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Dollarization, pass-through, and domestic lending: Evidence from Turkish banking

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Dollarization, pass-through, and domestic lending: Evidence from Turkish banking

Abstract

This paper examines financial dollarization in Turkish banking sector during the 2002 Q4 – 2018 Q4 period. We find significant currency mismatch in banks' balance sheets: banks happen to transfer less than 30% of their foreign denominated deposits into foreign denominated credit. In addition, banks with greater currency imbalance are more likely to extend their domestic denominated currency loans. Although raising funds in foreign currency to lend in domestic currency can help banks increase their profits, this also increases banks' exposure to exchange rate risks. Further examination shows that banks continue facing great currency risk despite hedging through off-balance transactions.

Keywords: financial dollarization, commercial banks, currency mismatch, pass-through

JEL classification: G20, G21.

1. Introduction

Financial dollarization is a phenomenon widely observed in emerging and transition economies.[1] This phenomenon is particularly important because a rapid depreciation of the domestic currency can trigger imbalance of payments and financial crises. As a consequence, several studies have examined the drivers as well as consequences of dollarization using annual cross-sectional panel datasets for emerging economies.[2] Very few studies have looked at these issues in the context of a single country e.g. Turkey (Ozsoz, Rengifo, and Kutan 2015; Rengifo, Ozsoz, and Akinkunmi 2013). However, to the best of our knowledge, existing studies have not examined the issues related to financial dollarization from the perspective of domestic banks operating in a country i.e. investigating financial dollarization at bank level.

Lack of research along these lines creates a gap in our understanding. More specifically, those very domestic banks, which accept foreign currency denominated deposits or raise dollar denominated funds, act as an intermediary channeling funds from savers to spenders. At the same time, they also affect the health of the financial system as they shift risks which may emerge from sudden changes in the value of the domestic currency. Hence, to understand the consequences of dollarization, it is important to examine this phenomenon from the perspective of commercial banks that operate in a highly dollarized country.

In this study, we focus on a panel of commercial banks collected from Turkey to examine the degree to which banks transfer their foreign currency funds into foreign currency loans.

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[1] We use the term financial dollarization to describe the denomination of bank deposits and loans in a foreign currency rather than the domestic currency of the country in which they are held.

[2] Theories on the causes of financial dollarization can be divided into four main views including the monetary substitution view, the asset portfolio view, the institutional view, and the market failure view. See, for instance, Broda and Yeyati (2006); Calvo (2002), De La Torre and Schmukler (2004), De Nicoló, Honohan, and Ize (2005); Engineer (2000); Honig (2009); Kutan, Ozsoz, and Rengifo (2012); Luca and Petrova (2008); and Yeyati (2006) for empirical examination.

In doing so, we also examine to what extent macroeconomic factors affect banks' foreign currency denominated loans. Given that the country experienced a highly inflationary period, which started as of the mid-1980s and ended with the implementation of a structural reform package following the 2001 financial crises, financial dollarization has been a major issue in Turkey for quite a long time, reaching 56% in 2001. During these two decades, many businesses, banks and finance houses declared bankruptcy or went into administration for they could not pay back their debt as the value of the domestic currency depreciated on a daily basis. Following the 2001 stabilization program, rate of inflation dropped to less than 10% per annum by 2004 and stayed around the 6-9% level until recently. Yet, in 2017 the rate of inflation exceeded the critical 10% level and in 2018 it hit 25%, as the political and economic environment became unstable. Along with the worsening of the political environment and the upward trend in inflation, the exchange rate depreciated substantially, rendering banks more cautious in their operations.

Hence, an examination of Turkish banking system is meaningful as the country continues to experience high levels of dollarization despite the 2001 reforms. In fact, after the lira had fallen to the by-then record lows against the dollar in November 2016, the central bank tweaked banks' foreign exchange reserve requirements in a way that could allow banks to use an additional $2.9bn to meet their FX liquidity needs.[3] This decision shows that the central bank is keen to interfere in the exchange rate markets as the lira loses value, economy slows down and the rate of inflation exceeds the target.[4] Furthermore, the substantial loss of value of Turkish lira in the summer of 2018, led depositors to increase their foreign currency holdings despite the Turkish central bank increased the base rates by 625 basis points from its previous rate of 17.75 in September 2018. It seems that savers and borrowers who did not trust the actions of the government, which continuously

[3] In 2018, Turkish lira has fallen further, setting the new record lows.

[4] Turkey tweaks reserve rules to boost FX liquidity. https://www.ft.com/content/56351a10-a7ee-357b-8ce6-2b2500dff6fe, Accessed 25.06.2018.

indicated that the economy was in safe hands, will continue to use foreign denominated assets (currency) for major transactions and portfolio allocation purposes into the foreseeable future.[5] In this context our study contributes to the literature in two ways. First, we provide new evidence on financial dollarization using data from Turkey, a highly developed emerging country. Second, we offer a channel that can explain the low pass-through from credit dollarization to deposit dollarization.

Figure 1 displays the extent of financial dollarization in Turkey since 2003. We see that loan dollarization was around 40-50% in the end of 2002 - beginning of 2003, yet over the next 5 years it declined to 25% by 2008. Then after, loan dollarization began to increase reaching at approximately 40% by the end of the sample period. Deposit dollarization portrays a worse tendency. The deposit dollarization ratio was around 70% in the beginning of the sample. Although a slow downward trend brings this ratio to 40% in 2012, at the end of 2014, deposit dollarization reached to 50%. The figure, in fact, suggests that the overall health of the Turkish economy is dependent on the resilience of the banking sector to shocks. If the health of the banking sector was to deteriorate due to an adverse shock, the Turkish economy, which is suffering from chronic current account deficit and high levels of debt, could easily experience a recession deeper than that in 2001.

(Figure 1 about here)

Our results can be summarized as follows. We first provide evidence of a partial pass-through from deposit dollarization to credit dollarization, suggesting the imbalance between foreign currency denominated loans and deposits in banks' balance sheets. We further show that banks with greater mismatch, indicated by the higher ratio of the difference between foreign currency deposits and loans to total assets, tend to extend their domestic lending. This finding reveals a profitable but risky strategy experienced by

[5] Vieira et al. (2012) argues that dollarization is a response to the future inflation expectations. Hence, low inflation does not necessarily promote de-dollarization.

Turkish banks as they take deposits in foreign currencies while lending in domestic currency. We further show that banks continue facing great currency risk despite their efforts to hedge the risk through off-balance sheet activities. Given the trade-off between lending in foreign currencies versus domestic currency (default risks vs. exchange rate risks), we claim that there is a need for an optimal composition of the two loan types in the loan portfolios of banks. Hence, banks can minimize risks while maintaining their profits.

Our study is organized as follows. In Section 2 we describe our empirical strategy. In Section 3 we lay out our data and results. Conclusion is provided in Section 4.

2. Empirical specification

Because of high and chronic inflation experienced in the late 70s and the liberalization of the foreign exchange regime in 1984, foreign exchange deposits became an important financial saving instrument in Turkey by the mid-1980s. This development increased the availability of funds to corporations which needed large sums for their fixed capital investment projects. However, high inflation and cut-throat competition in the financial markets, which continued throughout the turbulent 80s and 90s, have led to bankruptcy of many brokerage firms as well as established family firms, and paved the way to emergence of several new corporations which were able to adapt to the new economic conditions.

With the implementation of the structural changes in 2001, the rate of inflation declined to single digit figures and stabilized around the 6-9% band. The banking sector was also restructured. Yet there was no secular change with respect to the extent of dollarization. Hence, it is important to examine financial dollarization in Turkey for the post 2002-period during which the rate of inflation was in single digits and the exchange rate was stable. Furthermore, the observation that the rate of inflation exceeded the critical 10% level in 2017 and that it hit 25% in 2018 and that depositors continued to increase their foreign currency holdings despite the Turkish central bank increased the base rates 625 basis points from its previous rate of 17.75% in September 2018 add more reasoning to carry out this analysis. In what follows, we empirically investigate financial dollarization from two

facets. We initially examine the extent to which foreign denominated liabilities are passed onto borrowers in the form of credit. We then examine the relationship between currency mismatch and domestic currency denominated lending. It is useful to note that all variables are measured in US dollars because banks in Turkey mainly use the US Dollar to extend loans to borrowers, while lending in other hard currencies such as in Euro or Japanese Yen is less common.

To examine foreign liability pass-through in the banking sector, we use the following form:

$$Dollarization_{it}^{L} = \alpha + \beta_1 Dollarization_{it}^{D} + \beta_2 Macro_t + \beta_3 Dollarization_{it}^{D} \times Macro_t + Controls_{it}\beta_4 + \mu_t + v_i + \epsilon_{it} \quad (1)$$

where *i* refers to a bank and *t* refers to a time period. Credit dollarization, $Dollarization^L$, is defined as the ratio of loans denominated in foreign currency to total credits. In this model we are specifically interested in the coefficient associated with $Dollarization^D$ which measures the total foreign currency denominated deposits to total deposits ratio. Model (1) is estimated using fixed-effect estimator.[6]

Pass-through also might depend on other factors. In particular, we introduce in our models several macroeconomic variables which played significant role when researchers have used cross country data. One of the macroeconomic variables evaluates the role of risks that may emanate from exchange rate fluctuations. To measure exchange rate volatility, we compute the within year standard deviation of the exchange rate between Turkish lira against the US Dollar ($Macro^{XRATE}$). We also employ loan interest rate differential ($Macro^{\Delta CR}$) or deposit interest rate differential ($Macro^{\Delta DR}$) to gauge the effect of cost or revenue margins between domestic and foreign currencies loans. The change in inflation index ($Macro^{\Delta IFL}$) is employed to capture macroeconomic uncertainty.

[6] Results based on Generalized Linear Model (GLM) estimator are quantitatively similar to those we present here and they are available upon request.

Equation (1) further contains an interaction term between the macroeconomic variables and deposit dollarization. We expect that the sign of β_3 would be positive. Such an observation would imply that as risks and the cost of raising external funds increase, the total pass-through should increase. Lastly, our model incorporates bank level control variables including size (*Log*(*TA*)), equity ratio (*Equity/TA*), and deposits-to-assets ratio (*Deposits/TA*). Bank fixed effects are depicted by v_i, time effects are captured by μ_t, and the error term is denoted by ϵ_{it}.

Any estimate of β_1 in model (1) that is less than unity would suggest that the banks do not fully pass foreign denominated funds to borrowers. In this context, a low pass-through implies that foreign denominated funds which banks do not lend out in foreign currency are converted into domestic currency and extended as credit in domestic currency to borrowers. The empirical model used to test this argument is as follows:

$$Loans_{it}^{Lira} = \alpha + \beta_1 FX\ Mismatch_{it} + \beta_2 Macro_t + \beta_3 FX\ Mismatch_{it} \times Macro_t + Controls_{it}\beta_4 + \mu_t + v_i + \epsilon_{it} \quad (2)$$

where the dependent variable, $Loans^{lira}$, is the ratio of Turkish lira denominated loans to total loans. The main variable of interest, *FX Mismatch*, is defined as the $\frac{foreign\ denominated\ deposits - foreign\ denominated\ loans}{foreign\ denominated\ loans}$ ratio. By construction, the higher this variable is, the more excessive foreign denominated deposits we observe. The remaining in the model variables are similar to those in equation (1). Model (2) is estimated using fixed effect estimator.

3. Data and Empirical Results

Data

We examine financial dollarization of Turkish banks during the 2002 Q4 – 2018 Q4 period. We start the investigation as of 2002 Q4 as the 2001 stabilization program led to single

digit inflation level in 2004.[7] We stop our sample in 2018 Q4 to ensure the consistency of data availability across employed variables, including the peak inflation rate since the pre-2001 crises in the examination. During our sample period, inflation levels were generally stable and lower than 10% but dollarization was still an issue. To carry out our investigation, we downloaded data published on the Banks Association of Turkey website. To work with a set of banks that were fully operational during this period, we screened the data as follows. We, first, excluded investment and development banks as well as banks that have gone into administration from our data. Second, we removed observations with zero values for both deposits and loans from estimation sample. Third, to alleviate the influence of extreme observations, bank-level variables are winsorized at the most extreme (top and bottom) one percent level of the distribution. After the screening, our sample consisted of 1,495 bank-quarter observations pertaining to 9 private, 1 state, and 16 foreign owned banks.

The descriptive statistics of the estimation sample is presented in Table 1. We observe that on average 32.7% of loans extended by banks in Turkey are denominated in foreign currency. Given that the associated standard deviation is 20.5%, it is clear that while some banks extend quite a lot credit in foreign currency than the average, others lend much less. Furthermore, more than 52% of all deposits are denominated in foreign currency. Similar to the case of loans, the standard deviation of deposits denominated in foreign currency is high (21.3%). However, on average the amount of foreign currency denominated deposits is about 6 times higher than the amount of foreign currency denominated loans, suggesting the significant imbalance between foreign currency deposits and loans. Examining banks' other characteristics, we observe that 16.5% of assets are made up by equity capital. Turkish banks rely heavily on deposit findings since deposits accounts for more than 54% of total assets.

[7] Inflation level in in 2002 was around 30%, down from 60% the year before. In 2003 the rate fell to 12.7%, As of and including 2004 until 2017 inflation stayed within single digit figures.

Over the period of investigation, average exchange rate volatility has been reasonably low. The average difference between domestic and foreign denominated deposit and loan rates is in the order of 12-13% with a standard deviation of 8-9% suggesting a decline over the years as the rate of inflation slightly fell. However, compared to developed economies, the real interest rate in Turkey is quite high, perhaps to compensate for the risks and high inflation embedded in the system.

(Table 1 about here)

Empirical results

Table 2 reports results for the pass-through from deposit dollarization to credit dollarization. We find that the pass-through is between 0.21 and 0.26, i.e. less than unity. This suggests that for each unit of foreign currency deposited in a bank, at most 26% of it is passed to borrowers in the form of foreign currency loans. When we examine the impact of macroeconomic factors including exchange rate volatility, change in inflation index, and interest rate differential, we see that in most cases, these factors do not affect loans in foreign currency. The exceptions include credit and deposit interest rate differentials: the higher disparity between lira rates and foreign currency rates is associated with the higher level of foreign currency denominated loans. However, the coefficients become insignificant when both variables are included in the estimation (Column 1). Furthermore, most interaction terms are not significant, either. One exception is the impact of exchange rate volatility. In general, the pass-through rate of banks that have more foreign currency – denominated deposits is higher than that of banks with lower level of foreign currency deposits. This result is comparable with previous studies on the short-run determinants of loan dollarization (e.g., Neanidis and Savva 2009).

(Table 2 about here)

Since only a small part of foreign currency deposits is transferred into foreign currency credit, the remainder is either kept as reserves or converted into domestic currency to provide credit in domestic currency. In this context, the significant and positive coefficients

on *FX Mismatch* in Table 3 suggest that it is indeed the latter case. This finding can be explained by a number of factors. First, given the concern about political turmoil that can affect the value of the currency and impact the ability of the borrowers to pay back their loans, borrowers are reluctant to borrow money in foreign currencies. Second, in recent years, political pressure has been put on Turkish commercial banks to increase lira lending (Kandemir 2018) and on the Turkey's Central Bank to keep low interest rates (The Economist 2018a). Further, there is a great demand for lira loans, which exceeds lira deposits by large (The Economist 2018b). In this scenario, banks have incentives to take foreign currency denominated deposits and lend in lira to be profitable as raising funds in domestic currency is more expensive than raising funds in foreign currencies.

(Table 3 about here)

It is worth stressing that regardless of underlying causes, Turkish banks are highly exposed to exchange rate risk. This risk exposure seems to be persistent as it was also observed during the 2003 – 2009 period (see Ozsoz, Rengifo, and Kutan 2015). The exposure, in its turn, can trigger a series of bankruptcies and jeopardize the stability of the financial system. Further, the degree of exposure is amplified by the fact that Turkish banking system is mostly unhedged against exchange rate fluctuations (Rengifo, Ozsoz, and Akinkunmi 2013). One may object to this argument indicating that the GDP is growing. However, growth is not a consequence of productivity but it is due to investments in construction industry and consumption. Furthermore, given that the domestic currency has been devaluated against the major currencies since mid-2015 in the order of 30-40%, it would not be incorrect to say that the banking sector and the country along with it will go through a difficult period and experience a notable contraction.

Further considerations

To account for the fact that Turkish banks have increasingly borrowed money from aboard, we adjust our deposit dollarization and currency mismatch measures as follows. The $Dollarization^D$ variable is now calculated as a ratio of the total foreign currency

denominated funds including deposits and borrowed funds to total funds. Similarly, the *FX Mismatch* is measured as $\frac{foreign\ denominated\ funds - foreign\ denominated\ loans}{foreign\ denominated\ loans}$ ratio. Results for the estimations with these alternative measures are reported in Tables 4 and 5 and are consistent with our baseline findings. More specifically, Turkish banks pass at most 36.4% of their funding in foreign currencies into foreign denominated loans. Further, the higher level of imbalance between foreign currency funds and foreign currency loans is related to the higher share of loans in Turkish lira.

(Tables 4 and 5 about here)

In addition, it has been widely viewed that banks can hedge risks arising from the mismatch between foreign currency denominated loans and deposits by involving in off-balance sheet activities such as FX derivatives. In other words, banks would not face currency risk if the (positive) difference between foreign denominated deposits and loans is completely offset by the (positive) difference between foreign denominated financial derivative assets and liabilities. In this sense, banks' net exposure to currency risk would be the mismatch that is not counterbalanced by the net off-balance sheet position. To examine the degree to which Turkish banks' currency risk is diminished by off-balance sheet activities, we employ the following model:

$$Net\ off-balance\ sheet\ position_{it} = \alpha + \beta_1 FX\ Imbalance_{it} + \beta_2 Macro_t + \beta_3 FX\ Imbalance_{it} \times Macro_t + Controls_{it}\beta_4 + \mu_t + v_i + \epsilon_{it} \quad (3)$$

where the dependent variable, *Net off-balance sheet position*, is the difference between foreign denominated financial derivative assets and foreign denominated financial derivative liabilities (measured in billion USD). *FX Imbalance* is the difference between foreign denominated deposits and foreign denominated loans (measured in billion USD). The remaining variables are similar to the ones in models (1) and (2). Results presented in Table 6 suggest that only about a half of the imbalance between FX deposits and FX loans is balanced by the net off-balance sheet position. This result is in support of Rengifo, Ozsoz, and Akinkunmi (2013) who also acknowledge the absence of hedging against

exchange rate fluctuations in the Turkish banking system. In other words, despite the current effort of using hedging instruments, Turkish banks are still largely exposed to currency risk, especially following the developments in the summer of 2018 when Turkish lira has fallen to the new record lows.

(Table 6 about here)

To further check the robustness of our baseline results, we examine several additional specifications. For instance, considering the covered interest rate disparity, we can write:

$$1 + r_d = \frac{F}{S} \times \left(1 + r_f\right)$$

where r_d is the interest rate in domestic currency, r_f is the interest rate in foreign currency, F is the forward exchange rate, and S is the spot exchange rate. Thus, one could use the ratio of 3-month forward USD/TRY exchange rate to spot USD/TRY exchange rate as a proxy for loan interest rate differential. A similar approach can be implemented for 1-month, 6-month, and 1-year forward exchange rate to calculate covered interest rate disparity. Our results are similar when we use these alternative measures.[8]

Moreover, Ize and Yeyati (2003) and Yeyati (2006) show that the minimum variance portfolio dollarization (MVP dollarization), which is a function of macroeconomic uncertainty, can approximate the real level of financial dollarization. Hence, we also include MVP dollarization to estimate models (1) and (2).

$$MVP\ dollarization = \frac{Var^{IFL} + Cov^{IFL,XRATE}}{Var^{IFL} + Var^{XRATE} + 2Cov^{IFL,XRATE}}$$

where Var^{IFL}, Var^{XRATE}, and $Cov^{IFL,XRATE}$ are the variance of inflation, variance of exchange rate, and covariance between inflation and exchange rate, respectively. Since MVP dollarization is already a function of inflation and exchange rate fluctuations, we exclude

[8] The results are available upon request.

$Macro^{XRATE}$ and $Macro^{\Delta DR}$ from the estimations in which MVP dollarization is included. Our results are robust to all these tests.[9]

4. Conclusion

In this paper, we examine financial dollarization and currency mismatch for a panel of commercial banks in Turkey. The data cover the period between 2002 Q4 and 2018 Q4. An examination as such on Turkish banks is relevant because dollarization has become an acute problem in Turkey. Our investigation shows that there is a partial pass-through of foreign deposits into borrowers in the form of foreign denominated loans. The remaining funds are likely to be converted into domestic currency to lend to other borrowers since a bank with greater imbalance between foreign deposits and foreign loans tends to increase lira loans. Further investigation shows that the mismatch between foreign denominated loans and deposits remains a problem despite banks' attempt to hedge currency risk through off-balance sheet activities.

Given our findings, we argue that the high currency exposure risk of Turkish commercial banks can cause a significant adverse impact on the soundness of the whole financial system if the value of Turkish lira declines substantially. In a situation as such, one would expect to see the government and the central bank to act convincingly so that financial stability is maintained. However, when a government does not strive to resolve the structural problems of the economy, the effort of the central bank may not be sufficient to stabilize the financial markets, let alone to control the value of the currency. Additionally, the debates in policy circles that the Turkish central bank is failing to act as an independent institution is not helping the situation, either. In this context, the country may find itself in the middle of a perfect storm if an adverse political or financial shock hits the system. For instance, if foreign investors pull out of the country while the value of the domestic currency declines, banks that dollarized as well as the rest of the financial institutions can easily collapse under the weight of bad loans. Thus, all things considered, there is a need

[9] The results are available upon request.

for a long-term solution to tackle the chronic problems rather than short-term solutions that will just save the day.

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Tables

Table 1. Summary statistics

	Mean	SD	Obs.
Dollarization^{L}	0.327	0.205	1,495
Dollarization^{D}	0.525	0.213	1,495
FX Mismatch	5.100	18.423	1,495
Loans^{lira}	0.673	0.205	1,495
Log(TA)	7.680	2.259	1,495
Equity/TA	0.165	0.131	1,495
Deposits/TA	0.544	0.206	1,495
Macro^{XRATE}	0.067	0.106	1,495
$\text{Macro}^{\Delta IFL}$	-0.000	0.007	1,451
$\text{Macro}^{\Delta DR}$	0.121	0.087	1,495
$\text{Macro}^{\Delta CR}$	0.130	0.078	1,495

This table presents the summary statistics for the estimation sample. $Dollarization^{D}$ is the ratio of USD denominated deposits to total deposits. $Dollarization^{L}$ is the ratio of USD denominated loans to total loans. *FX Mismatch* is the ratio of the difference between foreign currency denominated deposits and foreign currency denominated loans to foreign denominated loans. *Log(TA)* is the natural logarithm of total assets. *Equity/TA* is the ratio of equity to total assets. *Deposits/TA* is the deposits-to-total assets ratio. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Table 2. Pass-through from deposit dollarization to credit dollarization

	(1)	(2)	(3)	(4)	(5)
Dollarization^{D}	0.235***	0.213***	0.232***	0.262***	0.246***
	(0.063)	(0.041)	(0.039)	(0.056)	(0.059)
Macro^{XRATE}	-0.123	-0.133			
	(0.116)	(0.083)			
$\text{Macro}^{\Delta IFL}$	0.515		0.053		
	(1.316)		(1.285)		
$\text{Macro}^{\Delta DR}$	0.749			0.503**	
	(0.905)			(0.246)	
$\text{Macro}^{\Delta CR}$	-0.440				0.431**
	(0.826)				(0.220)
$\text{Dollarization}^{D}\times\text{Macro}^{XRATE}$	0.414**	0.411***			
	(0.207)	(0.147)			
$\text{Dollarization}^{D}\times\text{Macro}^{\Delta IFL}$	-2.600		-1.491		
	(2.699)		(2.624)		
$\text{Dollarization}^{D}\times\text{Macro}^{\Delta DR}$	-1.230			-0.205	
	(1.474)			(0.325)	
$\text{Dollarization}^{D}\times\text{Macro}^{\Delta CR}$	0.869				-0.062
	(1.428)				(0.338)
Log(TA)	0.010	0.002	0.008	0.001	0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Equity/TA	-0.748***	-0.722***	-0.741***	-0.727***	-0.722***
	(0.075)	(0.076)	(0.074)	(0.077)	(0.077)
Deposits/TA	-0.216***	-0.187***	-0.189***	-0.188***	-0.181***
	(0.037)	(0.033)	(0.033)	(0.035)	(0.034)
Obs.	1,451	1,495	1,451	1,495	1,495
R-squared	0.696	0.684	0.692	0.684	0.684

Column (1) shows results with all macroeconomic variables. Columns (2)-(5) show results for regressions with standard deviation of US dollar - Turkish lira exchange rate ($Macro^{XRATE}$), first difference of inflation index ($Macro^{\Delta IFL}$), difference between US dollar denominated deposit rate and Turkish lira denominated deposit rates ($Macro^{\Delta DR}$), and difference between US dollar denominated loan rates and Turkish lira denominated loan rates ($Macro^{\Delta CR}$) as the macroeconomic variable, respectively. In all regressions, a constant term, bank and time fixed effects are included but not reported. Robust standard errors are in parentheses. $Dollarization^{D}$ is the ratio of USD denominated deposits to total deposits. *Log(TA)* is the natural logarithm of total assets. *Equity/TA* is the ratio of equity to total assets. *Deposits/TA* is the deposits-to-total assets ratio. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Table 3. Currency mismatch and domestic currency lending

	(1)	(2)	(3)	(4)	(5)
FX Mismatch	0.004***	0.004***	0.003***	0.003***	0.003***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
$Macro^{XRATE}$	-0.092*	-0.099**			
	(0.053)	(0.042)			
$Macro^{\Delta IFL}$	0.733		0.711*		
	(0.524)		(0.397)		
$Macro^{\Delta DR}$	0.038			-0.377**	
	(0.487)			(0.166)	
$Macro^{\Delta CR}$	-0.226				-0.463***
	(0.390)				(0.152)
FX Mismatch ×$Macro^{XRATE}$	-0.001	-0.003***			
	(0.002)	(0.001)			
FX Mismatch ×$Macro^{\Delta IFL}$	0.000		-0.020		
	(0.040)		(0.035)		
FX Mismatch ×$Macro^{\Delta DR}$	0.018			0.002	
	(0.016)			(0.003)	
FX Mismatch ×$Macro^{\Delta CR}$	-0.020				0.000
	(0.015)				(0.003)
Log(TA)	-0.004	0.004	-0.001	0.005	0.005
	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)
Equity/TA	0.483***	0.459***	0.495***	0.467***	0.464***
	(0.076)	(0.076)	(0.075)	(0.077)	(0.077)
Deposits/TA	0.079**	0.069**	0.080**	0.070**	0.066*
	(0.035)	(0.034)	(0.034)	(0.035)	(0.035)
Obs.	1,451	1,495	1,451	1,495	1,495
R-squared	0.726	0.717	0.722	0.716	0.717

Column (1) shows results with all macroeconomic variables. Columns (2)-(5) show results for regressions with standard deviation of US dollar - Turkish lira exchange rate ($Macro^{XRATE}$), first difference of inflation index ($Macro^{\Delta IFL}$), difference between US dollar denominated deposit rate and Turkish lira denominated deposit rates ($Macro^{\Delta DR}$), and difference between US dollar denominated loan rates and Turkish lira denominated loan rates ($Macro^{\Delta CR}$) as the macroeconomic variable, respectively. In all regressions, a constant term, bank and time fixed effects are included but not reported. Robust standard errors are in parentheses. *FX Mismatch* is the ratio of the difference between foreign currency denominated deposits and foreign currency denominated loans to foreign denominated loans. *Log(TA)* is the natural logarithm of total assets. *Equity/TA* is the ratio of equity to total assets. *ROA* is the return on assets ratio. *Deposits/TA* is the ratio of total deposits to total assets. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Table 4. Pass-through from deposit dollarization to credit dollarization – alternative measure

	(1)	(2)	(3)	(4)	(5)
Dollarization^{D}	0.364***	0.333***	0.324***	0.359***	0.354***
	(0.059)	(0.037)	(0.035)	(0.049)	(0.053)
Macro^{XRATE}	0.104	0.102			
	(0.134)	(0.110)			
$\text{Macro}^{\Delta IFL}$	0.138		-0.211		
	(1.373)		(1.323)		
$\text{Macro}^{\Delta DR}$	0.934			0.523**	
	(0.857)			(0.257)	
$\text{Macro}^{\Delta CR}$	-0.571				0.494**
	(0.766)				(0.240)
$\text{Dollarization}^{D}\times\text{Macro}^{XRATE}$	0.002	-0.027			
	(0.227)	(0.183)			
$\text{Dollarization}^{D}\times\text{Macro}^{\Delta IFL}$	-1.849		-0.931		
	(2.473)		(2.375)		
$\text{Dollarization}^{D}\times\text{Macro}^{\Delta DR}$	-1.344			-0.243	
	(1.325)			(0.333)	
$\text{Dollarization}^{D}\times\text{Macro}^{\Delta CR}$	0.905				-0.189
	(1.266)				(0.349)
Log(TA)	0.011	0.003	0.010	0.003	0.003
	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)
Equity/TA	-0.717***	-0.687***	-0.710***	-0.694***	-0.692***
	(0.071)	(0.073)	(0.070)	(0.073)	(0.074)
Deposits/TA	-0.150***	-0.125***	-0.134***	-0.135***	-0.131***
	(0.034)	(0.032)	(0.032)	(0.033)	(0.032)
Obs.	1,451	1,495	1,451	1,495	1,495
R-squared	0.702	0.690	0.700	0.691	0.691

Column (1) shows results with all macroeconomic variables. Columns (2)-(5) show results for regressions with standard deviation of US dollar - Turkish lira exchange rate ($Macro^{XRATE}$), first difference of inflation index ($Macro^{\Delta IFL}$), difference between US dollar denominated deposit rate and Turkish lira denominated deposit rates ($Macro^{\Delta DR}$), and difference between US dollar denominated loan rates and Turkish lira denominated loan rates ($Macro^{\Delta CR}$) as the macroeconomic variable, respectively. In all regressions, a constant term, bank and time fixed effects are included but not reported. Robust standard errors are in parentheses. $Dollarization^{D}$ is the ratio of USD denominated funds (including deposits and borrowed funds) to total funds. *Log(TA)* is the natural logarithm of total assets. *Equity/TA* is the ratio of equity to total assets. *Deposits/TA* is the deposits-to-total assets ratio. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Table 5. Currency mismatch and domestic currency lending – alternative measure

	(1)	(2)	(3)	(4)	(5)
FX Mismatch	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Macro^{XRATE}$	-0.095*	-0.101**			
	(0.053)	(0.042)			
$Macro^{\Delta IFL}$	0.740		0.700*		
	(0.534)		(0.401)		
$Macro^{\Delta DR}$	-0.020			-0.384**	
	(0.495)			(0.170)	
$Macro^{\Delta CR}$	-0.184				-0.460***
	(0.393)				(0.153)
FX Mismatch ×$Macro^{XRATE}$	-0.000	-0.001			
	(0.001)	(0.001)			
FX Mismatch ×$Macro^{\Delta IFL}$	-0.010		-0.009		
	(0.019)		(0.017)		
FX Mismatch ×$Macro^{\Delta DR}$	0.010			0.000	
	(0.009)			(0.001)	
FX Mismatch ×$Macro^{\Delta CR}$	-0.012				-0.001
	(0.009)				(0.001)
Log(TA)	-0.009	-0.001	-0.006	0.000	-0.000
	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)
Equity/TA	0.565***	0.538***	0.567***	0.538***	0.538***
	(0.073)	(0.074)	(0.073)	(0.074)	(0.074)
Deposits/TA	0.133***	0.125***	0.133***	0.123***	0.121***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Obs.	1,451	1,495	1,451	1,495	1,495
R-squared	0.725	0.715	0.721	0.715	0.716

Column (1) shows results with all macroeconomic variables. Columns (2)-(5) show results for regressions with standard deviation of US dollar - Turkish lira exchange rate ($Macro^{XRATE}$), first difference of inflation index ($Macro^{\Delta IFL}$), difference between US dollar denominated deposit rate and Turkish lira denominated deposit rates ($Macro^{\Delta DR}$), and difference between US dollar denominated loan rates and Turkish lira denominated loan rates ($Macro^{\Delta CR}$) as the macroeconomic variable, respectively. In all regressions, a constant term, bank and time fixed effects are included but not reported. Robust standard errors are in parentheses. *FX Mismatch* is the ratio of the difference between foreign currency denominated funds and foreign currency denominated loans to foreign denominated loans. *Log(TA)* is the natural logarithm of total assets. *Equity/TA* is the ratio of equity to total assets. *ROA* is the return on assets ratio. *Deposits/TA* is the ratio of total deposits to total assets. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

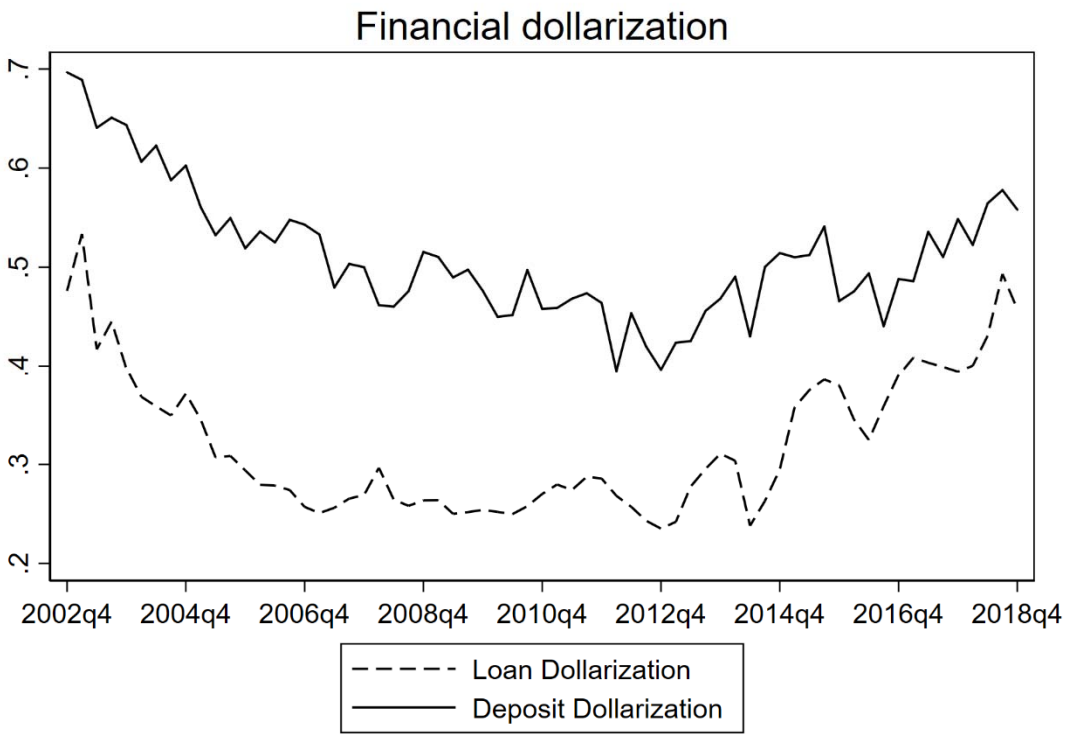
Table 6. Currency deposits – loans imbalance and net off-balance sheet position

	(1)	(2)	(3)	(4)	(5)
FX Imbalance	0.377***	0.413***	0.438***	0.500***	0.458***
	(0.039)	(0.036)	(0.035)	(0.039)	(0.041)
$Macro^{XRATE}$	0.734	-0.855*			
	(0.534)	(0.447)			
$Macro^{\Delta IFL}$	-0.367		-1.375		
	(5.438)		(6.715)		
$Macro^{\Delta DR}$	19.817***			2.125	
	(3.822)			(1.572)	
$Macro^{\Delta CR}$	-19.679***				-0.107
	(3.704)				(1.607)
FX Imbalance×$Macro^{XRATE}$	-0.130	0.327			
	(0.202)	(0.199)			
FX Imbalance×$Macro^{\Delta IFL}$	1.213		2.339		
	(1.963)		(2.544)		
FX Imbalance×$Macro^{\Delta DR}$	-6.879***			-1.264***	
	(0.730)			(0.254)	
FX Imbalance×$Macro^{\Delta CR}$	5.707***				-0.304
	(0.707)				(0.240)
Log(TA)	0.031	-0.052	0.000	0.064	0.021
	(0.066)	(0.072)	(0.080)	(0.081)	(0.079)
Equity/TA	0.187	0.754***	0.975***	1.192***	1.083***
	(0.231)	(0.286)	(0.285)	(0.285)	(0.282)
Deposits/TA	-0.142	-0.778***	-0.854***	-0.681***	-0.859***
	(0.145)	(0.165)	(0.174)	(0.173)	(0.177)
Obs.	1,068	1,079	1,068	1,079	1,079
R-squared	0.669	0.600	0.593	0.610	0.593

Column (1) shows results with all macroeconomic variables. Columns (2)-(5) show results for regressions with standard deviation of US dollar - Turkish lira exchange rate ($Macro^{XRATE}$), first difference of inflation index ($Macro^{\Delta IFL}$), difference between US dollar denominated deposit rate and Turkish lira denominated deposit rates ($Macro^{\Delta DR}$), and difference between US dollar denominated loan rates and Turkish lira denominated loan rates ($Macro^{\Delta CR}$) as the macroeconomic variable, respectively. In all regressions, a constant term, bank and time fixed effects are included but not reported. Robust standard errors are in parentheses. *FX Imbalance* is the difference between foreign currency denominated funds and foreign currency denominated loans to foreign denominated loans ratio. *Log(TA)* is the natural logarithm of total assets. *Equity/TA* is the ratio of equity to total assets. *ROA* is the return on assets ratio. *Deposits/TA* is the ratio of total deposits to total assets. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Figures

Figure 1. Financial dollarization in Turkish banking (2002 Q4 – 2018 Q4)



Financial dollarization in Turkish banking sector during the 2002 Q4 – 2018 Q4 period.