2.5.2 Model with Firms

The basic model in this paper included only risk averse households who seek to maximize the return and minimizing the variance of the loan/deposit portfolio. However, corporate loan dollarization is also of interest. In fact, as our data set shows, it is sizeable and generally higher than household loan dollarization. Therefore, we now extend the model to include firms which, as is common in the literature, we will assume to be risk neutral.

We assume that a representative firm has a project (investment opportunity) available, whereby investing V at period 1 the firm will get MV at period 2, where M is the real return on the project and is stochastic. We further assume that the firm has no funds in period 1 and hence is forced to borrow the entire initial investment from banks. The firm maximizes expected profits (Q) selecting the currency composition of the total amount borrowed from banks given the interest rates on each loan type. Profits are risky due to variations in M, inflation (μ_π) and real exchange rate (μ_S). We assume these three stochastic processes are jointly normally distributed with mean $[\bar{M}, 0, 0]'$ and variance Σ, where

$$\Sigma = \begin{pmatrix} S_{M,M} & S_{M,\pi} & S_{M,S} \\ S_{\pi,M} & S_{\pi,\pi} & S_{\pi,S} \\ S_{S,M} & S_{S,\pi} & S_{S,S} \end{pmatrix}.$$

In order to make the portfolio currency selection non-trivial we assume that the firm may default if profits at period 2 are negative [13].

Formally, the firm problem is

$$\begin{aligned} \max_{\{\alpha_v\}} E[Q] &= \max_{\{\alpha_v\}} E\left[\max\left\{MV - \bar{R}_v V, 0\right\}\right] \\ \text{where} \quad & \bar{R}_v = (1-\alpha_v)\hat{R}_v + \alpha_v \hat{R}^*_v \\ & \hat{R}_v = R_v - \mu_\pi \\ & \hat{R}^*_v = R^*_v + \mu_S \\ & V = v + v^* \\ & v = (1-\alpha_v)V \\ & v^* = \alpha_v V \end{aligned}$$

[13] Under no default firms would select the currency for which the loan interest rate is the lowest so the result would be total dollarization, no dollarization or indeterminacy (if rates are equal).

Following the same modelling simplification as in the basic model we also introduce a corporate loan aggregator or a syndicated loan manager. The syndicated loan manager receives loan demands v and v^* from the firm and gets funding from each bank i to minimize the total loan costs ($\int_0^1 rv_i v_i di$ and $\int_0^1 rv_i^* v_i^* di$), such that $v = \left[\int_0^1 v_i^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$ and $v^* = \left[\int_0^1 (v_i^*)^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$. That way

$$v_i = \left[\frac{rv_i}{R_v}\right]^{-\theta} v \tag{12}$$

$$v_i^* = \left[\frac{rv_i^*}{R_v^*}\right]^{-\theta} v^* \tag{13}$$

$$\text{where} \quad R_v = \left[\int_0^1 (rv_i)^{1-\theta} di\right]^{\frac{1}{1-\theta}} \quad \text{and} \quad R_v^* = \left[\int_0^1 (rv_i^*)^{1-\theta} di\right]^{\frac{1}{1-\theta}}.$$

If the firm defaults the loan manager pays a cost of verification K and gets $M(v+v^*)$ from the firm's project. In order to simplify bank i's problem we assume that in case of a default the loan manager will charge K_i and K_i^* such that each bank will get back $Mv_i - K_i = v_i$ and $Mv_i^* - K_i^* = v_i^*$ or zero net returns. This insurance mechanism is provided by a government agency that effectively does a transfer for the loan manager to cover the gain or loss given the realizations of M such that the net profit of the loan aggregator is zero. The insurance mechanism, or the transfer, is provided as long as the loan manager's expected return without the transfer is not smaller than the return he/she would get using the funds to make loans to the households (assumed to be risk free), hence

$$E[\min\{\bar{R}_v V, MV\} - \mathsf{Def}K] \geqslant V\bar{R}_l. \tag{14}$$

Where Def is a dummy variable that takes the value 1 in case of default and zero otherwise. Note that this constraint will actually bind in equilibrium and is effectively a participation constraint for the loan manager to perform the loan.

Given the participation constraint, the firm problem can be modified as follows (see Jeanne (2003) for more details)

$$\max_{\{\alpha_v\}} E[Q] = \max_{\{\alpha_v\}} \left[E\left[\max\left\{MV - \bar{R}_v V, 0\right\}\right] + E[\min\{\bar{R}_v V, MV\} - \mathsf{Def}K] - V\bar{R}_l\right]$$

$$\max_{\{\alpha_v\}} E[Q] = \max_{\{\alpha_v\}} \left[E[MV] - E[\mathsf{Def}]K - V\bar{R}_l\right]$$

That implies that in order to maximize profits (Q) the firm actually seeks to minimize $E[\mathsf{Def}]$ or the probability of default. In the model presented by Jeanne (2003) that would imply minimizing the variance since there, UIP holds. In our case, as expected interest rate from local and foreign currency loans might not be the same, the problem of the firm becomes

$$\begin{aligned} \min_{\{\alpha_v\}} \quad & \text{Prob[Default]} = \int_{-\infty}^{0} \text{Prob}[Q]dQ \\ \text{where} \quad Q &= (M - (1-\alpha_v)\hat{R}_v - \alpha_v \hat{R}_v^*)V \\ &= (M + (1-\alpha_v)\mu_\pi - \alpha_v \mu_S - [(1-\alpha_v)R_v + \alpha_v R_v^*])V. \end{aligned}$$

Given our assumption of joint normality of M, μ_π and μ_S, this problem, after some manipulation, becomes

$$\min_{\{\alpha_v\}} \quad \Phi\left(\frac{(1-\alpha_v)R_v + \alpha_v R_v^* - \bar{M}}{\sigma_p}, 0, 1\right)$$

Where Φ is the standard normal cumulative density function and ${\sigma_P}^2 = S_{M,M} + (1-\alpha_v)^2 S_{\pi,\pi} + \alpha_v^2 S_{S,S} - 2(1-\alpha_v)\alpha_v S_{\pi,S} - 2\alpha_v S_{M,S} + 2(1-\alpha_v)S_{M,\pi}$.

The first order condition of this minimization is

$$\frac{R_v^* - R_v}{(S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S})} = \left[\frac{(1-\alpha_v)R_v + \alpha_v R_v^* - \bar{M}}{\sigma_p}\right]\left(\alpha_v - \lambda_{MVP} - \lambda_{COV}\right) \tag{15}$$

Where $\lambda_{COV} = \frac{S_{M,\pi}+S_{M,S}}{(S_{\pi,\pi}+S_{S,S}+2S_{\pi,S})}$.

First note that if $R_v = R_v^*$ then the firm will only minimize the variance ($\min_{\alpha_v} {\sigma_p}^2$), hence $\alpha_v = \lambda_{MVP} + \lambda_{COV}$. That way firm loan dollarization is determined by the original trade-off between inflation and the real exchange rate (summarized by λ_{MVP}) plus an additional term reflecting the optimal hedging strategy of firms as regards to the real return on their investments.

On the one hand, if the real return is positively correlated with the real exchange rate then choosing foreign currency denominated loans protects the firm against default; higher interest payment will occur when investment returns are high. Hence high $S_{M,S}$ leads to more dollarization.

On the other hand, if inflation and real investment returns are negatively correlated, then when inflation is low and interest rate payments are high the investment return will also be high, protecting the firm against default. Thus, lower $S_{M,\pi}$ leads to less dollarization.

If $R_v^* > R_v$ (assuming $\bar{M} - (1-\alpha_v)R_v - \alpha_v > 0$ or the expected return on investment is positive) then $\alpha_v < \lambda_{MVP} + \lambda_{COV}$; corporate loan dollarization decreases. The firm shifts the portfolio allocation towards the cheaper loan type, which in this case is the one denominated in local currency. The opposite occurs when $R_v^* < R_v$. Therefore, the firm portfolio choice is very similar to that of the households but for the new covariance term.

Finally, the introduction of firms changes the bank problem as follows. Each bank i uses total funds (deposits + F) to make loans for the representative household and the firm. So the bank's problem becomes[14]

$$\max_{\{rl_i, rl_i^*, rd_i, rd_i^*, rv_i, rv_i^*\}} \quad E\Big[(rl_i - 1)\, l_i + (rl_i^* - 1) l_i^* - (rd_i - 1)\, d_i - (rd_i^* - 1) d_i^* + E[\min\{(rv_i - 1)v_i, (M-1)v_i\} - \mathsf{Def}K_i] + E[\min\{rv_i^* - 1)v_i^*, (M-1)v_i^*\} - \mathsf{Def}K_i^*] \Big]$$

subject to demand functions (5)-(8), (12) and (13), and

$$l_i + v_i = d_i + (1-\phi)F \quad (16)$$

$$l_i^* + v_i^* = d_i^* + \phi F \quad (17)$$

$$E[\min\{(rv_i - 1)v_i, (M-1)v_i\} - \mathsf{Def}K_i] = E[(rl_i - 1)v_i] \quad (18)$$

$$E[\min\{(rv_i^* - 1)v_i^*, (M-1)v_i^*\} - \mathsf{Def}K_i^*] = E[(rl_i^* - 1)v_i^*] \quad (19)$$

Where the last two equations ((18) and (19)) are the participation constraints for each bank to take part in the firm's syndicated loan, which can also be written as

E[Net return| no default]+E[Net return|default] = E[Net return on household loan].

Firstly note that since each bank i contributes with a small share of the firm's loan they take the probability of default as given. Secondly, given our assumption that K_i and K_i^* are set such that, in case of default, net return for bank i is zero, the second term on the left hand side is zero. Hence, the participation constraints can be written as

$$(1-\varphi)(rv_i - 1) = (rl_i - 1) \quad \text{and} \quad (1-\varphi)(rv_i^* - 1) = (rl_i^* - 1)$$

[14] We set $\gamma = 0$.

Where $\varphi = \Phi\left(\frac{(1-\alpha_v)R_v+\alpha_v R_v^*-\bar{M}}{\sigma_p}, 0, 1\right)$ = probability of default.

The insurance mechanism introduced in the syndicated loan manager problem clearly simplifies the bank's problem and will impact on the equilibrium size of the firm's credit spread. However, since the probability of default is given for each bank i, this assumption will not change the qualitative results of our model.

The first order conditions of the bank problem, simplified using the market clearing condition (bank rates are equal to rate indexes), are: (16) - (19) and

$$\begin{aligned} -L\alpha_l R_d(1+\theta)+R_l\left[-V\alpha_v+L\alpha_l(\theta-1)+\frac{V\alpha_v\theta(R_l-R_d\frac{1-\theta}{\theta})}{R_v(1-\varphi)}\right] &= 0 \\ -L(1-\alpha_l)R_d^*(1+\theta)+R_l^*\left[-V(1-\alpha_v)+L(1-\alpha_l)(\theta-1)+\frac{V(1-\alpha_v)\theta(R_l^*-R_d^*\frac{1-\theta}{\theta})}{R_v^*(1-\varphi)}\right] &= 0 \end{aligned}$$

3 Model Solution and Main Implications

In order to solve the model we assume the parameter values[15] shown in Table 1. Discount factors are chosen to allow for a wider range of specifications for other parameters of the model for which the equilibrium rates are still within the range $[1/\beta_H, 1/\beta_L]$. Income (Y) and σ are set to make sure that loan and deposit demands are sensitive enough to interest rate changes. The model is solved for different values of F (smaller than 0.06), $\theta = 35$ and $\gamma = 0.00005$, which, given the other parameters, ensure the funds are never greater than 70% of total of deposits and banking spreads are around 7% (average in our sample). Finally, we assume that $\lambda_{MVP} = 0.5$[16].

Table 1: Parameter Values

β_H	β_L	Y	σ	θ	γ	λ_{MVP}
0.99	0.65	10	0.175	35	0.00005	0.5

Given that there has been a strong increase in foreign bank ownership ratios (both in number of banks and percentage of assets) coupled with raises

[15] We have attempted to select plausible parameter values to match the observed data. Nonetheless we are primarily concerned with the qualitative implications of the model.

[16] Where $S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S} = 0.1$ and $S_{\pi,\pi} + S_{\pi,S} = 0.05$.

in foreign liabilities in transition economies in the last ten years the main question to be analysed with the model is how financial dollarization is impacted by increases in the ratio of foreign denominated funds (ϕ) together with an overall increase in total funds F.

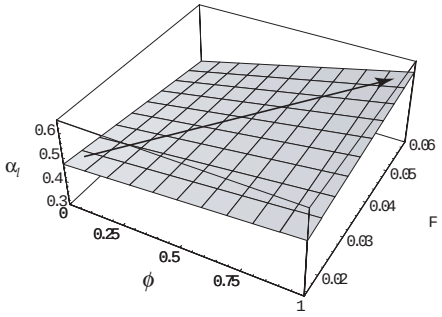
Figure 1 shows the result of changing the amount of funds and the proportion of funds in foreign currency for loans and deposits dollarization. When both variables are increasing (top right corner of Figure 1(a) and 1(b)) the foreign currency loans share (α_l) increases and the foreign currency deposits share actually decreases. Figures 1(c),1(e), and 1(d), 1(f) show the two dimensional slices from the Figures 1(a) and 1(b), respectively, holding F constant at high (0.06) and low (0.015) levels. If initial funds are high, banks have more leverage resulting in more sensitivity on foreign currency shares given a change in ϕ.

The fact that deposit dollarization is negatively affected by an increase in ϕ might seem surprising at first. However, this can be explained by the way banks are managing total funds (deposits plus F). If funds (F) are more concentrated in foreign currency (ϕ increases) banks find it optimal to offer better rates on foreign loans, attracting more demand for these loans from households. Households, therefore, decide to shift their portfolio towards foreign currency loans but due to risk aversion still want some local currency denominated loans. As a result, banks need a source of local currency funds and offer better deposit rates for domestic currency deposits, which, in turn leads to a shift towards local currency in the households' deposit portfolio. Hence the main implication from an increase in the proportion of funds in foreign currency is that loan dollarization should increase while deposit dollarization should decrease.

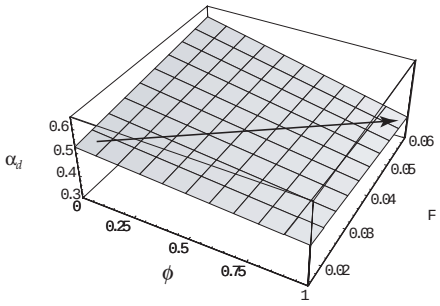
Note that when $\phi = 0.5$, banks have no "preference" between foreign and local currency loans and deposits, thus $R_d = R_d^*$ and $R_l = R_l^*$, which implies $\alpha_d = \alpha_l = \lambda_{MVP} = 0.5$. Our model therefore nests the MVP framework of Ize and Levy-Yeyati (2003).

Given that we obtain equilibrium rates for all the markets we can also calculate interest rate differentials (local currency minus foreign currency rates) for loans and deposits as well as margins (loan minus deposit rates) for foreign and local currency.

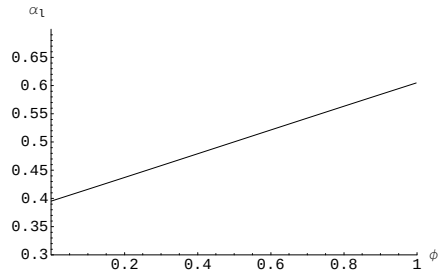
Figure 2 shows that interest rate differentials increase as ϕ and F increase. Hence there is a positive co-movement between loan differential and loan dollarization and a negative co-movement between deposit differential and dollarization. This is consistent with the bank's fund management rea-



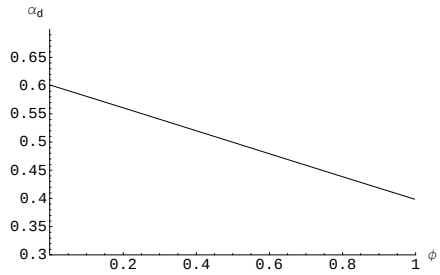
(a) Loan Dollarization



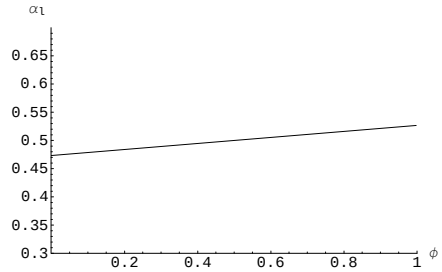
(b) Deposit Dollarization



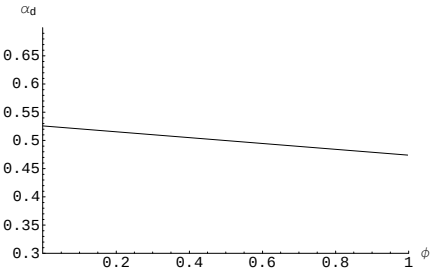
(c) Loan Dollarization - $F = 0.06$



(d) Deposit Dollarization - $F = 0.06$

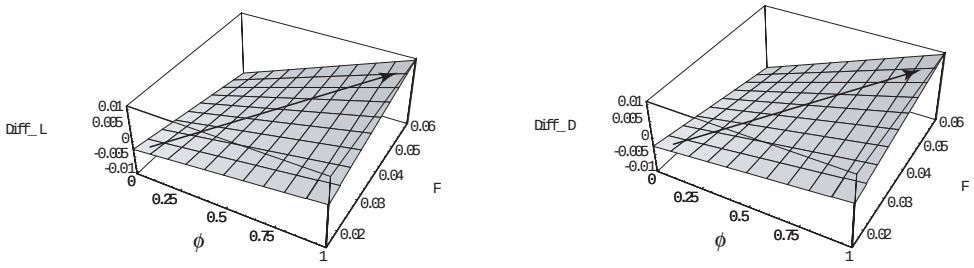


(e) Loan Dollarization - $F = 0.015$



(f) Deposit Dollarization - $F = 0.015$

Figure 1: Loans and Deposits Foreign Currency Shares as ϕ increases



(a) Loan Differential (b) Deposit Differential

Figure 2: Interest Rate Differentials

soning. As banks make foreign currency loans and local currency deposits more attractive both differentials increase (local currency loan and deposits rates increase while foreign currency rates decrease). This induces households to take more foreign currency loans and make less foreign currency deposits. Note that the relationship between interest rate differentials and dollarizations is easily verified by looking at the fund manager's first order conditions (equations (2) and (4)), since households will only deviate from the λ_{MVP} if the differentials move.

The direction of the movements of loan and deposit dollarization and of interest rate differentials as ϕ and F change are very robust across different parameterizations of the model. Movements in margins, however, depend on the parametrization of the model. More precisely, they depend on the amount of funds compared to deposits[17], and on the degree of monopoly power of banks[18] compared with how much banks care about loan market shares (γ). Given that we have assumed that funds are always within a specific range below 70% of deposits the first condition is not relevant for our analysis.

If banks have low market power (θ) relative to how much they care about market shares (γ) then margin in foreign currency increases while margin in local currency decreases as ϕ increases. The reason for this result is that as γ increases relative to $1/\theta$, the bank will be less willing to specialize in the foreign market. Hence banks will not move loan rates apart as much as they do for deposit rates leading to an increase in the foreign currency margin and a decrease in local currency margin. The opposite happens when banks

[17]Implicitly given by F and the intertemporal elasticity of substitution $1/\sigma$.

[18]Elasticity of substitution between different bank deposits and loans in the composite index θ.

market power is high and relevance of loan market share is low. Table 2 summarises the two cases.

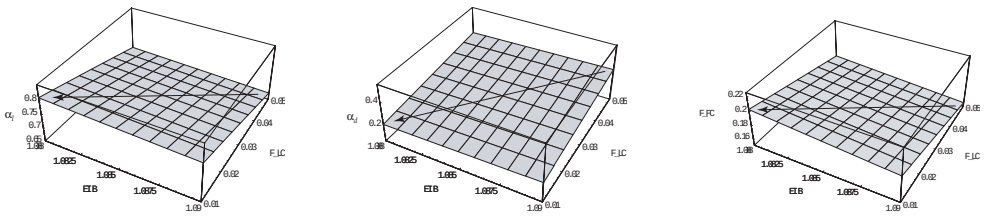
Table 2: Margins when ϕ increases for different parameter values

Case 1 - γ low relative to θ	
$R_l \uparrow\uparrow$ increases more than $R_d \downarrow$	Margin_LC $\uparrow$, $\alpha_l \uparrow$ and $\alpha_d \downarrow$
$R_l^* \downarrow\downarrow$ decreases more than $R_d^* \uparrow$	Margin_FC $\downarrow$, $\alpha_l \uparrow$ and $\alpha_d \downarrow$
Case 2 - γ high relative to θ	
$R_l \uparrow$ increases less than $R_d \uparrow\uparrow$	Margin_LC $\downarrow$, $\alpha_l \uparrow$ and $\alpha_d \downarrow$
$R_l^* \downarrow$ decreases less than $R_d^* \downarrow\downarrow$	Margin_FC $\uparrow$, $\alpha_l \uparrow$ and $\alpha_d \downarrow$

3.1 Model Extensions Results

3.1.1 Endogenous Foreign Funds - Results

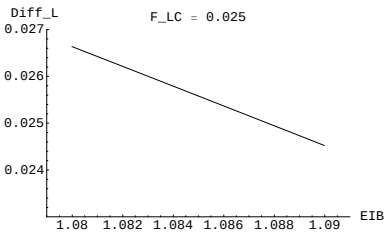
The main implications of the model do not change if banks are free to choose the amount of foreign funds. As figure 3 shows when the external interest rate EIB decreases and the amount of funds denominated in local currency (F_{LC}) decreases (bottom left hand corner), banks decide to increase the foreign denominated funding (F_{FC} or Foreign Liabilities) which leads to an increase in loan dollarization and a decrease in deposit dollarization. This follows the same pattern observed in the main model when initial funds were exogenous.



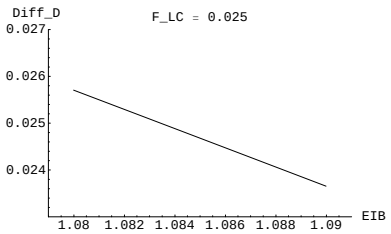
(a) Loans For. Currency Share (b) Deposits For. Currency Share (c) Funds in For. Currency

Figure 3: Dollarization and Foreign Funds as external rate and local currency funds increase

Interest rate differentials also move in the same fashion (Figure 4) as in the basic model, higher differentials lead to more loan dollarization and less

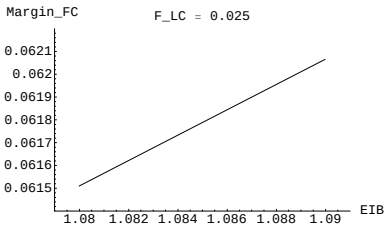


(a) Loan Differential

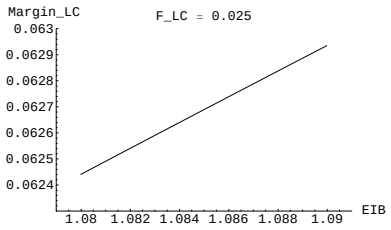


(b) Deposit Differential

Figure 4: Interest Rate Differentials - Endogenous Foreign Funds



(a) Margin in Foreign Currency Market



(b) Margin in Local Currency Market

Figure 5: Interest Rate Margins - Endogenous Foreign Funds

deposit dollarization. Interestingly both margins (Figure 5) now move in the same direction, decreasing as foreign liabilities increase. This is so since banks use foreign funds increasingly to supply the loan market without using deposits, leaving deposit rates roughly unchanged while moving both loan rates down.

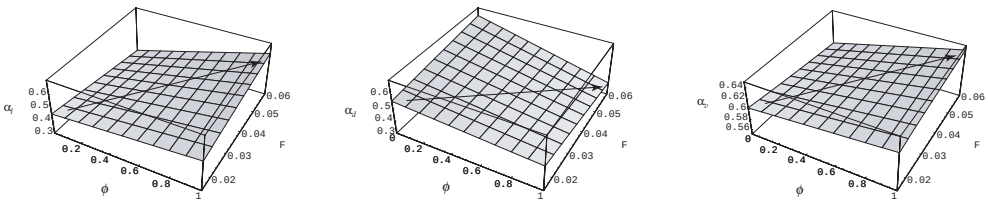
3.1.2 Model with Firms - Results

An extra set of parameters values must be chosen in order to solve the model with firms. They are shown in Table 3. The variance of M ($S_{M,M}$) is assumed to be 33% higher than the variances of real exchange rate and inflation, which were assumed to be equal. The correlation of real returns and real exchange rate ($\rho_{M,S}$), and real returns and inflation ($\rho_{M,\pi}$) are set to be equal to 0.4 and zero respectively. We will show how the model solution changes when these are changed. The value of the mean of M ($\bar{M}$) was set such that the probability of default is not greater than 20% across all our simulation and V (initial investment) was set as the mean value of total funds F, which in our simulation vary from 0.01 to 0.06.

Table 3: Additional Parameter Values

$S_{M,M}$	$\rho_{M,S}$	$\rho_{M,\pi}$	$\bar{M}$	V
0.04	0.4	0	1.6	0.03

We again analyze how financial dollarization (household loans, household deposits and firm loan (α_v) dollarization) changes when the ratio of foreign denominated funds (ϕ) increases together with an overall increase in total funds F. Figure 6 shows the results. The same pattern as in the basic model arises, loan dollarization for both firm and household increase and deposit dollarization decreases. Interest rate differential (not shown here) also moves in the same fashion as in the basic model. Therefore the main implications of our model are the same both for risk averse and risk neutral agents (allowing for default).



(a) Household Loans (b) Household Deposits (c) Firm Loans

Figure 6: Dollarization of Household and Firm Portfolios

Observe that when $\phi = 0.5$ the firm loan dollarization is 61% given that $\lambda_{COV} = 0.11$ and $\lambda_{MVP} = 0.5$ under the chosen parameter specification.

Figure 7 shows that the firm loan dollarization increases when the correlation between investment real return and real exchange rate ($\rho_{M,S}$) increases[19], as indicated by (15). Note that if both $\rho_{M,S}$ and $\rho_{M,\pi}$ are equal to zero, then λ_{COV} equals to zero and share of foreign denominated loans equals to $\lambda_{MVP} = 0.5$, reverting back to the solution of the household's portfolio decision.

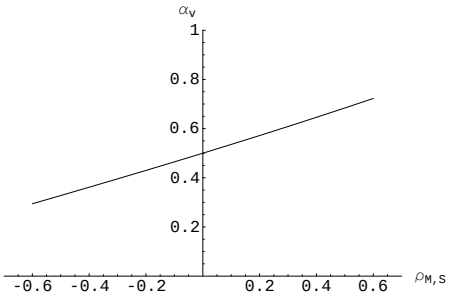


Figure 7: Firm Loan Dollarization and Correlation between investment return and real exchange rate

For economies with high degree of openness, a real depreciation of the local currency leads to higher real output/investment return, or in other words, greater the degree of openness higher the correlation between real exchange rate and real output changes (high $\rho_{M,S}$). Hence, an additional implication of the model when firms are included is that higher degree of openness leads to higher corporate financial dollarization as firms use their loan portfolio selection as a hedging strategy against default.

4 Data and Methodology

4.1 Data

Our analysis is based on a unique monthly data set compiled mostly from national central banks for the panel of 24 transition economies (Table 29 in the appendix). In line with the variables included in our theoretical model and suggested by the literature we collected data for credit and deposits denominated in foreign and domestic currency, and their respective interest

[19]Setting $\rho_{M,\pi}$ =0. The same pattern would be observed if $\rho_{M,\pi}$ changes, holding ρ_{MS} fixed.

rates. For the majority of the countries in our sample we can distinguish between individuals and firms, long term and short term FD. For some of the countries we also obtained data for euro denominated credit and deposits.

The time series available are of varying length resulting in an unbalanced panel. For some of the countries (Bosnia and Herzegovina, Serbia and Montenegro) no interest rate data is available or it is available only for loans but not for deposits (Russia). After examining our data set we decided to use data from January 2000 onwards to avoid the problem of dealing with the effects of the Russian crisis.

We construct a measure of the share of foreign loans taking a ratio of foreign currency denominated and total domestic credit. We calculate this ratio for overall credit[20], individuals and nonfinancial corporations (NFC). The share of foreign currency denominated deposits is constructed in the same fashion. All these measures are constructed using stock variables if available. For countries where stock variables are not available, new business loans and deposits are used (e.g. Albania).

To verify the implications of our theoretical model we calculate interest rate differentials for loans and deposits (ir_dif_d and ir_dif_l), defining the differential as foreign currency interest rate minus the domestic currency interest rate. In constructing this measure one year interest rates on the stock values are used if available. If not available longer maturity or new business measures are used. In case aggregate rates are not available, interest rates on loans and deposits by NFCs are used as proxies. For a few countries in the sample it is possible to distinguish between differentials faced by households and NFCs.

In order to incorporate a measure of competitiveness and market structure we calculate interest rate margins in local and foreign currency ($margin\_lc$ and $margin\_fc$). As in the model margins are defined as the difference between the loan and deposit rates in each currency.

Our model suggests that FD is also determined by λ_{MVP} which is defined as in Ize and Levy-Yeyati (2003):

$$\lambda_{MVP} = \frac{S_{\pi,\pi} + S_{\pi,S}}{S_{\pi,\pi} + S_{S,S} + 2S_{\pi,S}}$$

[20]This measure refers to households and firms only. In some countries, however, a broader measure was used, as it was not possible to exclude government and financial institutions from domestic credit.

where, $S_{\pi,\pi}$ and $S_{S,S}$ are variances, and $S_{\pi,S}$ is the covariance of inflation and change in real exchange rate.

While the minimum variance portfolio rationale may be true, it relies on obtaining forward looking variances of inflation and change in the real exchange rate. As these are not observed, the most common alternative is to use historical information to calculate variances. This practice, however, introduces mismeasurement of λ_{MVP}, which may lead to wrong inference and even rejection of the theory. Trying to overcome this difficulty we calculate λ_{MVP} estimating variances and covariances of inflation and change in the real exchange rate over varying period lengths and with respect to different currencies.

One could estimate variances over the whole sample period, but this would introduce lookahead bias and make it impossible to account for unobserved heterogeneity in our empirical analysis. Thus, as a compromise, we estimate λ_{MVP} based on all historical information up to the observation point[21]. The change in the real exchange rate (S) is calculated as a percentage change in the real exchange rate over the period of one year. Inflation is computed in the same fashion, calculating the percentage change in the consumer price index over one year.

As it can be seen from Table 7, the proportion of foreign currency loans or deposits denominated in euro is quite significant. In addition, a number of countries in the region have exchange rate regimes referenced to the euro. Hence our focus is on the euro/local currency exchange rate, which is only available since 1999. However, not accounting for pre 1999 exchange rate variability risks losing information that agents may take into account when forming expectations about future exchange rate variability. Therefore, we are faced with the challenge of choosing the relevant exchange rate for the pre 1999 period. For this period we estimate the variance of the change in the real exchange rate using either the US dollar exchange rate (*lambda_mue*) or the Deutsche Mark exchange rate (*lambda_mde*).

Note that for currency board countries the variability of real exchange rate is directly linked to the variability of inflation, thus if a currency board is fully credible, λ_{MVP} is theoretically undefined. In other words, there would be no difference between local currency and foreign currency denominated

[21] Various other possibilities were investigated, estimating λ_{MVP} over various moving window length (1 year, 2 years, etc.). After careful investigation it appeared that moving window methodology "forgets" periods of high variability and results in very volatile estimates of λ_{MVP}.

assets. However, as the observed returns are in fact different these assets are not the same. Hence one must decide how to estimate λ_{MVP} for currency board countries. In what follows we calculate λ_{MVP} as for the other countries relying on the small deviations of exchange rate due to transaction costs and/or bid/ask spread movements.

One of the implications of our model is that increasing ϕ (proportion of foreign currency denominated funds) leads to increasing loan dollarization and decreasing deposit dollarization. To test this hypothesis we construct an empirical counterpart of ϕ taking the ratio of foreign liabilities[22] of banks as a share of total funds net of deposits (i.e. foreign liabilities + capital). Implicit is the assumption that all foreign liabilities are denominated in foreign currency, which is the case for transition economies. Since no consistent measure of total bank capital is available we proxy it by assuming that the actual capital adequacy ratio of the banking system in each country is binding. It has to be noted that regulatory capital may differ from accounting capital. The constructed variable is defined as:

$$ratio = \frac{foreign\ liabilities}{foreign\ liabilities + total\ assets * CAR}$$

where CAR is the actual capital adequacy ratio of the banking system as reported by Barth, Caprio, and Levine (2004) and the accompanying data set provided by the World Bank[23].

While presenting our theoretical model we linked access to foreign funds to the level of foreign bank penetration in the domestic banking local system. The European Bank for Reconstruction and Development (EBRD) publishes two indexes of foreign bank penetration, one measuring the percentage of foreign ownership of total assets (*sfb_ta*) and one measuring the number of foreign owned banks (*sfb_nb*). These are provided only yearly, and hence can not be directly used in our empirical analysis. Nonetheless we found a strong positive correlation between the level of foreign liabilities in the banking sector and both measures of foreign bank penetration for almost all the countries in our sample (see table 6).

[22]Note that all banks and bank-like institutions resident in a country are covered by the banking sector survey used to measure foreign liabilities. Specifically, "a subsidiary unit of a non-resident principal is regarded resident of the economy in which its operations are carried out" (International Monetary Fund (1984)), thus the mode of entry of foreign banks (subsidiaries versus branches) do not affect the foreign liabilities measure.

[23]Accessible at http://www.worldbank.org/research/projects/bank_regulation.htm.

As regards to the correlation between *ratio* and foreign bank penetration we found it positive for some countries and negative for others. On one hand, as foreign banks enter into the local financial system, through privatization or greenfield direct investments, total capital in the banking sector increases leading to an overall improvement of the banking system and a decrease in *ratio*. On the other hand, foreign bank ownership leads to higher levels of foreign liabilities, which in turn increases *ratio*. Therefore, the variable *ratio* captures both effects of foreign bank penetration, higher levels of foreign liabilities and higher capitalization of the banking sector.

As suggested by Barajas and Morales (2003) we also control for different exchange rate regimes by using a central bank intervention index that compares the variabilities of international reserves and the exchange rate. The index is defined as:

$$interv = \frac{\left(\frac{\Delta int\_res}{broad\_m}\right)^2}{\left(\frac{\Delta er}{er}\right)^2 + \left(\frac{\Delta int\_res}{broad\_m}\right)^2}$$

where int_res stands for international reserves, $broad\_m$ for broad money and er for local currency/euro exchange rate. The variable used in our empirical analysis is smoothed taking the moving average over 12 months. A country with low (high) variability in exchange rate and high (low) variability in international reserves is said to have a *de facto* pegged (floating) exchange rate regime. Note that according to this measure a country with low variability of exchange rate and low variability of international reserves is of "unknown" exchange rate regime. It may be that the exchange rate is pegged and there is little central bank intervention, or that the exchange rate is freely floating but is barely changing.

In our model firm loan dollarization is shown to be dependent on how open an economy is. Besides that, it is important to control for real dollarization, which can be proxied by the openness of the economy. Hence we also include openness, computed as the ratio of total imports and exports compared to quarterly GDP ($open = \frac{imp+exp}{GDP}$), as an explanatory variable. Finally, we control for different levels of credit market development including a market depth variable ($depth$), which is calculated as a ratio of domestic credit to GDP. Both variables are smoothed taking the moving average over 12 months.

4.2 Descriptive Statistics

Figure 8 shows the variability and the median of dollarization over the sample period for every country. Shaded bars represent 25-75 percentile of observations, while vertical lines show the range of variation. The median is denoted by a light line in the shaded bar. As can immediately be seen loan and deposit dollarization are not exactly two sides of the same coin. There are countries in our sample that have loan dollarization being higher than deposit dollarization and vice versa. One can notice that there is a large variation in dollarization for Serbia and Montenegro (CS) and Bosnia and Herzegovina (BA). This is explained by the fact that in CS as of June 2006 around 80% of local currency loans had a foreign currency indexation clause that linked repayments of principal and interest to the evolution of the dinar exchange rate.[24] It is suspected that something similar is happening in BA. Loan indexation is also prevalent in Croatia, but, we managed to obtain indexation adjusted data for this country. As indexation adjusted data and interest rate data for BA and CS are not available these countries will not be included in our empirical analysis.

Over time FD is evolving quite differently across countries (Figure 9). Loan dollarization is increasing in Bulgaria, Estonia, Hungary, Latvia, Poland, Slovenia and Slovakia, while deposit dollarization in these countries is falling with the exception of Latvia. It is also apparent that household loan dollarization is lower compared to firm dollarization (Table 4). This seems to be true for all the countries except of Croatia and Latvia. Deposit dollarization, though being higher for households in general, is very much country specific. Long term loan dollarization is prevailing, while there is no clear distinction between short term and long term deposit dollarization (short term being defined as less than one year).

For several countries in our sample we are able to estimate the share of foreign loans and deposits denominated in euro. The share of the euro among foreign currency denominated loans is relatively high. With the exception of Bosnia and Herzegovina euro loan denomination is more frequent than deposit euro denomination (Table 7).

The step change in deposit dollarization that can be observed in FYR Macedonia around January 2002 (Figure 9) can be explained by the euro cash changeover effect. As high levels of euro legacy currency holdings had to be exchanged to euro, some holdings were no longer held in cash "under

[24] "Survey of Banks Business Activities and Intentions" National Bank of Serbia

Table 4: Loan and deposit dollarization across countries (total, individual/nonfinancial corporate, short term/long term, 2000-2006

Country	ls_tot	ls_ind	ls_nfc	ls_st	ls_lt	ds_tot	ds_ind	ds_nfc	ds_st	ds_lt
AL	0.68	.	.	0.64	0.77	0.31	0.26	0.54	0.47	0.2
AM	.	.	.	.	.	0.75	.	.	.	.
AZ	0.62	.	.	0.59	0.69	0.59	0.89	0.38	.	.
BA	0.39	.	.	.	.	0.52	.	.	0.37	0.79
BG	0.41	0.08	0.54	0.42	0.4	0.5	0.6	0.46	0.5	0.4
BY	.	.	.	.	.	0.57	0.51	0.63	0.59	0.56
CS	0.35	0.06	0.41	0.17	0.51	0.63	0.78	0.48	0.63	0.66
CZ	0.14	0.01	0.19	0.13	0.14	0.11	0.07	0.2	0.13	0
EE	0.8	0.68	0.8	0.6	0.82	0.3	0.19	0.42	0.29	0.41
GE	0.83	.	.	0.75	0.91	0.94	.	.	0.93	0.96
HU	0.35	0.13	0.39	.	.	0.17	0.15	0.21	0.18	0.01
HR*	0.78	0.82	0.73	.	.	0.65	0.79	0.36	.	.
KZ	0.57	.	.	.	.	0.51	0.6	0.44	.	.
LT**	0.64	0.46	0.66	0.46	0.61	0.4	0.24	0.37	0.22	0.23
LV	0.61	0.65	0.59	.	.	0.41	0.44	0.37	.	.
MD	0.72	0.02	0.84	.	.	0.5	.	.	.	0.5
MK	0.2	0.01	0.24	0.14	0.27	0.48	0.66	0.29	.	.
PL	0.16	0.09	0.28	0.05	0.33	0.17	0.16	0.2	0.17	0.18
RO	0.59	0.29	0.62	0.52	0.69	0.44	0.74	.	.	.
RU	0.31	0.2	0.33	0.23	0.51	0.39	0.32	0.63	0.4	0.41
SI	0.25	0.02	0.34	0.2	0.27	0.33	0.42	0.21	0.35	0.25
SK	0.18	0.01	0.3	.	.	0.15	0.13	0.19	0.39	.
TJ	0.7	.	.	.	.	0.57	0.81	0.47	.	.
UA	0.43	.	.	0.35	0.53	0.35	.	.	0.26	0.44
Total	0.47	0.21	0.47	0.35	0.51	0.44	0.46	0.39	0.4	0.42

Source: National Central Banks
* Adjusted for indexation
** Split into short term/long term and individual/nonfinancial corporate is for euro denomination only.

Table 5: Correlation of loan and deposit dollarization, 2000-2006

Country	Correlation
AL	0.0778
AZ	-0.4538
BA	0.7088
BG	-0.8201
CS	-0.8333
CZ	0.6954
EE	-0.5933
GE	0.8124
HU	-0.5577
HR	0.8744
KZ	0.7933
LT	0.7076
LV	0.6675
MD	0.3912
MK	-0.2490
PL	-0.2843
RO	0.4952
RU	0.6850
SI	-0.0202
SK	-0.7123
TJ	-0.4376
UA	0.7836
Overall	0.5770

Source: National Central Banks

Table 6: Correlation of *ratio* (1-2),foreign liabilities (3-4) and different measures of foreign bank presence

Country	sfb_ta	sfb_nb	sfb_ta	sfb_nb
	(1)	(2)	(3)	(4)
AL	0.9400	0.7512	0.9182	0.6865
AM	-0.2201	-0.1636	0.7988	0.9236
AZ	-0.4040	-0.0296	0.5166	0.7735
BA	-0.9375	-0.9584	-0.6011	-0.6448
BG	0.7039	-0.2653	0.5422	0.3908
BY	0.8743	0.8743	0.9117	0.8870
CS	-0.5649	-0.6833	0.0592	0.0079
CZ	-0.2718	-0.1547	-0.0432	0.1129
EE	0.8610	0.8487	0.5376	0.7697
GE	-0.0911	0.0928	0.7208	0.7372
HU	-0.2277	-0.0528	0.3759	0.5745
HR	0.1806	-0.0915	0.6630	0.4568
KZ	-0.1002	-0.9120	-0.2825	-0.6681
LT	0.8196	0.7829	0.6004	0.4912
LV	0.2590	0.4268	-0.3731	-0.2467
MD	-0.2634	-0.6053	0.3621	0.6646
MK	-0.1181	-0.2308	0.5741	0.4737
PL	0.8888	0.9114	0.8845	0.9463
RO	0.1753	0.2560	0.5398	0.5166
RU	0.7631	0.4543	0.1403	0.7664
SI	0.7598	0.8308	0.7438	0.8087
SK	0.2735	0.2891	0.4895	0.4743
TJ	-0.2979	0.1361	-0.8437	0.9197
UA	-0.2188	0.4730	0.4682	0.5811
Overall	0.2524	-0.0888	-0.0835	0.0820

Source: National Central Banks and EBRD

Table 7: Share of foreign loans and deposits denominated in euro, 2000-2006

Country	ls_eur	ds_eur
AL	0.58	0.46
BA	0.48	0.81
BG	0.87	0.59
CZ	0.68	0.64
EE	0.91	0.4
LT	0.76	0.48
SK	0.74	0.63
Total	0.7	0.58

Source: National Central Banks

Table 8: Interest rate differentials (on loans and deposits) and interest rate margins(in foreign currency and local currency), 2000-2006

Country	ir_dif_l	ir_dif_d	margi_fc	margi_lc
AL	6.30	4.95	5.49	6.83
AM	0.22	2.59	15.11	12.74
AZ	-1.38	0.01	9.29	7.90
BA	.	.	.	.
BG	3.08	0.78	8.01	10.32
BY	5.92	16.16	.	.
CS	.	.	.	.
CZ	0.91	-0.16	1.86	2.81
EE	2.12	0.07	2.24	4.04
GE	2.24	-3.44	12.07	17.76
HU	5.43	4.16	1.79	4.55
HX	4.14	1.10	1.83	7.57
KZ	3.23	0.87	9.23	11.59
LT	1.51	-0.31	3.42	5.35
LV	3.88	1.01	2.49	3.86
MD	11.17	12.23	8.43	7.37
MK	4.58	4.01	6.47	7.04
PL	5.33	2.37	3.80	6.76
RO	13.96	8.34	4.31	9.93
RU	5.33	.	.	10.79
SI	3.07	1.78	2.90	5.17
SK	1.27	0.65	1.41	2.01
TJ	0.56	0.07	18.00	18.50
UA	11.72	3.10	6.89	15.51
Total	4.29	2.78	7.18	8.89

Source: National Central Banks

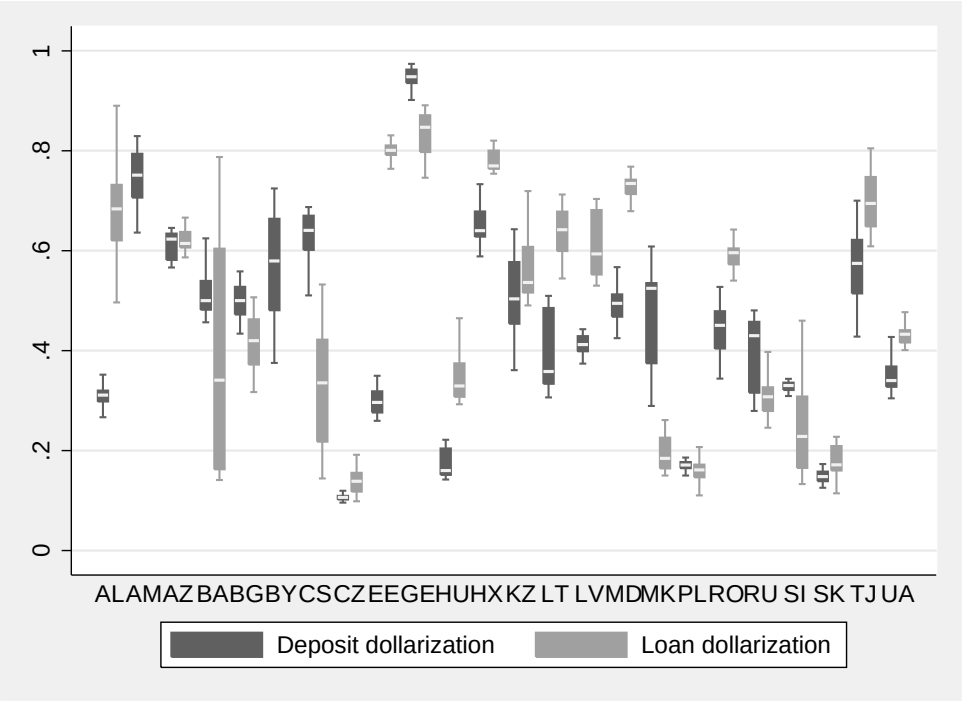


Figure 8: Financial dollarization in transition economies, 2000-2006

the mattress" but rather were deposited in euro denominated accounts. This is not observed for the other countries in our sample.

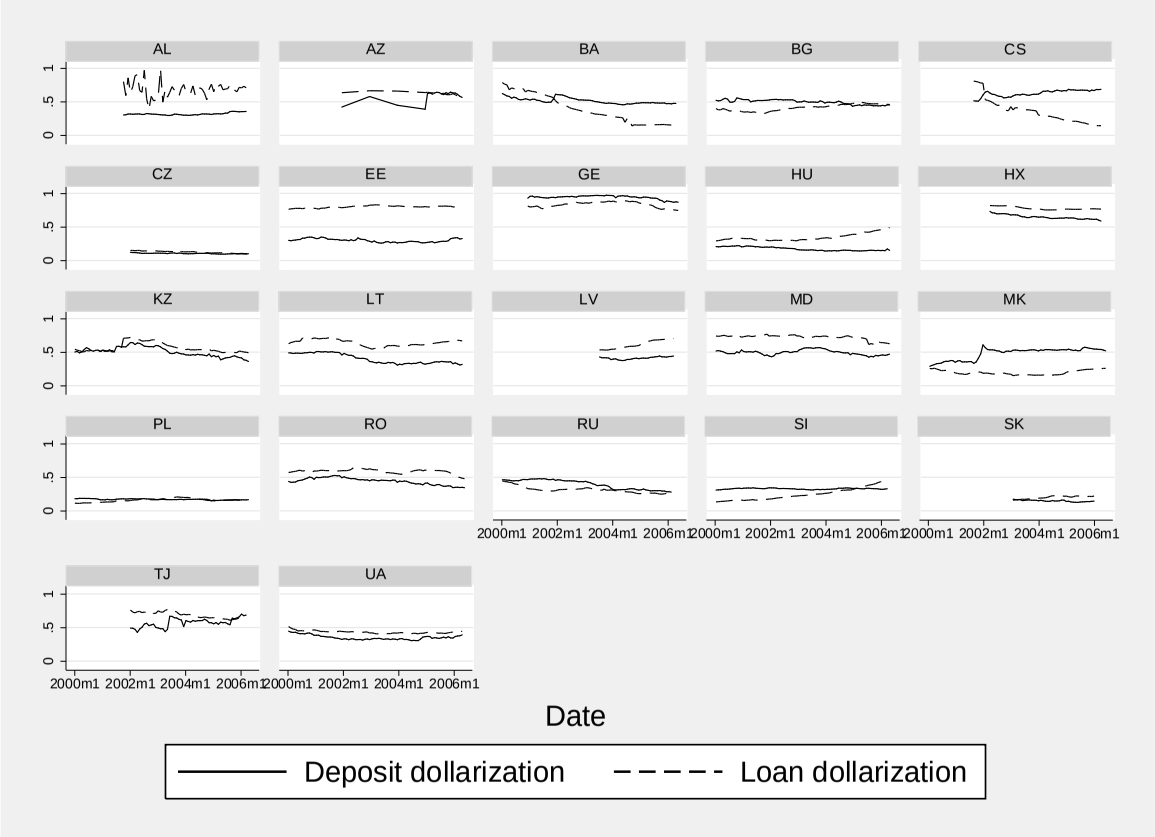


Figure 9: Financial dollarization

4.3 Methodology

Based on the existing literature and the implications of our theoretical model we estimate the following model:

$$share_{it} = \beta_1 ratio_{it} + \beta_2 \lambda_{it} + \beta_3 ir\_dif_{it} + \gamma margin_{it} + \delta macro_{it} + c_i + e_{it} \quad (20)$$

Where *share* stands for dollarization (loans or deposits), *ratio* is the proportion of foreign currency denominated funds (as defined above, and which aims to capture foreign bank penetration), ir_dif stands for the interest differentials (loans and deposits) and *margin* stads for the interest rate margins (local currency and foreign currency). Finally, *macro* stands for the following macroeconomic controls: openness of the economy, exchange rate regime, and financial depth. After examination (Hausman specification test) fixed effects are included to control for unobserved heterogeneity.

Equation 20 is estimated via FGLS with panel heteroscedasticity and panel specific autocorrelation. Modified Wald test for groupwise heteroscedasticity rejects the null of $\sigma_i^2 = \sigma^2$ and partial autocorrelation function of the error term dies out quickly justifying AR1 structure for the error term.

Endogeneity of interest rate differentials and margins may be suspected. Formal endogeneity tests were not carried out due to the lack of proper instruments. However, to account for possible endogeneity the model is estimated using lagged values of interest rate differentials and margins. In any case, estimation of the model based on the contemporaneous variables yields qualitatively similar results.

Four specifications of equation 20 are considered. First of all they differ in the way λ_{MVP} is calculated. In the first specification we use *lambda_mue*.[25] In the second specification *lambda_mde* is used.[26] The third and fourth specifications are estimated excluding currency board countries from the sample.

Tables 9 and 10 report regression results with the levels of dollarization as dependent variables, while tables 11 and 12 report regression results with the change in dollarization as a dependent variable. As our variables for FD are calculated using stock measures they can not capture well the changes in the dollarization of the new loans and deposits. Since the measures of new business activity are not available we proxy it by looking at the changes in the stock variables.

[25] Using the euro/local currency exchange rate since 1999 and the USD/local currency exchange rate prior to 1999.

[26] Using the euro/local currency exchange rate since 1999 and the DEM/local currency exchange rate prior to 1999.

Regression results reported in columns 1 through 6 correspond to the use of *lambda_mue* and columns 7 through 12 correspond to the use of *lambda_mde*. In the odd columns of the tables we report estimation results where the dependent variable is loan dollarization, while in the even columns we report results for deposit dollarization. Estimations are carried out for total (columns 1-2 and 7-8), individual (columns 3-4 and 9-10), and nonfinancial corporate dollarization (columns 5-6 and 11-12).

5 Estimation results

The main estimation results are reported in tables 9 through 12.

Share of funds in foreign currency

As predicted by the model, the share of funds in foreign currency (*ratio*) has a positive impact on loan dollarization and a negative impact on deposit dollarization. This result is very robust across specifications. While *ratio* is found to be very significant in explaining total and NFC loan and deposit dollarization, it fails to explain loan dollarization by individuals.

Although we find that *ratio* has a positive effect on the change in loan dollarization and a negative effect on the change in deposit dollarization by individuals, overall significance of *ratio* explaining the change in dollarization is minimal. This lends support to the explanation that the *level* of dollarization is dependent on the share of foreign funds, while the variability around that level is not. This is in line with the view that increased foreign bank presence in the region, by allowing banks to have greater access to foreign funds, has contributed to loan dollarization. Consistent with our model, access to foreign funds leads to lower deposit dollarization.

Minimum variance portfolio dollarization

Estimation results confirm the theoretical argumentation of Ize and Levy-Yeyati (2003), incorporated into our model, that the level of dollarization is increasing with the increase in λ_{MVP}. This results is quite robust no matter what measure of λ_{MVP} is being used. It must be noted, though, that the coefficient appears to be negative for household and firm loan dollarization (but not for total) when the currency board countries are included in the

sample (Table 9 columns 3, 5, and 9). This artifact disappears if the currency board countries are dropped from the sample. As discussed above, theoretically, λ_{MVP} is not defined for currency board countries. It may be argued that λ_{MVP} should be dropped in case currency board countries are included, but then the model is misspecified with respect to non currency board countries. Tables 19 and 20 in the appendix show that the exclusion of λ_{MVP} in the regressions with currency board countries does not alter the qualitative results.

We also find that *lambda_mue* has a positive impact on the change in loan dollarization for all sectors of the economy. This holds both for the whole sample and when the currency board countries are dropped suggesting that minimum variance portfolio argumentation is also relevant in explaining new loan dollarization.

Interest rate differentials

The estimation results suggest that interest rate differentials influence the currency composition of loans and deposits. Interest rate differentials have better explanatory power on changes in dollarization as compared to its level.

Estimation with the *change* in dollarization as a dependent variable yields consistent results for all the specifications. The interest rate differential on loans has a positive effect on loan dollarization, while the interest rate differential on deposits has a negative effect on deposit dollarization. This is in line with the predictions of the model and appears to be the case for households and firms.

Analyzing the impact of interest rate differentials on the *level* of FD, we find that deposit dollarization of the individuals and firms is affected by interest rate differential. It is higher when interest rate differential on deposits is lower (Table 9 and 10). This is also consistent with our model.

The fact that interest rate differentials have almost no impact on the *level* of dollarization may be explained by the way we measure it. The share of foreign currency denominated loans and deposits being used in our estimation is calculated from the stock variables, which naturally responds less to interest rate differentials. Therefore, it is expected that interest rate differentials have stronger explanatory power on new businesses than on stock variables.

Margins

The prediction of our model is that relation of margins to dollarization depends consistently on the parametrization of the model. In case banks care a lot about the loan market share relative to their market power, foreign currency margin and loan dollarization move in the same direction, while local currency margin moves in the opposite direction (as share of funds in foreign currency changes). This would predict a positive sign on $margin\_fc$ and a negative sign on $margin\_lc$ in explaining loan dollarization. Signs for deposit dollarization should be reversed.

However, empirical results on margins explaining the level of dollarization do not lend consistent support to the model implications. Increasing domestic margins seem to be decreasing loan dollarization, but this result is not robust if currency board countries are excluded from the sample. Margins on foreign currency ($margin\_fc$) appear to have weak predicting power or yield contradicting results.

In the regressions with the change in dollarization as the dependent variable margins appear to have higher explanatory power. Local currency margin decreases loan dollarization (as is predicted by the model in case 2). Deposit dollarization though, increases with $margin\_fc$ (opposite of case 2).

One rationalization of this result is that in reality banks care not only about loan market share (as is modeled), but also about deposit share. Thus, as the deposit market share becomes important, increasing domestic (foreign) margins should decrease (increase) dollarization of deposits (as is confirmed by regression results in Table 11 and 12).

This result can also be rationalized by the fact that in these economies bank market power is comparatively high and banks are increasingly doing business in the currency with higher return. If local currency margin increases, dollarization of deposits and loans decreases, while increasing foreign currency margin has the opposite effect.

Macroeconomic conditions

In specifications with the level of FD as the dependent variable openness of the economy is found to be increasing deposit dollarization, while at the same time it is decreasing loan dollarization. If the currency board countries are dropped from the sample openness looses significance in explaining loan dollarization. However, openness has a positive impact for corporate loan and

deposit dollarization with and without the currency board countries. This confirms the implication of our model with firms and furthermore indicates that real dollarization contributes to FD.

The central bank intervention index (*interv*) has mostly no explanatory power. For the few specifications where this variable is significant it seems to have a negative impact on deposit dollarization.

Despite the fact that more interventions would lead to less variability in foreign exchange rate and therefore a shift towards dollarization, λ_{MVP} is already capturing that effect as argued by Ize and Levy-Yeyati (2003). Hence the extra explanatory power of interventions could be coming from the increased confidence in local currency. This can be confirmed by the fact that when λ_{MVP} is excluded from the regression, intervention looses its significance (Table 19 and 20).

The signs of credit market depth (*depth*) coefficient seem to match with the signs of the coefficients of the *ratio* variable (positive for loans and negative for deposits). That leads us to conclude that domestic credit growth in transitional economies is mostly driven by the influx of foreign funds (through the increase in foreign liabilities).

Table 9: Financial dollarization estimation results (GLS)

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	0.044**	-0.087***	0.015	-0.039**	0.153***	-0.271***	0.047***	-0.066***	0.011	-0.034**	0.158***	-0.267***
	(2.51)	(-5.06)	(1.45)	(-2.50)	(4.61)	(-6.94)	(2.65)	(-4.06)	(1.23)	(-2.19)	(4.85)	(-6.36)
open	-0.025*	0.046***	-0.018***	-0.002	0.047***	0.101***	-0.014	0.057***	-0.018***	0.011	0.052***	0.108***
	(-1.92)	(2.74)	(-6.74)	(-0.13)	(3.07)	(3.43)	(-1.19)	(3.37)	(-7.57)	(0.76)	(3.37)	(3.62)
interv	0.004	0.004	0.000	0.002	-0.006	-0.024	0.003	-0.000	-0.001	-0.000	-0.005	-0.017
	(0.45)	(0.43)	(0.06)	(0.20)	(-0.50)	(-1.21)	(0.35)	(-0.05)	(-0.23)	(-0.05)	(-0.41)	(-0.79)
lambda_mue	0.068**	0.289***	-0.052**	0.062**	-0.201*	0.356***						
	(2.21)	(8.22)	(-2.52)	(1.98)	(-1.92)	(4.99)						
lambda_mde							0.041**	0.084***	-0.050***	0.030**	-0.016	0.067***
							(2.45)	(4.07)	(-3.11)	(2.37)	(-0.63)	(2.69)
depth	0.053	-0.248***	0.306***	-0.280***	0.195***	-0.021	0.021	-0.302***	0.303***	-0.291***	0.175***	0.030
	(1.02)	(-7.09)	(11.87)	(-8.36)	(3.82)	(-0.37)	(0.48)	(-8.10)	(12.23)	(-8.29)	(3.46)	(0.48)
margin_fc	-0.000	0.000					-0.000	0.000				
	(-0.94)	(0.74)					(-0.29)	(0.90)				
margin_lc	-0.000	-0.000					0.000	-0.000				
	(-0.58)	(-0.67)					(0.17)	(-0.41)				
margin_fc_ind			-0.000	0.000					-0.000	0.000		
			(-0.10)	(0.67)					(-0.39)	(0.70)		
margin_lc_ind			-0.000*	0.000					-0.000**	-0.000		
			(-1.90)	(0.04)					(-2.28)	(-0.11)		
margin_fc_nfc					-0.001	-0.000					-0.001	-0.000
					(-1.38)	(-0.31)					(-1.56)	(-0.37)
margin_lc_nfc					-0.001**	0.000					-0.001**	0.000
					(-2.07)	(0.25)					(-2.08)	(0.44)
ir_dif_l	0.000						0.000					
	(0.52)						(1.25)					
ir_dif_d		-0.000						-0.000				
		(-1.07)						(-0.53)				
dif_l_ind			0.000						0.000			
			(0.75)						(0.81)			
dif_d_ind				-0.001***						-0.001***		
				(-2.74)						(-2.76)		
dif_l_nfc					-0.000						-0.000	
					(-0.84)						(-0.99)	
dif_d_nfc						-0.001						-0.001
						(-1.10)						(-0.68)
Log L	2751	2899	1877	2107	1539	1446	2740	2885	1878	2105	1535	1439
N	850	921	476	591	456	561	850	921	476	591	456	561

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 10: Financial dollarization estimation results (GLS): dropping currency board countries

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	0.041**	-0.059***	-0.001	-0.022	0.062	-0.275***	0.051**	-0.056***	-0.002	-0.020	0.084**	-0.260***
	(2.07)	(-3.20)	(-0.07)	(-1.08)	(1.43)	(-6.81)	(2.43)	(-2.95)	(-0.26)	(-1.00)	(2.03)	(-6.33)
open	-0.021	0.055***	-0.001	0.006	0.065***	0.065**	-0.015	0.081***	-0.002	0.015	0.067***	0.102***
	(-1.52)	(2.81)	(-0.59)	(0.27)	(4.85)	(2.02)	(-1.08)	(4.10)	(-1.10)	(0.68)	(5.10)	(3.26)
interv	0.017	-0.005	0.001	-0.003	0.009	-0.053**	0.016	-0.019*	0.004	-0.001	0.009	-0.094***
	(1.64)	(-0.42)	(0.29)	(-0.25)	(0.56)	(-2.45)	(1.63)	(-1.65)	(0.85)	(-0.09)	(0.55)	(-4.73)
lambda_mue	0.083***	0.199***	0.006	0.030	0.121	0.375***						
	(2.61)	(4.30)	(0.45)	(0.67)	(1.16)	(4.56)						
lambda_mde							0.111***	0.125***	0.063***	0.054**	0.168***	0.094**
							(4.04)	(4.84)	(3.71)	(2.05)	(3.80)	(2.45)
depth	-0.011	-0.181***	0.021	-0.511***	-0.133	0.065	-0.059	-0.375***	0.062***	-0.481***	-0.149*	0.189**
	(-0.16)	(-2.70)	(1.35)	(-8.64)	(-1.49)	(0.80)	(-0.93)	(-6.21)	(2.88)	(-8.12)	(-1.89)	(2.33)
margin_fc	-0.000	0.000					-0.000	0.000				
	(-0.72)	(1.00)					(-0.67)	(1.14)				
margin_lc	-0.000	-0.000					0.000	-0.000				
	(-0.31)	(-0.86)					(0.14)	(-0.68)				
margin_fc_ind			0.000	0.000					0.000	-0.000		
			(0.24)	(0.01)					(0.52)	(-0.05)		
margin_lc_ind			-0.000	-0.000					-0.000	-0.000		
			(-0.42)	(-1.19)					(-1.08)	(-1.01)		
margin_fc_nfc					-0.000	0.001					-0.001	0.001
					(-0.80)	(0.74)					(-0.96)	(0.88)
margin_lc_nfc					-0.000	-0.002*					-0.000	-0.002*
					(-0.75)	(-1.65)					(-0.60)	(-1.85)
ir_dif_l	0.000						0.000					
	(0.76)						(0.83)					
ir_dif_d		-0.000						-0.000				
		(-0.40)						(-0.17)				
dif_l_ind			0.000						0.000			
			(0.28)						(0.78)			
dif_d_ind				-0.001*						-0.001*		
				(-1.81)						(-1.84)		
dif_l_nfc					0.000						-0.000	
					(0.18)						(-0.37)	
dif_d_nfc						-0.003**						-0.003***
						(-2.38)						(-2.72)
Log L	1968	2206	1381	1444	971	1027	1959	2187	1343	1455	974	1019
N	625	696	307	422	281	388	625	696	307	422	281	388

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 11: Change in financial dollarization estimation results (GLS)

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	0.020**	-0.004	0.002	-0.036***	0.002	-0.008	0.014*	-0.004	0.003	-0.037***	0.001	-0.007
	(2.47)	(-0.48)	(0.51)	(-3.72)	(0.20)	(-0.33)	(1.80)	(-0.53)	(0.65)	(-3.79)	(0.10)	(-0.29)
open	0.001	-0.006*	0.003	0.003	0.004	-0.004	-0.000	-0.006*	0.003	0.003	0.005	-0.002
	(0.29)	(-1.94)	(1.45)	(1.00)	(1.10)	(-0.41)	(-0.18)	(-1.95)	(1.28)	(0.93)	(1.15)	(-0.24)
interv	-0.005*	0.004	0.006**	0.007*	0.001	0.005	-0.004	0.004	0.006***	0.007*	0.002	0.004
	(-1.69)	(1.00)	(2.37)	(1.93)	(0.28)	(0.40)	(-1.44)	(1.01)	(2.75)	(1.92)	(0.37)	(0.34)
lambda_mue	0.020**	-0.003	0.018**	0.019**	0.051***	-0.005						
	(2.46)	(-0.37)	(2.14)	(2.03)	(3.54)	(-0.19)						
lambda_mde							-0.004	-0.002	0.006	0.006*	0.007	-0.006
							(-0.94)	(-0.68)	(1.39)	(1.86)	(1.44)	(-0.76)
depth	-0.016**	0.014	0.011*	0.006	-0.022**	0.006	-0.008	0.016	0.010	0.007	-0.013	0.010
	(-2.38)	(1.41)	(1.77)	(0.80)	(-2.21)	(0.27)	(-1.24)	(1.53)	(1.59)	(0.94)	(-1.31)	(0.44)
margin_fc	0.000	0.001**					0.000	0.001**				
	(0.15)	(2.03)					(0.51)	(2.10)				
margin_lc	-0.000**	-0.000					-0.000	-0.000				
	(-2.13)	(-0.63)					(-1.53)	(-0.70)				
margin_fc_ind			0.000	0.000					0.000	-0.000		
			(1.55)	(0.01)					(1.53)	(-0.08)		
margin_lc_ind			-0.000	-0.000					-0.000	-0.000		
			(-0.98)	(-1.49)					(-0.90)	(-1.16)		
margin_fc_nfc					-0.000	0.001					0.000	0.001
					(-0.24)	(1.14)					(0.06)	(1.22)
margin_lc_nfc					-0.001	-0.000					-0.000	-0.000
					(-1.57)	(-0.45)					(-1.32)	(-0.65)
ir_dif_l	0.000						0.000					
	(0.91)						(1.13)					
ir_dif_d		-0.001***						-0.001***				
		(-3.75)						(-3.68)				
dif_l_ind			0.000						0.000			
			(1.64)						(1.63)			
dif_d_ind				-0.001***						-0.001***		
				(-3.39)						(-3.35)		
dif_l_nfc					0.000**						0.001**	
					(1.96)						(2.25)	
dif_d_nfc						-0.002*						-0.001*
						(-1.76)						(-1.69)
Log L	2797	2896	2207	2171	1625	1401	2796	2897	2201	2171	1620	1404
N	846	917	475	586	455	556	846	917	475	586	455	556

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 12: Change in financial dollarization estimation results (GLS): dropping currency board countries

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	0.012	-0.006	-0.002	-0.051***	0.022	0.005	0.012	-0.006	-0.001	-0.051***	0.016	-0.000
	(1.14)	(-0.66)	(-0.37)	(-3.81)	(1.13)	(0.19)	(1.13)	(-0.66)	(-0.21)	(-3.78)	(0.81)	(-0.00)
open	0.000	-0.006*	0.005	-0.001	0.011*	-0.012	0.000	-0.006*	0.004	-0.002	0.008	-0.011
	(0.03)	(-1.86)	(1.61)	(-0.28)	(1.89)	(-0.96)	(0.01)	(-1.85)	(1.46)	(-0.45)	(1.43)	(-0.88)
interv	-0.009*	0.005	0.010***	0.003	-0.004	0.008	-0.008*	0.005	0.009***	0.001	-0.005	0.008
	(-1.84)	(1.01)	(3.19)	(0.39)	(-0.55)	(0.37)	(-1.79)	(0.98)	(3.64)	(0.22)	(-0.64)	(0.40)
lambda_mue	0.022*	0.004	0.024**	0.015	0.066***	0.008						
	(1.79)	(0.42)	(2.09)	(0.84)	(2.85)	(0.20)						
lambda_mde							0.014***	-0.000	0.014***	0.006	0.016**	-0.006
							(2.73)	(-0.04)	(3.17)	(1.00)	(2.46)	(-0.55)
depth	-0.000	0.004	0.014	0.022	-0.045	-0.007	-0.010	0.008	0.006	0.021	-0.021	0.016
	(-0.01)	(0.24)	(1.06)	(0.98)	(-1.50)	(-0.13)	(-0.54)	(0.47)	(0.44)	(0.96)	(-0.79)	(0.37)
margin_fc	0.000	0.001**					0.000	0.001**				
	(0.30)	(2.12)					(0.31)	(2.25)				
margin_lc	-0.001**	-0.000					-0.001**	-0.000				
	(-2.34)	(-1.10)					(-2.35)	(-1.01)				
margin_fc_ind			0.000**	-0.000					0.000**	-0.000		
			(1.98)	(-0.03)					(2.08)	(-0.03)		
margin_lc_ind			-0.000	-0.000					-0.000	-0.000		
			(-1.02)	(-1.18)					(-0.91)	(-1.05)		
margin_fc_nfc					-0.000	0.002*					-0.000	0.002*
					(-0.14)	(1.78)					(-0.23)	(1.79)
margin_lc_nfc					-0.001	-0.000					-0.001	-0.000
					(-1.39)	(-0.45)					(-1.37)	(-0.52)
ir_dif_l	0.000						0.000					
	(1.17)						(1.41)					
ir_dif_d		-0.001***						-0.001***				
		(-3.86)						(-3.73)				
dif_l_ind			0.000**						0.000**			
			(2.12)						(2.19)			
dif_d_ind				-0.001***						-0.001***		
				(-3.38)						(-3.53)		
dif_l_nfc					0.001**						0.001***	
					(2.52)						(3.15)	
dif_d_nfc						-0.002**						-0.002**
						(-2.36)						(-2.24)
Log L	2013	2214	1488	1508	1027	999	2016	2214	1493	1509	1027	1003
N	621	692	307	418	281	384	621	692	307	418	281	384

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Sensitivity analysis

Table 13: Sensitivity analysis of country by country exclusions

Dep. variable	ratio	open	interv	lambda	depth	margin_fc	margin_lc	ir_dif
l_share_tot								
looses significance		AZ CZ LT MD		AZ MD UA				
gains significance			EE		AZ EE HR UA			
d_share_tot								
looses significance		PL						
gains significance								
Δ l_share_tot								
looses significance	EE GE SI		AL GE HU LT MK RO SI	SI	EE		RO UA	
gains significance								GE
Δ d_share_tot								
looses significance		CZ MD SI UA				AM KZ		
gains significance			LT		SI SK			

We test the robustness of our results in a number of different ways. First, we used two different measures of λ_{MVP} and, as discussed, results are robust across these two measures. Second, we estimated the model with and without the currency board countries, which produced very similar results with the only exception of λ_{MVP}.

Thirdly, because of better small sample properties we reestimate all of the above specifications of the model via OLS with heteroscedasticity and autocorrelation robust errors. OLS estimation results are presented in the appendix in Tables 15 and 18. The main qualitative results do not change. Note that, when explaining the level of household dollarization, interest rate differentials have the opposite sign compared to the model predictions, although impact on the change in dollarization remains the same.

Fourthly, we reestimate the empirical model for total dollarization of deposits and loans (column 1 and 2 in Tables 9 and 11) dropping one country at the time from the sample. None of the estimated parameters reverse signs, although some loose significance, while others gain. We report in Table 13 countries for which their exclusion leads to these changes.

In all the regressions lagged values for $margin$ and ir_dif are used. The same results are obtained when regressing on the contemporaneous variables (Tables 21 to 28 in the Appendix).

6 Conclusions

This paper develops a model to explain the determinants of financial dollarization. Implications of the model are empirically verified using a newly compiled data set on transition economies. We find that dollarization of deposits is not generally matched by the dollarization of credit in contrast with the model predictions of Ize (2005). For some countries in our sample credit dollarization is higher than deposit dollarization and vice versa.

The richness of our data set, split by households and firms as well as long term and short term, allows us to explore financial dollarization in great detail. We observe that household credit dollarization is lower compared to corporate dollarization, which might be comforting knowing that households usually have less hedging capabilities.

An important distinction between households and firms is that a country's openness to the international economy is contributing to corporate but not to household financial dollarization, supporting the real dollarization paradigm. Note that the explanatory power of our model is generally lower for household vis-a-vis total and corporate dollarization. Hence, this framework does not seem to capture all the main determinants of household dollarization and more research is needed in this area.

We also find that long term credit dollarization is generally higher than short term credit dollarization. While short term credit dollarization carries an increased risk of combining currency and maturity mismatches, the exchange rate risk per se is higher in the case of foreign currency long-term credit. This could be regarded as a potential vulnerability, as shocks to the exchange rate are expected to be more likely over a longer time span.

Our analysis nests the minimum variance portfolio framework. In line with previous studies, the trade off between inflation and real exchange rate variability is found to be a significant factor explaining financial dollarization.

One of the main features of transition economies is the increasing presence of foreign banks and the consequent influx of foreign funds. According to our model, as well as the empirical results, access to foreign funds increases credit dollarization although it decreases dollarization of deposits. This could

potentially increase currency mismatches in the agent's portfolios in these countries, leading to higher credit risk (due to exchange risk) and a more fragile financial system. Thus, de-dollarization of credit could possibly be achieved by implementing controls on accumulation of net foreign liabilities in the banking sector. Note that even when credit and deposit dollarization are matched at the aggregate level, there may be currency mismatches in the economy.

If uncovered interest rate parity holds then any interest rate differential that is observed on domestic and foreign currency denominated assets should be explained by an *expected* depreciation or appreciation of the currency. Thus, interest rate differentials should not affect the currency composition of loans and deposits.

In contrast with the literature we allow for uncovered interest rate parity not to hold necessarily, hence the interest rate differential can play a part. Matching the implications of the model, our empirical results show that a higher interest rate differential on loans increases credit dollarization. On the other hand, deposit dollarization decreases when the interest rate differential on deposits increases. Hence interest rate differentials matter.

Appendix A

An alternative specification of our model is when households choose at once the set $(D, L, \alpha_d, \alpha_l)$, where D = total deposits, L = total loans, α_d = portion of deposits in foreign currency (deposit dollarization) and α_l = portion of loans in foreign currency (loan dollarization), instead of splitting the households into investors and fund managers. The other agents face the same problems.

We assume households maximize a Kreps-Porteus/Epstein-Zin utility function allowing us to distinguish intertemporal elasticity of substitution(σ) and degree of risk aversion (η) subject to period 1 and 2 budget constraints.

Formally household $j \in H, L$ solves the following problem

$$\max_{\{C_1, C_2, D, L, \alpha_d, \alpha_l\}} \frac{C_1^{1-1/\sigma}}{1-1/\sigma} + \beta_j \frac{\left[E\left[C_2^{1-\eta}\right]^{\frac{1-1/\sigma}{1-\eta}}\right]}{1-1/\sigma}$$

subject to

$$\begin{aligned}
Y &= C_1 + D - L \\
Y &= C_2 - \bar{R}_d D + \bar{R}_l L \\
\bar{R}_d &= \left[\frac{R_d}{p_2}(1-\alpha_d) + e_2 R_d^* \alpha_d\right] \\
\bar{R}_l &= \left[\frac{R_l}{p_2}(1-\alpha_l) + e_2 R_l^* \alpha_l\right] \\
D &= d + d^*, \quad d = (1-\alpha_d)D \quad \text{and} \quad d^* = \alpha_d D \\
L &= l + l^*, \quad l = (1-\alpha_l)L \quad \text{and} \quad l^* = \alpha_l L
\end{aligned}$$

where $\bar{R}_d$ and $\bar{R}_l$ are the deposit and loan interest rates given by the weighted average of their respective rate indexes (formally defined in the aggregator problem), (d, l) are the local currency denominated deposits and loans, (d^*, l^*) are the foreign currency denominated deposits and loans and p_2 and e_2 are price and real exchange rate at period 2, which are stochastic (period one price and exchange rate are equal to 1). Main variables of interest are α_d (deposit dollarization) and α_l (loan dollarization).

The algorithm to solve this specification of the model with a single household unit is very computationally intensive and therefore its solution for only

Table 14: Model Specification Comparison

	Alternative Specification		*Main Specification*	
	$\phi = 0.5$	$\phi = 0.525$	$\phi = 0.5$	$\phi = 0.525$
D	0.1095	0.109475	0.118977	0.118978
α_d	0.5	0.4940	0.5	0.495743
L	0.1595	0.1595	0.168977	0.168978
α_l	0.5	0.504	0.5	0.5045
R_d	1.1670	1.1675	1.17056	1.17077
R_d^*	1.1670	1.6640	1.17056	1.17034
R_l	1.2350	1.2355	1.23880	1.23902
R_l^*	1.2350	1.2343	1.23880	1.23858

$\phi = 0.5$ and $\phi = 0.525$ are presented. The same parameter values shown in table 1 were used.

In addition we assume that $\eta = 10$, making sure differences in variances and rates lead to portfolio diversification and that there are four possible states: both price and exchange rates are high ($p_h = 1.75$,$e_h = 1.4285$) with probability 0.4, both price and exchange rate are low ($p_l = 0.7$,$e_l = 0.5715$) with the same probability and the other two when one variable takes its high value and the other its low value, both with a probability of 0.1.

We then calculate the equilibrium of the model using the following grid search problem. Given a list of four rate indexes the household problems are solved obtaining the aggregate demands. We then solve the bank problem using the rate indexes and aggregate demands. The equilibrium rates are obtained when the rates chosen by the banks are equal to the four rate indexes. If no rate is found we increase the granularity of the grids.

Table 14 shows the results for both specifications of the model. Both showed the same patterns, as ϕ increases loan dollarization and interest rate differentials increase while deposit dollarization decreases. Note that L and D are always lower in the alternative specification due to precautionary motive when variances are considered into the loans and deposits demand decision. Recall that due to the certainty equivalence assumption variances are not considered in that decision in the main specification of the model.

Appendix B

Table 15: Financial dollarization estimation results (OLS with HAC robust errors)

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	0.018	-0.166***	0.153	-0.335***	0.506***	-0.404***	0.040	-0.121**	0.154	-0.328***	0.518***	-0.416***
	(0.29)	(-3.36)	(1.61)	(-2.77)	(5.06)	(-5.91)	(0.66)	(-2.16)	(1.62)	(-2.74)	(5.37)	(-5.71)
open	-0.005	0.023	-0.054**	0.072***	0.077**	0.094**	0.006	0.041**	-0.056**	0.080***	0.085**	0.102**
	(-0.22)	(1.30)	(-2.05)	(2.81)	(2.43)	(2.24)	(0.28)	(2.16)	(-2.11)	(3.23)	(2.58)	(2.24)
interv	0.038	0.006	0.055	-0.047	-0.117***	-0.017	0.061**	0.038	0.055	-0.041	-0.108***	-0.014
	(1.42)	(0.22)	(1.06)	(-1.08)	(-3.03)	(-0.40)	(2.27)	(1.27)	(1.04)	(-0.91)	(-2.71)	(-0.34)
lambda_mue	0.233***	0.394***	-0.114	0.111	0.291*	0.291**						
	(3.40)	(10.03)	(-1.07)	(0.81)	(1.83)	(2.31)						
lambda_mde							0.159***	0.179***	-0.008	0.088**	0.106*	0.072*
							(3.83)	(4.98)	(-0.20)	(2.23)	(1.94)	(1.79)
depth	0.127**	-0.200***	0.154*	-0.310***	-0.158	0.010	0.050	-0.253***	0.124	-0.363***	-0.172*	0.028
	(2.16)	(-3.24)	(1.74)	(-3.49)	(-1.58)	(0.14)	(0.80)	(-2.97)	(1.42)	(-3.83)	(-1.79)	(0.35)
margin_fc	-0.002	0.003**					-0.001	0.006***				
	(-1.02)	(2.29)					(-0.57)	(3.87)				
margin_lc	0.000	-0.001					0.000	0.000				
	(0.04)	(-1.36)					(0.25)	(0.20)				
margin_fc_ind			-0.002	-0.003					-0.003	-0.003		
			(-1.22)	(-1.32)					(-1.39)	(-1.44)		
margin_lc_ind			-0.006**	0.002					-0.007**	0.002		
			(-2.01)	(0.87)					(-2.13)	(0.92)		
margin_fc_nfc					-0.009***	-0.002					-0.009***	-0.002
					(-2.82)	(-0.98)					(-3.05)	(-1.13)
margin_lc_nfc					-0.007***	-0.003					-0.006**	-0.003
					(-2.61)	(-1.46)					(-2.24)	(-1.30)
ir_dif_l	0.001						0.001					
	(0.73)						(1.09)					
ir_dif_d		-0.001						-0.001				
		(-1.52)						(-0.62)				
dif_l_ind			-0.005**						-0.005**			
			(-2.35)						(-2.49)			
dif_d_ind				0.006**						0.006**		
				(2.15)						(2.02)		
dif_l_nfc					0.003*						0.004**	
					(1.66)						(2.07)	
dif_d_nfc						-0.001						-0.001
						(-0.69)						(-0.24)
Log L	1441	1882	957	1043	892	1038	1444	1813	956	1047	894	1031
N	850	921	476	591	456	561	850	921	476	591	456	561

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 16: Financial dollarization estimation results (OLS with HAC robust errors): dropping currency board countries

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	-0.006	-0.073	0.467***	-0.173	-0.062	-0.401***	0.060	-0.018	0.492***	-0.133	0.015	-0.414***
	(-0.08)	(-1.39)	(3.26)	(-1.42)	(-0.54)	(-5.37)	(0.87)	(-0.34)	(3.71)	(-1.14)	(0.14)	(-5.75)
open	-0.011	0.036*	0.058	0.087**	0.068*	0.080*	0.010	0.059***	0.075**	0.094**	0.079**	0.081*
	(-0.34)	(1.77)	(1.54)	(2.04)	(1.68)	(1.72)	(0.33)	(2.74)	(2.07)	(2.41)	(2.14)	(1.65)
interv	0.030	-0.082***	0.160**	-0.104	-0.016	-0.129*	0.028	-0.089***	0.159**	-0.122*	-0.026	-0.143**
	(0.94)	(-2.94)	(2.50)	(-1.56)	(-0.40)	(-1.75)	(0.85)	(-3.32)	(2.47)	(-1.95)	(-0.63)	(-2.07)
lambda_mue	0.218**	0.418***	0.326***	0.369*	0.241	0.201						
	(2.16)	(6.67)	(2.63)	(1.69)	(1.49)	(1.22)						
lambda_mde							0.285***	0.248***	0.196***	0.282***	0.224***	0.071
							(4.23)	(5.33)	(4.10)	(4.14)	(3.29)	(1.37)
depth	0.017	-0.537***	-0.589**	-1.059***	0.592**	0.214	-0.321*	-0.569***	-0.733***	-1.270***	0.287	0.252
	(0.07)	(-4.31)	(-2.46)	(-4.18)	(2.19)	(1.15)	(-1.76)	(-3.95)	(-3.49)	(-5.41)	(1.17)	(1.60)
margin_fc	-0.003	0.003**					-0.003*	0.005***				
	(-1.30)	(2.15)					(-1.76)	(3.19)				
margin_lc	0.001	-0.002**					0.001	-0.001				
	(0.62)	(-2.57)					(0.69)	(-1.24)				
margin_fc_ind			-0.003	-0.002					-0.003	-0.002		
			(-1.23)	(-0.76)					(-1.16)	(-0.79)		
margin_lc_ind			-0.003	0.001					-0.000	0.001		
			(-1.08)	(0.30)					(-0.10)	(0.51)		
margin_fc_nfc					0.009*	-0.001					0.005	-0.001
					(1.75)	(-0.29)					(1.53)	(-0.42)
margin_lc_nfc					0.001	-0.007***					0.002	-0.007***
					(0.54)	(-2.88)					(0.95)	(-2.73)
ir_dif_l	-0.000						-0.001					
	(-0.05)						(-0.43)					
ir_dif_d		-0.002*						-0.001				
		(-1.87)						(-0.85)				
dif_l_ind			-0.005**						-0.005***			
			(-2.57)						(-2.77)			
dif_d_ind				0.005						0.003		
				(1.60)						(1.08)		
dif_l_nfc					0.001						0.001	
					(0.36)						(0.52)	
dif_d_nfc						-0.004						-0.004
						(-1.43)						(-1.28)
Log L	1019	1403	675	705	628	727	1038	1382	691	719	658	725
N	625	696	307	422	281	388	625	696	307	422	281	388

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 17: Change in financial dollarization estimation results (OLS with HAC robust errors)

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	0.002	-0.014	-0.014	-0.070***	-0.015	-0.006	-0.001	-0.014	-0.015	-0.070***	-0.018	-0.008
	(0.14)	(-1.09)	(-1.15)	(-3.74)	(-1.02)	(-0.24)	(-0.05)	(-1.10)	(-1.20)	(-3.70)	(-1.17)	(-0.32)
open	0.006	-0.012**	0.010**	-0.004	-0.001	-0.022	0.005	-0.012**	0.011**	-0.004	-0.001	-0.025
	(0.41)	(-2.01)	(2.01)	(-0.54)	(-0.31)	(-1.11)	(0.33)	(-2.06)	(2.04)	(-0.54)	(-0.24)	(-1.15)
interv	-0.011**	0.007	0.005	0.004	0.008	0.026	-0.009*	0.008	0.005	0.005	0.008	0.027
	(-2.06)	(0.94)	(1.04)	(0.46)	(1.43)	(1.11)	(-1.71)	(0.96)	(0.98)	(0.52)	(1.45)	(1.09)
lambda_mue	0.013	0.003	0.020	0.025	0.036**	0.080						
	(0.82)	(0.25)	(1.60)	(0.95)	(2.03)	(1.24)						
lambda_mde							-0.006	-0.000	-0.002	0.006	0.004	0.008
							(-0.73)	(-0.04)	(-0.38)	(1.08)	(0.66)	(0.62)
depth	-0.002	0.024	0.019	0.018	-0.010	-0.004	0.007	0.025	0.028**	0.020	-0.001	0.013
	(-0.16)	(1.53)	(1.50)	(1.13)	(-0.95)	(-0.15)	(0.48)	(1.47)	(2.08)	(1.22)	(-0.11)	(0.46)
margin_fc	0.001	0.000					0.001	0.000				
	(0.85)	(0.52)					(0.93)	(0.60)				
margin_lc	-0.001	0.000					-0.001	0.000				
	(-1.29)	(0.06)					(-1.14)	(0.13)				
margin_fc_ind			0.001**	-0.001					0.001***	-0.001		
			(2.42)	(-0.72)					(2.74)	(-0.74)		
margin_lc_ind			-0.001**	-0.000					-0.001*	-0.000		
			(-2.06)	(-0.41)					(-1.79)	(-0.24)		
margin_fc_nfc					-0.000	0.001					-0.000	0.001
					(-0.81)	(0.69)					(-0.45)	(0.63)
margin_lc_nfc					-0.001*	0.000					-0.001*	0.000
					(-1.94)	(0.24)					(-1.80)	(0.44)
ir_dif_l	0.000						0.000					
	(0.51)						(0.55)					
ir_dif_d		-0.001***						-0.001***				
		(-3.06)						(-3.00)				
dif_l_ind			0.001***						0.001***			
			(3.02)						(3.14)			
dif_d_ind				-0.002***						-0.002**		
				(-2.63)						(-2.55)		
dif_l_nfc					0.001*						0.001**	
					(1.89)						(2.08)	
dif_d_nfc						-0.002						-0.001
						(-1.10)						(-1.00)
Log L	1534	2471	1831	1766	1554	1246	1534	2471	1830	1766	1552	1245
N	846	917	475	586	455	556	846	917	475	586	455	556

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 18: Change in financial dollarization estimation results (OLS with HAC robust errors): dropping currency board countries

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	0.000	-0.019	-0.021	-0.090***	-0.009	0.023	0.000	-0.018	-0.020	-0.089***	-0.013	0.008
	(0.01)	(-1.13)	(-1.03)	(-3.90)	(-0.30)	(0.77)	(0.00)	(-1.07)	(-1.03)	(-3.90)	(-0.44)	(0.26)
open	0.007	-0.014**	0.014**	-0.019**	0.000	-0.038	0.008	-0.014**	0.015**	-0.018*	-0.001	-0.046
	(0.36)	(-1.97)	(2.28)	(-2.11)	(0.05)	(-1.50)	(0.37)	(-1.99)	(2.44)	(-1.90)	(-0.20)	(-1.59)
interv	-0.012*	0.010	0.012*	-0.006	0.003	0.064	-0.011	0.010	0.012*	-0.007	0.003	0.060
	(-1.69)	(0.77)	(1.88)	(-0.38)	(0.37)	(1.20)	(-1.64)	(0.76)	(1.88)	(-0.38)	(0.32)	(1.12)
lambda_mue	0.026	0.019	0.028	-0.006	0.044	0.134						
	(0.86)	(0.74)	(1.55)	(-0.15)	(1.52)	(1.39)						
lambda_mde							0.011	0.006	0.014**	0.001	0.014*	0.016
							(0.66)	(0.52)	(2.47)	(0.13)	(1.84)	(0.75)
depth	-0.018	0.007	0.025	0.077*	-0.010	-0.093	-0.013	0.015	0.020	0.070*	0.005	-0.013
	(-0.30)	(0.20)	(0.89)	(1.65)	(-0.23)	(-0.96)	(-0.24)	(0.39)	(0.80)	(1.80)	(0.14)	(-0.18)
margin_fc	0.001	0.000					0.001	0.001				
	(0.72)	(0.51)					(0.75)	(0.64)				
margin_lc	-0.001	-0.000					-0.001	-0.000				
	(-1.28)	(-0.35)					(-1.22)	(-0.04)				
margin_fc_ind			0.001***	-0.001					0.001***	-0.001		
			(2.94)	(-0.75)					(3.09)	(-0.73)		
margin_lc_ind			-0.000	0.000					-0.000	0.000		
			(-1.60)	(0.09)					(-0.77)	(0.03)		
margin_fc_nfc					-0.000	0.002					-0.001	0.002
					(-0.69)	(1.59)					(-0.67)	(1.45)
margin_lc_nfc					-0.001*	0.000					-0.001*	0.001
					(-1.84)	(0.12)					(-1.75)	(0.53)
ir_dif_l	0.000						0.000					
	(0.35)						(0.45)					
ir_dif_d		-0.001***						-0.001***				
		(-2.95)						(-2.99)				
dif_l_ind			0.001***						0.001***			
			(3.32)						(3.35)			
dif_d_ind				-0.002***						-0.002***		
				(-2.64)						(-2.60)		
dif_l_nfc					0.001*						0.001**	
					(1.91)						(2.12)	
dif_d_nfc						-0.004**						-0.004**
						(-2.42)						(-2.31)
Log L	1034	1816	1215	1206	962	857	1034	1815	1217	1206	962	856
N	621	692	307	418	281	384	621	692	307	418	281	384

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 19: Financial dollarization estimation results (GLS/HAC)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	GLS regression						OLS HAC correction					
	l_share_tot	d_share_tot	l_share_ind	d_share_ind	l_share_nfc	d_share_nfc	l_share_tot	d_share_tot	l_share_ind	d_share_ind	l_share_nfc	d_share_nfc
ratio	0.037**	-0.107***	0.008	-0.043***	0.148***	-0.274***	-0.012	-0.163***	0.156*	-0.342***	0.472***	-0.432***
	(2.10)	(-5.22)	(0.77)	(-2.66)	(4.61)	(-6.40)	(-0.19)	(-2.80)	(1.66)	(-2.83)	(5.04)	(-5.78)
open	-0.013	0.038**	-0.018***	0.002	0.053***	0.123***	-0.010	0.028	-0.055**	0.071***	0.077**	0.095**
	(-1.29)	(2.33)	(-7.07)	(0.14)	(3.29)	(4.19)	(-0.42)	(1.45)	(-2.09)	(2.96)	(2.40)	(2.04)
interv	-0.002	0.004	0.000	-0.004	-0.005	-0.018	0.064**	0.037	0.055	-0.048	-0.118***	-0.024
	(-0.22)	(0.35)	(0.00)	(-0.62)	(-0.44)	(-0.86)	(2.21)	(1.28)	(1.07)	(-1.11)	(-3.01)	(-0.57)
depth	0.004	-0.200***	0.293***	-0.266***	0.173***	0.111**	0.200***	-0.089	0.115	-0.274***	-0.048	0.098*
	(0.09)	(-6.02)	(11.80)	(-8.30)	(3.41)	(2.21)	(3.23)	(-1.50)	(1.48)	(-4.06)	(-0.54)	(1.71)
margin_fc	0.000	0.000					-0.000	0.007***				
	(0.22)	(1.03)					(-0.19)	(4.34)				
margin_lc	0.000	0.000					0.001	0.001				
	(0.45)	(0.47)					(0.71)	(0.90)				
margin_fc_ind			-0.000	0.000					-0.003	-0.003		
			(-0.29)	(0.80)					(-1.47)	(-1.30)		
margin_lc_ind			-0.001***	0.000					-0.007**	0.003		
			(-2.95)	(0.26)					(-2.14)	(1.02)		
margin_fc_nfc					-0.001	-0.000					-0.007*	-0.002
					(-1.42)	(-0.33)					(-1.94)	(-1.02)
margin_lc_nfc					-0.001**	0.000					-0.006**	-0.003
					(-2.04)	(0.28)					(-2.43)	(-1.28)
ir_dif_l	0.001**						0.001					
	(2.13)						(1.14)					
ir_dif_d		0.000						-0.000				
		(0.26)						(-0.08)				
dif_l_ind			0.000						-0.005**			
			(1.21)						(-2.51)			
dif_d_ind				-0.001***						0.007**		
				(-2.74)						(2.40)		
dif_l_nfc					-0.000						0.004*	
					(-0.94)						(1.90)	
dif_d_nfc						-0.000						-0.000
						(-0.38)						(-0.04)
Log L	2743	2869	1869	2102	1544	1437	1428	1769	956	1044	885	1030
N	851	922	476	592	456	562	851	922	476	592	456	562

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 20: Change in financial dollarization estimation results (GLS/HAC)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	GLS regression						OLS HAC correction					
	Δl_sh_tot	Δd_sh_tot	Δl_sh_ind	Δd_sh_ind	Δl_sh_nfc	Δd_sh_nfc	Δl_sh_tot	Δd_sh_tot	Δl_sh_ind	Δd_sh_ind	Δl_sh_nfc	Δd_sh_nfc
ratio	0.017**	-0.003	0.002	-0.037***	-0.001	-0.005	0.001	-0.014	-0.014	-0.071***	-0.019	-0.009
	(2.11)	(-0.41)	(0.53)	(-3.81)	(-0.07)	(-0.24)	(0.06)	(-1.09)	(-1.19)	(-3.77)	(-1.27)	(-0.38)
open	0.001	-0.006*	0.003	0.003	0.004	-0.003	0.005	-0.012**	0.011**	-0.005	-0.001	-0.026
	(0.22)	(-1.93)	(1.33)	(0.83)	(0.93)	(-0.30)	(0.37)	(-2.00)	(2.07)	(-0.64)	(-0.30)	(-1.16)
interv	-0.004	0.004	0.006**	0.007*	0.001	0.004	-0.009*	0.007	0.005	0.005	0.007	0.026
	(-1.35)	(0.94)	(2.49)	(1.73)	(0.22)	(0.34)	(-1.73)	(0.93)	(1.00)	(0.46)	(1.40)	(1.06)
depth	-0.010*	0.012	0.012**	0.015**	-0.007	-0.000	0.002	0.025*	0.026**	0.026**	0.003	0.020
	(-1.71)	(1.39)	(2.02)	(2.15)	(-0.74)	(-0.01)	(0.10)	(1.66)	(2.29)	(2.00)	(0.37)	(0.79)
margin_fc	0.000	0.001**					0.001	0.000				
	(0.59)	(2.01)					(0.92)	(0.61)				
margin_lc	-0.000	-0.000					-0.001	0.000				
	(-1.62)	(-0.71)					(-1.16)	(0.16)				
margin_fc_ind			0.000*	0.000					0.001***	-0.001		
			(1.74)	(0.05)					(2.69)	(-0.74)		
margin_lc_ind			-0.000	-0.000					-0.001*	-0.000		
			(-0.89)	(-0.92)					(-1.79)	(-0.16)		
margin_fc_nfc					0.000	0.001					-0.000	0.001
					(0.18)	(1.14)					(-0.30)	(0.63)
margin_lc_nfc					-0.000	-0.000					-0.001*	0.001
					(-1.37)	(-0.59)					(-1.87)	(0.50)
ir_dif_l	0.000						0.000					
	(1.07)						(0.55)					
ir_dif_d		-0.001***						-0.001***				
		(-3.87)						(-3.02)				
dif_l_ind			0.000*						0.001***			
			(1.82)						(3.13)			
dif_d_ind				-0.001***						-0.002**		
				(-2.81)						(-2.50)		
dif_l_nfc					0.001**						0.001**	
					(2.20)						(2.06)	
dif_d_nfc						-0.002*						-0.001
						(-1.93)						(-1.00)
Log L	2799	2898	2201	2169	1619	1406	1536	2472	1830	1769	1552	1247
N	847	918	475	587	455	557	847	918	475	587	455	557

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 21: Financial dollarization estimation results using contemporaneous interest rate variables (GLS)

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	0.040**	-0.076***	0.019*	-0.018	0.147***	-0.288***	0.046***	-0.065***	0.013	-0.015	0.146***	-0.280***
	(2.46)	(-4.22)	(1.82)	(-1.34)	(4.71)	(-7.48)	(2.83)	(-3.56)	(1.34)	(-1.13)	(4.82)	(-6.60)
open	-0.022*	0.047***	-0.019***	-0.007	0.061***	0.077***	-0.014	0.054***	-0.020***	0.002	0.065***	0.072**
	(-1.88)	(2.79)	(-6.97)	(-0.46)	(4.86)	(2.80)	(-1.25)	(3.25)	(-7.54)	(0.10)	(5.12)	(2.55)
interv	0.006	-0.007	0.002	-0.003	-0.016	-0.021	0.006	-0.011	0.002	-0.003	-0.013	0.003
	(0.72)	(-0.70)	(0.35)	(-0.43)	(-1.28)	(-1.02)	(0.72)	(-1.08)	(0.37)	(-0.50)	(-1.10)	(0.12)
lambda_mue	0.052*	0.300***	-0.066***	0.036	-0.213**	0.278***						
	(1.90)	(8.76)	(-3.41)	(1.18)	(-2.31)	(4.03)						
lambda_mde							0.033*	0.087***	-0.057***	0.024*	-0.015	0.071***
							(1.89)	(4.34)	(-3.61)	(1.93)	(-0.61)	(2.97)
depth	0.093*	-0.255***	0.317***	-0.238***	0.232***	0.010	0.069	-0.313***	0.318***	-0.245***	0.214***	0.021
	(1.78)	(-7.15)	(12.22)	(-6.84)	(4.72)	(0.17)	(1.47)	(-8.05)	(12.49)	(-6.67)	(4.29)	(0.33)
margin_fc	0.000	-0.000					0.001	-0.000				
	(1.36)	(-0.76)					(1.45)	(-0.75)				
margin_lc	0.001***	0.001*					0.001***	0.001**				
	(2.76)	(1.96)					(3.16)	(2.07)				
margin_fc_ind			-0.000	0.000					-0.000	0.000		
			(-1.02)	(0.89)					(-1.36)	(0.82)		
margin_lc_ind			-0.000	0.000					-0.000*	0.000		
			(-1.61)	(1.44)					(-1.86)	(1.35)		
margin_fc_nfc					0.000	-0.002***					0.000	-0.003***
					(0.69)	(-2.58)					(0.62)	(-2.64)
margin_lc_nfc					0.001	0.000					0.001	0.000
					(1.42)	(0.44)					(1.45)	(0.49)
ir_dif_l	0.001**						0.001**					
	(2.21)						(2.52)					
ir_dif_d		0.000						0.000				
		(0.41)						(1.09)				
dif_l_ind			0.000						0.000			
			(0.39)						(0.41)			
dif_d_ind				0.000						0.000		
				(0.45)						(0.46)		
dif_l_nfc					0.001						0.001	
					(1.33)						(1.25)	
dif_d_nfc						0.000						0.000
						(0.23)						(0.43)
Log L	2810	2919	1916	2159	1580	1478	2801	2909	1911	2158	1575	1476
N	863	934	487	603	465	572	863	934	487	603	465	572

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 22: Financial dollarization estimation results using contemporaneous interest rate variables (GLS): dropping currency board countries

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	0.035*	-0.051**	0.000	-0.011	0.065	-0.278***	0.045**	-0.056***	-0.003	-0.011	0.080**	-0.246***
	(1.93)	(-2.48)	(0.07)	(-0.56)	(1.55)	(-7.40)	(2.34)	(-2.71)	(-0.45)	(-0.59)	(2.00)	(-6.30)
open	-0.021*	0.055***	-0.001	-0.004	0.077***	0.049*	-0.016	0.071***	-0.002	0.004	0.081***	0.073***
	(-1.71)	(2.84)	(-0.85)	(-0.15)	(4.92)	(1.77)	(-1.39)	(3.65)	(-1.27)	(0.17)	(5.15)	(2.66)
interv	0.016	-0.020	0.004	-0.009	0.010	-0.061***	0.015	-0.030**	0.006	-0.008	0.009	-0.074***
	(1.58)	(-1.61)	(1.10)	(-0.77)	(0.58)	(-2.77)	(1.48)	(-2.45)	(1.34)	(-0.65)	(0.55)	(-3.21)
lambda_mue	0.053*	0.226***	-0.005	0.019	0.048	0.327***						
	(1.84)	(5.12)	(-0.43)	(0.44)	(0.46)	(4.36)						
lambda_mde							0.083***	0.139***	0.055***	0.047*	0.129***	0.105***
							(3.15)	(5.80)	(3.82)	(1.81)	(2.74)	(2.91)
depth	0.101	-0.229***	0.019	-0.430***	-0.094	0.038	0.029	-0.446***	0.057***	-0.415***	-0.166**	0.090
	(1.44)	(-3.49)	(1.60)	(-6.85)	(-1.01)	(0.49)	(0.44)	(-7.84)	(3.44)	(-6.62)	(-2.09)	(1.10)
margin_fc	0.000	-0.001					0.000	-0.000				
	(0.95)	(-1.28)					(0.68)	(-0.97)				
margin_lc	0.001***	0.001**					0.001***	0.001*				
	(3.18)	(2.02)					(3.28)	(1.95)				
margin_fc_ind			-0.000	0.000					0.000	0.000		
			(-0.19)	(0.43)					(0.45)	(0.46)		
margin_lc_ind			-0.000	0.000					-0.000	0.000		
			(-0.01)	(0.70)					(-0.63)	(0.66)		
margin_fc_nfc					0.001	-0.003**					0.001	-0.003**
					(1.26)	(-2.28)					(1.00)	(-2.38)
margin_lc_nfc					0.001*	-0.000					0.001*	-0.000
					(1.83)	(-0.43)					(1.93)	(-0.38)
ir_dif_l	0.001*						0.001*					
	(1.85)						(1.68)					
ir_dif_d		0.001						0.001				
		(1.57)						(1.58)				
dif_l_ind			-0.000						0.000			
			(-0.18)						(0.52)			
dif_d_ind				0.000						-0.000		
				(0.11)						(-0.02)		
dif_l_nfc					0.000						0.000	
					(0.93)						(0.66)	
dif_d_nfc						-0.000						0.000
						(-0.04)						(0.22)
Log L	2027	2225	1449	1498	1003	1056	2017	2214	1406	1505	1008	1050
N	638	709	317	433	290	398	638	709	317	433	290	398

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 23: Financial dollarization estimation results using contemporaneous interest rate variables (OLS with HAC robust errors)

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	0.015	-0.166***	0.171*	-0.302**	0.477***	-0.406***	0.038	-0.121**	0.171*	-0.295**	0.493***	-0.415***
	(0.25)	(-3.41)	(1.80)	(-2.57)	(5.03)	(-6.14)	(0.63)	(-2.20)	(1.78)	(-2.53)	(5.39)	(-5.92)
open	-0.011	0.029	-0.053**	0.081***	0.080**	0.098**	0.001	0.044**	-0.054**	0.088***	0.087***	0.106**
	(-0.47)	(1.62)	(-2.05)	(3.16)	(2.50)	(2.38)	(0.03)	(2.32)	(-2.09)	(3.55)	(2.66)	(2.38)
interv	0.040	-0.001	0.047	-0.052	-0.117***	-0.014	0.063**	0.031	0.048	-0.046	-0.106***	-0.011
	(1.55)	(-0.03)	(0.94)	(-1.20)	(-3.06)	(-0.35)	(2.43)	(1.06)	(0.92)	(-1.04)	(-2.70)	(-0.26)
lambda_mue	0.228***	0.385***	-0.107	0.101	0.265*	0.289**						
	(3.41)	(9.56)	(-1.07)	(0.76)	(1.73)	(2.41)						
lambda_mde							0.160***	0.175***	-0.004	0.080**	0.111**	0.075*
							(3.85)	(4.96)	(-0.11)	(2.13)	(2.09)	(1.95)
depth	0.131**	-0.207***	0.136	-0.309***	-0.126	0.006	0.053	-0.254***	0.105	-0.357***	-0.156	0.023
	(2.22)	(-3.28)	(1.51)	(-3.56)	(-1.28)	(0.09)	(0.84)	(-2.99)	(1.13)	(-3.91)	(-1.63)	(0.28)
margin_fc	-0.003	0.003**					-0.002	0.006***				
	(-1.41)	(2.44)					(-1.04)	(4.09)				
margin_lc	0.001	-0.001					0.001	0.000				
	(0.46)	(-1.56)					(0.70)	(0.24)				
margin_fc_ind			-0.003	-0.001					-0.003	-0.002		
			(-1.40)	(-0.77)					(-1.57)	(-0.91)		
margin_lc_ind			-0.006*	0.002					-0.006*	0.002		
			(-1.79)	(0.84)					(-1.92)	(0.91)		
margin_fc_nfc					-0.008**	-0.002					-0.008***	-0.002
					(-2.42)	(-0.91)					(-2.71)	(-1.02)
margin_lc_nfc					-0.006**	-0.004*					-0.006**	-0.004*
					(-2.41)	(-1.94)					(-2.13)	(-1.70)
ir_dif_l	0.001						0.001					
	(0.55)						(0.87)					
ir_dif_d		-0.001						-0.000				
		(-0.73)						(-0.29)				
dif_l_ind			-0.006***						-0.006***			
			(-2.65)						(-2.78)			
dif_d_ind				0.008***						0.007***		
				(2.71)						(2.61)		
dif_l_nfc					0.003						0.004**	
					(1.63)						(2.05)	
dif_d_nfc						0.001						0.001
						(0.33)						(0.70)
Log L	1463	1907	977	1068	903	1063	1467	1842	976	1071	906	1056
N	863	934	487	603	465	572	863	934	487	603	465	572

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 24: Financial dollarization estimation results using contemporaneous interest rate variables (OLS with HAC robust errors): dropping currency board countries

	(1) l_share_tot	(2) d_share_tot	(3) l_share_ind	(4) d_share_ind	(5) l_share_nfc	(6) d_share_nfc	(7) l_share_tot	(8) d_share_tot	(9) l_share_ind	(10) d_share_ind	(11) l_share_nfc	(12) d_share_nfc
ratio	-0.018	-0.072	0.464***	-0.144	-0.049	-0.396***	0.046	-0.021	0.498***	-0.114	0.025	-0.409***
	(-0.24)	(-1.40)	(3.27)	(-1.21)	(-0.47)	(-5.59)	(0.66)	(-0.40)	(3.74)	(-1.00)	(0.24)	(-5.94)
open	-0.020	0.043**	0.059	0.097**	0.079*	0.102**	0.001	0.061***	0.078**	0.104***	0.089**	0.101**
	(-0.63)	(2.05)	(1.54)	(2.22)	(1.97)	(2.22)	(0.03)	(2.80)	(2.10)	(2.63)	(2.50)	(2.11)
interv	0.035	-0.087***	0.149**	-0.096	-0.030	-0.109*	0.036	-0.091***	0.151**	-0.108*	-0.033	-0.121**
	(1.14)	(-3.28)	(2.30)	(-1.56)	(-0.70)	(-1.65)	(1.12)	(-3.56)	(2.39)	(-1.83)	(-0.78)	(-1.98)
lambda_mue	0.193**	0.402***	0.311***	0.364*	0.239	0.204						
	(2.06)	(6.48)	(2.65)	(1.68)	(1.59)	(1.32)						
lambda_mde							0.272***	0.236***	0.198***	0.258***	0.225***	0.071
							(4.13)	(5.31)	(4.23)	(3.97)	(3.47)	(1.43)
depth	0.076	-0.528***	-0.606**	-1.042***	0.568**	0.162	-0.257	-0.547***	-0.765***	-1.204***	0.271	0.209
	(0.34)	(-4.37)	(-2.54)	(-4.20)	(2.19)	(0.90)	(-1.40)	(-3.98)	(-3.63)	(-5.26)	(1.15)	(1.40)
margin_fc	-0.004	0.003**					-0.004**	0.005***				
	(-1.58)	(2.31)					(-2.06)	(3.45)				
margin_lc	0.002	-0.002***					0.002	-0.001				
	(1.08)	(-2.75)					(1.13)	(-1.19)				
margin_fc_ind			-0.003	-0.000					-0.003	-0.000		
			(-1.25)	(-0.02)					(-1.17)	(-0.05)		
margin_lc_ind			-0.003	0.001					0.000	0.001		
			(-0.84)	(0.18)					(0.15)	(0.45)		
margin_fc_nfc					0.010*	-0.001					0.007*	-0.002
					(1.83)	(-0.59)					(1.73)	(-0.67)
margin_lc_nfc					0.002	-0.008***					0.003*	-0.007***
					(1.25)	(-3.38)					(1.74)	(-3.19)
ir_dif_l	-0.000						-0.001					
	(-0.11)						(-0.53)					
ir_dif_d		-0.001						-0.001				
		(-1.17)						(-0.65)				
dif_l_ind			-0.005***						-0.006***			
			(-2.92)						(-3.17)			
dif_d_ind				0.006**						0.005*		
				(2.20)						(1.73)		
dif_l_nfc					-0.000						0.000	
					(-0.16)						(0.01)	
dif_d_nfc						0.000						0.001
						(0.11)						(0.19)
Log L	1041	1431	690	728	643	750	1061	1413	708	740	675	748
N	638	709	317	433	290	398	638	709	317	433	290	398

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
l_share_tot, d_share_tot - total loan (l) and deposit (d) dollarization, l_share_ind, d_share_ind - individual (ind) loan and deposit dollarization, l_share_nfc, d_share_nfc - corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 25: Change in financial dollarization estimation results using contemporaneous interest rate variables (GLS)

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	0.018**	-0.003	-0.000	-0.030***	0.009	-0.026	0.013	-0.003	0.002	-0.030***	0.010	-0.023
	(2.15)	(-0.37)	(-0.02)	(-3.02)	(0.69)	(-1.17)	(1.60)	(-0.38)	(0.58)	(-3.09)	(0.75)	(-1.04)
open	-0.001	-0.007**	0.003	0.004	0.008**	-0.003	-0.002	-0.007**	0.002	0.003	0.008**	-0.002
	(-0.32)	(-2.45)	(1.16)	(1.03)	(2.05)	(-0.37)	(-0.84)	(-2.47)	(0.75)	(0.93)	(2.16)	(-0.25)
interv	-0.005	0.005	0.006***	0.007*	-0.000	0.008	-0.005*	0.005	0.006***	0.007*	0.001	0.008
	(-1.51)	(1.21)	(2.63)	(1.73)	(-0.02)	(0.69)	(-1.66)	(1.25)	(3.48)	(1.81)	(0.13)	(0.73)
lambda_mue	0.008	-0.002	0.023***	0.016	0.046***	0.008						
	(0.88)	(-0.29)	(3.12)	(1.50)	(3.04)	(0.29)						
lambda_mde							-0.007*	-0.002	0.007*	0.005	0.008*	0.000
							(-1.72)	(-0.50)	(1.81)	(1.44)	(1.78)	(0.05)
depth	-0.015**	0.011	0.009	0.006	-0.022**	-0.003	-0.006	0.013	0.007	0.007	-0.016	-0.004
	(-2.23)	(1.16)	(1.56)	(0.82)	(-2.13)	(-0.15)	(-0.88)	(1.23)	(1.29)	(0.90)	(-1.55)	(-0.17)
margin_fc	-0.000	-0.000					-0.000	-0.000				
	(-0.96)	(-0.32)					(-0.79)	(-0.33)				
margin_lc	-0.000	0.000					0.000	0.000				
	(-0.22)	(1.13)					(0.16)	(1.12)				
margin_fc_ind			0.000	0.000					0.000	0.000		
			(0.27)	(0.39)					(0.21)	(0.31)		
margin_lc_ind			-0.000	-0.000					-0.000	-0.000		
			(-0.76)	(-0.64)					(-0.72)	(-0.40)		
margin_fc_nfc					-0.000	-0.002**					-0.000	-0.002**
					(-0.40)	(-2.21)					(-0.20)	(-2.17)
margin_lc_nfc					0.000	0.000					0.000	0.000
					(0.55)	(0.37)					(0.70)	(0.27)
ir_dif_l	0.000						0.000					
	(0.60)						(0.65)					
ir_dif_d		-0.001***						-0.001***				
		(-3.55)						(-3.51)				
dif_l_ind			0.000						0.000			
			(0.62)						(0.67)			
dif_d_ind				-0.001**						-0.001**		
				(-2.22)						(-2.33)		
dif_l_nfc					0.001***						0.001***	
					(3.10)						(3.38)	
dif_d_nfc						-0.001						-0.001
						(-1.16)						(-1.15)
Log L	2824	2929	2237	2196	1646	1431	2823	2929	2234	2196	1643	1433
N	855	926	484	596	462	565	855	926	484	596	462	565

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 26: Change in financial dollarization estimation results using contemporaneous interest rate variables (GLS): dropping currency board countries

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	0.011	-0.007	-0.004	-0.047***	0.026	-0.028	0.013	-0.006	-0.002	-0.047***	0.022	-0.026
	(0.95)	(-0.69)	(-0.57)	(-3.58)	(1.31)	(-1.04)	(1.15)	(-0.59)	(-0.52)	(-3.51)	(1.10)	(-1.03)
open	-0.002	-0.008**	0.005	-0.003	0.014**	-0.010	-0.002	-0.008**	0.003	-0.003	0.011*	-0.009
	(-0.66)	(-2.37)	(1.28)	(-0.52)	(2.36)	(-0.86)	(-0.51)	(-2.33)	(0.79)	(-0.66)	(1.94)	(-0.80)
interv	-0.009*	0.005	0.009***	0.001	-0.002	0.012	-0.009*	0.005	0.009***	0.000	-0.002	0.014
	(-1.83)	(1.02)	(2.74)	(0.11)	(-0.26)	(0.55)	(-1.82)	(1.01)	(3.71)	(0.03)	(-0.35)	(0.72)
lambda_mue	0.011	0.004	0.033***	0.013	0.065***	0.004						
	(0.88)	(0.35)	(2.69)	(0.68)	(2.77)	(0.11)						
lambda_mde							0.012**	-0.000	0.015***	0.007	0.015**	-0.003
							(2.03)	(-0.02)	(3.41)	(1.06)	(2.33)	(-0.22)
depth	0.004	0.007	0.009	0.023	-0.048	0.013	-0.006	0.009	0.002	0.019	-0.026	0.018
	(0.20)	(0.45)	(0.62)	(1.02)	(-1.60)	(0.26)	(-0.31)	(0.55)	(0.15)	(0.90)	(-0.98)	(0.41)
margin_fc	-0.000	-0.000					-0.000	-0.000				
	(-1.11)	(-0.55)					(-1.15)	(-0.46)				
margin_lc	-0.000	0.000					-0.000	0.000				
	(-0.38)	(0.61)					(-0.33)	(0.76)				
margin_fc_ind			0.000	0.000					0.000	0.000		
			(0.26)	(0.40)					(0.67)	(0.44)		
margin_lc_ind			-0.000	-0.000					-0.000	-0.000		
			(-0.54)	(-0.36)					(-0.68)	(-0.22)		
margin_fc_nfc					-0.000	-0.002*					-0.000	-0.002*
					(-0.26)	(-1.75)					(-0.38)	(-1.71)
margin_lc_nfc					-0.000	0.000					-0.000	0.000
					(-0.22)	(0.41)					(-0.27)	(0.34)
ir_dif_l	0.000						0.000					
	(0.32)						(0.28)					
ir_dif_d		-0.001***						-0.001***				
		(-3.29)						(-3.25)				
dif_l_ind			0.000						0.000			
			(0.30)						(0.74)			
dif_d_ind				-0.001***						-0.001***		
				(-2.93)						(-3.03)		
dif_l_nfc					0.001***						0.001***	
					(3.06)						(3.69)	
dif_d_nfc						-0.002						-0.002
						(-1.54)						(-1.51)
Log L	2035	2243	1516	1533	1047	1023	2037	2244	1526	1533	1046	1026
N	630	701	315	427	288	392	630	701	315	427	288	392

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 27: Change in financial dollarization estimation results using contemporaneous interest rate variables (OLS with HAC robust errors)

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	-0.002	-0.018	-0.011	-0.073***	0.001	-0.022	-0.004	-0.017	-0.012	-0.073***	0.000	-0.024
	(-0.11)	(-1.32)	(-0.99)	(-3.64)	(0.09)	(-0.93)	(-0.28)	(-1.27)	(-1.00)	(-3.60)	(0.04)	(-0.98)
open	-0.002	-0.016**	0.009*	-0.004	0.007	-0.025	-0.003	-0.016**	0.010*	-0.004	0.007	-0.027
	(-0.21)	(-2.43)	(1.87)	(-0.61)	(1.46)	(-1.26)	(-0.30)	(-2.45)	(1.92)	(-0.60)	(1.51)	(-1.27)
interv	-0.006	0.008	0.007	0.003	0.005	0.028	-0.005	0.009	0.007	0.004	0.005	0.030
	(-1.05)	(1.04)	(1.38)	(0.31)	(0.91)	(1.20)	(-0.93)	(1.10)	(1.34)	(0.37)	(0.97)	(1.20)
lambda_mue	0.005	0.008	0.025**	0.025	0.025	0.076						
	(0.28)	(0.53)	(2.22)	(0.91)	(1.42)	(1.27)						
lambda_mde							-0.007	0.002	-0.000	0.007	0.005	0.011
							(-0.84)	(0.28)	(-0.07)	(1.08)	(0.89)	(0.87)
depth	-0.002	0.022	0.015	0.016	-0.008	-0.004	0.006	0.022	0.024*	0.017	-0.005	0.008
	(-0.15)	(1.32)	(1.16)	(0.97)	(-0.74)	(-0.17)	(0.40)	(1.24)	(1.78)	(0.99)	(-0.41)	(0.30)
margin_fc	-0.001	-0.001					-0.001	-0.001				
	(-0.86)	(-0.69)					(-0.82)	(-0.67)				
margin_lc	0.000	0.000					0.000	0.000				
	(0.45)	(1.39)					(0.56)	(1.48)				
margin_fc_ind			0.001**	-0.001					0.001**	-0.001		
			(2.20)	(-1.17)					(2.53)	(-1.18)		
margin_lc_ind			-0.001**	-0.000					-0.001*	0.000		
			(-2.29)	(-0.08)					(-1.95)	(0.08)		
margin_fc_nfc					-0.000	-0.001					-0.000	-0.001
					(-0.37)	(-0.74)					(-0.23)	(-0.81)
margin_lc_nfc					0.000	0.001					0.000	0.001
					(0.92)	(0.81)					(1.02)	(1.01)
ir_dif_l	0.000						0.000					
	(0.36)						(0.37)					
ir_dif_d		-0.001***						-0.001***				
		(-2.87)						(-2.82)				
dif_l_ind			0.001***						0.001***			
			(2.85)						(2.99)			
dif_d_ind				-0.002***						-0.002**		
				(-2.60)						(-2.58)		
dif_l_nfc					0.001***						0.001***	
					(3.35)						(3.56)	
dif_d_nfc						-0.002						-0.002
						(-1.59)						(-1.53)
Log L	1555	2503	1855	1801	1581	1272	1555	2503	1853	1801	1580	1271
N	855	926	484	596	462	565	855	926	484	596	462	565

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc - (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 28: Change in financial dollarization estimation results using contemporaneous interest rate variables (OLS with HAC robust errors): dropping currency board countries

	(1) Δl_sh_tot	(2) Δd_sh_tot	(3) Δl_sh_ind	(4) Δd_sh_ind	(5) Δl_sh_nfc	(6) Δd_sh_nfc	(7) Δl_sh_tot	(8) Δd_sh_tot	(9) Δl_sh_ind	(10) Δd_sh_ind	(11) Δl_sh_nfc	(12) Δd_sh_nfc
ratio	-0.015	-0.025	-0.007	-0.094***	0.007	-0.004	-0.012	-0.023	-0.008	-0.092***	0.004	-0.016
	(-0.59)	(-1.42)	(-0.37)	(-3.82)	(0.24)	(-0.14)	(-0.49)	(-1.32)	(-0.40)	(-3.74)	(0.16)	(-0.55)
open	-0.005	-0.019**	0.015**	-0.020**	0.011	-0.043	-0.004	-0.019**	0.015**	-0.019**	0.010	-0.050*
	(-0.34)	(-2.40)	(2.31)	(-2.25)	(1.50)	(-1.63)	(-0.29)	(-2.40)	(2.38)	(-2.02)	(1.31)	(-1.65)
interv	-0.007	0.010	0.014**	-0.010	0.007	0.063	-0.007	0.010	0.013**	-0.010	0.006	0.060
	(-0.74)	(0.80)	(2.04)	(-0.59)	(0.75)	(1.19)	(-0.84)	(0.79)	(2.01)	(-0.59)	(0.70)	(1.12)
lambda_mue	-0.012	0.023	0.039**	-0.011	0.041	0.114						
	(-0.36)	(0.85)	(2.25)	(-0.26)	(1.46)	(1.33)						
lambda_mde							0.003	0.009	0.016***	0.001	0.014*	0.017
							(0.18)	(0.69)	(2.90)	(0.13)	(1.70)	(0.86)
depth	0.036	0.010	0.004	0.083*	-0.016	-0.067	0.019	0.018	0.006	0.071*	-0.006	-0.004
	(0.66)	(0.25)	(0.14)	(1.71)	(-0.38)	(-0.81)	(0.36)	(0.42)	(0.23)	(1.73)	(-0.16)	(-0.06)
margin_fc	-0.001	-0.001					-0.001	-0.001				
	(-0.93)	(-0.73)					(-0.99)	(-0.66)				
margin_lc	0.000	0.000					0.000	0.000				
	(0.57)	(0.88)					(0.50)	(1.30)				
margin_fc_ind			0.001**	-0.001					0.001**	-0.001		
			(2.39)	(-1.07)					(2.53)	(-1.03)		
margin_lc_ind			-0.001*	0.000					-0.000	0.000		
			(-1.77)	(0.33)					(-1.03)	(0.23)		
margin_fc_nfc					0.000	0.000					0.000	-0.000
					(0.15)	(0.02)					(0.01)	(-0.15)
margin_lc_nfc					0.000	0.001					0.000	0.001
					(0.46)	(0.71)					(0.56)	(1.03)
ir_dif_l	0.000						0.000					
	(0.41)						(0.29)					
ir_dif_d		-0.001***						-0.001***				
		(-2.63)						(-2.59)				
dif_l_ind			0.001***						0.001***			
			(2.92)						(3.00)			
dif_d_ind				-0.002***						-0.002***		
				(-2.92)						(-2.91)		
dif_l_nfc					0.001**						0.001***	
					(2.50)						(2.75)	
dif_d_nfc						-0.004**						-0.004**
						(-2.29)						(-2.23)
Log L	1053	1847	1230	1238	987	879	1053	1846	1231	1238	986	878
N	630	701	315	427	288	392	630	701	315	427	288	392

Note: t-ratios in the parenthesis. *, ** and *** - significant at 10%, 5%, and 1%
Δl_sh_tot, Δd_sh_tot - change in total loan (l) and deposit (d) dollarization, Δl_sh_ind, Δd_sh_ind - change in individual (ind) loan and deposit dollarization, Δl_sh_nfc, Δd_sh_nfc - change in corporate (nfc) loan and deposit dollarization, ratio - share of foreign funds in foreign currency, open - openness of the economy, interv - proxy for the exchange rate regime, lambda_mue lambda_mde - minimum variance portfolio (calculated using USD/EUR exchange rate - mue, and DM/USD exchange rate - mde),depth - financial market depth, margin_fc margin_lc (loan-deposit) interest rate margin in foreign (fc) and local currency (lc), ir_dif_l ir_dif_d - loan and deposit interest rate differentials (local currency - foreign currency), dif_l_ind, dif_d_ind, dif_l_nfc, dif_d_nfc - interest rate differentials for individuals and firms.

Table 29: ISO Country codes

Country	Code
Albania	AL
Armenia	AM
Azerbaijan	AZ
Bosnia and Herzegovina	BA
Bulgaria	BG
Belarus	BY
Serbia and Montenegro	CS
Czech Republic	CZ
Estonia	EE
Georgia	GE
Hungary	HU
Croatia	HR*
Kazakhstan	KZ
Lithuania	LT
Latvia	LV
Moldova	MD
FYR Makedonia	MK
Poland	PL
Romania	RO
Russia	RU
Slovenia	SI
Slovakia	SK
Tajikistan	TJ
Ukraine	UA

* HX for indexation adjusted

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