What Drives Dollarization in Turkey?

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What Drives Dollarization in Turkey?

Kıvılcım Metin-Özcan[*] and Vuslat Us[**]

This paper provides an analysis on the source of dollarization in Turkey by constructing measures for asset, liability and offshore dollarization. In doing so, the study seeks a co-integration relationship among these variables. Results suggest that rising asset dollarization was mainly demand-driven originating from increasing demand for foreign assets before the 2001 financial crisis. The increasing demand for foreign assets in turn resulted in an increase in foreign currency-denominated debt thus causing an increase in liability dollarization. However, this story changed radically after the crisis. The post-crisis period witnessed externally driven dollarization albeit at a decreasing rate. Increasing external funding opportunities for the banking system produced an increase in offshore dollarization, which eventually fed into higher asset dollarization than otherwise would have occurred. Thus, the empirical evidence suggests that if it were not for the increasing rate of offshore dollarization, asset dollarization would have been lower. The evidence also suggests that the strong fight against inflation under the Inflation Targeting framework led to lower asset dollarization through lower inflation and a more stable exchange rate; however the resulting interest rate differentials and decreased currency risk also motivated more external funding thus leading to higher offshore dollarization.

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I. Introduction

Emerging market economies (EMs) have been increasingly resorting to international markets to finance domestic production due to insufficient domestic capital. In the meantime, global liquidity has become abundant over the past years, mainly owing to extremely accommodative monetary policies in the US, Eurozone and Japan during 2002 and 2005. More specifically, the recent past can be characterized as one where excess global liquidity conditions and historical low levels of risk aversion remained in abundance. This has provided easy money to financial markets in the form of increase in foreign currency denominated liability.

In the meantime, EMs are still exposed to problems arising from deposit dollarization that tends to be high and persistent. Banking system when faced with large domestic and external liabilities denominated in foreign currencies may either absorb the currency risk by making domestic currency loans or shift the currency risk to the borrowers by lending in foreign currencies. Empirical findings suggest that banks once exposed to currency risk through dollar liabilities from domestic and external sources shift this risk onto firms by lending in foreign currency (Luca and Petrova, 2008).

In a dollarized economy, dollarization traditionally implied doubts about the stability of money, thus causing the monetary policy to be less effective and more complex (Reinhart et al, 2003). In other words, dollarization was an obstacle that challenged the pursuit of a coherent and independent monetary policy. [1]

The recent crisis situations in Russia, East Asia, Argentina and Turkey have shown that foreign currency-denominated deposits are mirrored by liabilities. Both seem to be important in determining the characteristics and the degree of dollarization. Hence, "liability dollarization" came to be noticed after increased attention to the vulnerability of EMs.

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[1] Seminal works on currency substitution that discuss the effects of dollarization on monetary policy effectiveness include Miles (1978), Bordo and Choudri (1982), Girton and Roper (1981), Ortiz (1983), Canzoneri and Diba (1992), Thomas (1985), Artis (1996), Giovannini (1991), Giovannini and Turtelboom (1994), Guidotti (1993), Krueger and Ha (1995), McKinnon (1982, 1985), Calvo and Végh (1992, 1996).

While asset dollarization is generally seen as being caused primarily by a history of macroeconomic mismanagement, liability dollarization can be attributed to several factors. These include financial sector development and completeness, moral hazard causing borrowers to increase their foreign currency liabilities and bailout expectations. (Caballero and Krishnamurthy, 2002; Dooley, 1997; Burnside et al, 1999). Liability dollarization can also be analyzed in the context of a general portfolio model by studying such factors as capital inflows, regulatory wedge, risk and market power differentials (Ize and Levy-Yeyati, 1998; Catao and Terrones, 2000). The increased globalization of financial markets and liberalization of domestic financial systems can lead to significant expansion in liability dollarization (Barajas and Morales, 2003).

The consequences of asset dollarization are mostly related to the loss in effectiveness of monetary policy, but liability dollarization has many implications. It exposes the balance sheets of both public and private sectors to large swings in the exchange rate, thus contributing to financial crises (Goldstein and Turner, 1996). This increased vulnerability in turn causes policymakers to favor a relatively stable exchange rate.[2] Thus, as liability dollarization amplifies potential downturns in economic activity (Caballero and Krisnamurthy, 2002), the cost of exchange rate volatility increases for policymakers. Therefore countries tend to be biased towards maintaining exchange rate stability until they are financially integrated, macroeconomically stable and can hedge their exchange rate risk exposure (Poirson, 2001).

Although asset dollarization and liability dollarization have different causes and implications, the issue of liability dollarization was not generally been addressed separately from the issue of asset dollarization. This is especially true for the Turkish economy. Even though Yılmaz (2005) and Akıncı et al (2005) made some initial attempts to create a composite dollarization index by analyzing different measures of dollarization in Turkey and measuring liability dollarization, there is still a need for further research that explores the link between asset

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[2] This argument was extended to explain why many countries do not let their exchange rates float (Calvo and Reinhart, 2000).

dollarization and liability dollarization in an econometric framework with the aim of finding the source of dollarization.

Clearly, the source of dollarization provides very useful information about the motivation to *dollarize* in addition to offering insight about its policy implications. In other words, depending on the source of dollarization, both the underlying motivation and the policy implications of dollarization can vary. Hence, finding the source of dollarization is essential for policymakers especially before launching a dedollarization scheme.

In seeking an econometric relation between various measures of dollarization, we exploit three distinct measures: asset dollarization, liability dollarization and offshore dollarization.[3] More specifically, asset dollarization is measured as a share of foreign currency-denominated deposits in broad money; liability dollarization is measured as the ratio of foreign currency-denominated credits to total credits supplied by domestic banks to residents. Offshore dollarization is measured as the ratio of cross-border foreign currency-denominated credits to total credits borrowed by the banking sector. [4]In this context, a partially dollarized economy would be described as one where households and firms hold a fraction of their portfolio in foreign currency assets and/or borrow in foreign currency; banks would lend in foreign currency, and they would also borrow from abroad in foreign currency.

Given this setting, the key objective of our paper is to shed light on the link between these competing concepts of dollarization. We ask whether dollarization is demand or supply driven, and we also study whether it starts domestically or externally. To our knowledge, these issues have not been previously addressed.

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[3] Clearly, in this paper, asset dollarization ignores other foreign currency denominated assets such as stocks and bonds and in fact boils down to measuring *deposit* dollarization. Similarly, liability dollarization measures only *loan* dollarization. Furthermore, owing to the lack of data, asset dollarization does not include foreign currency cash holdings or offshore deposits by the private sector.

[4] The share of cross-border foreign currency denominated credits to total credits borrowed by the banking sector is admittedly a coarse measure for offshore dollarization.

The paper is in four sections. After this brief introduction, the next section provides a short account of the Turkish experience with dollarization. The following section presents the findings of the econometric model. Finally, the last section deals with conclusions.

II. The History of Dollarization in Turkey

The Turkish economy has been experiencing dollarization since the introduction of foreign currency deposits in December 1983. Metin-Ozcan and Us (2007) point out that a high and volatile rate of inflation, a depreciating exchange rate, unsuccessful stabilization efforts, financial crises, and under-developed capital markets all contributed to the rising dollarization ratios. The authors point out that asset dollarization has been heavily and adversely affected by the volatility that has resulted from inflation, from exchange rate changes and expectations about exchange rate changes.

Figures 1-2 demonstrate that dollarization has been on a steady rise during 1985-1993. The below figures further show that that the significant devaluation of the Turkish lira in the aftermath of the 1994 financial crisis carried dollarization to an upper plateau. The collapse of the exchange-rate-based stabilization program in February 2001 further promoted the upward trend in dollarization. However, recent figures indicate that the dollarization ratio has been declining since the end of 2001-from 57 percent in October 2001 to 34 percent by mid 2006. Yet, a cursory look at figure 3 shows that the downward trend in asset dollarization stems from more than proportionate increase in M2Y, i.e. foreign currency-denominated deposits is still on the rise (Figure 3).

Figure 1. Asset Dollarization and
Exchange Rate (percent)

Figure 2. Asset Dollarization and
Inflation Rate (percent)
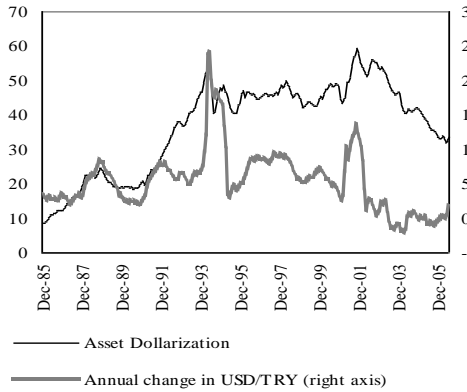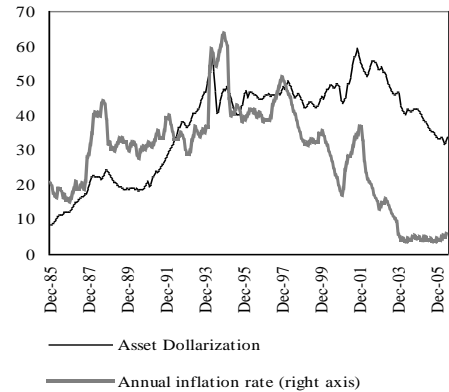
Source: Central Bank of Turkey   Source: Central Bank of Turkey

Figure 3. Asset Dollarization and FX Deposits
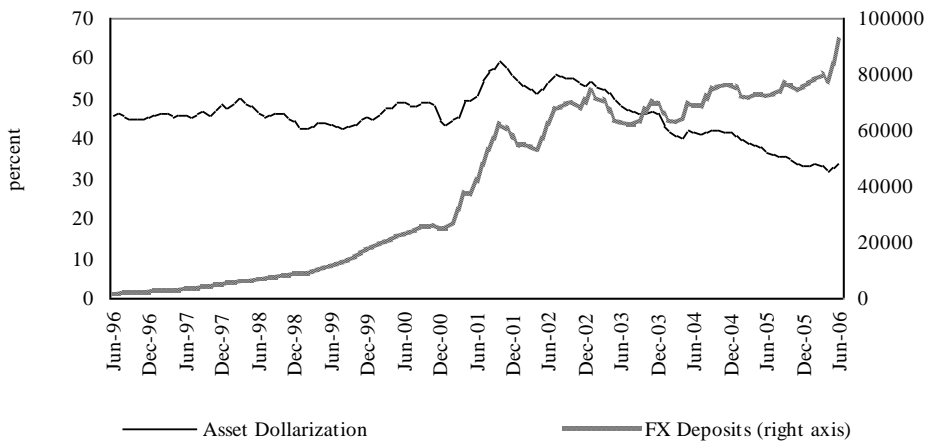
Source: Central Bank of Turkey

Liability dollarization that captures the financial system's exposure to systemic risk in the case of large devaluations follows a similar pattern with asset dollarization. In other words, liability dollarization, which is denoted by the share of foreign exchange credits in total credits, declined noticeably after the 2001 crisis from 50 percent in September

2001 to 17 percent in June 2006. However, foreign currency denominated credits followed an upward trend throughout the last decade (Figure 4).

Figure 4. Liability Dollarization and FX Credits
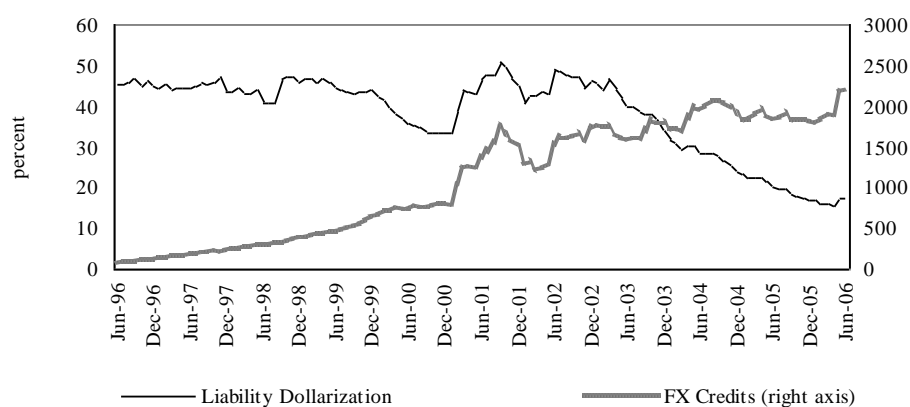
Source: Central Bank of Turkey

Offshore dollarization -our final measure of dollarization- is denoted by the ratio of foreign credits used by the banking sector to total credits borrowed by the banking sector and it shows an upward trend throughout the analysis. Unlike the other measures, offshore dollarization continued its upward trend after the 2001 financial crisis. Moreover, starting in mid 2003, foreign credits used by the banking sector increased at an accelerating rate (Figure 5).

Figure 5. Offshore Dollarization and Foreign Credits Used by the Banking Sector

——— Offshore Dollarization   ———— Foreign Credits Used by the Banking Sector (right axis)
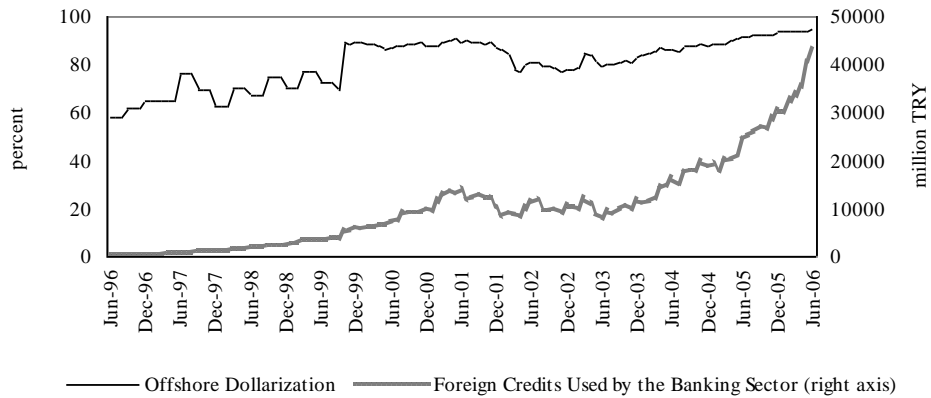
Source: Central Bank of Turkey

In summary, asset dollarization and liability dollarization decreased in the aftermath of the 2001 financial crisis, but the offshore dollarization ratio increased further. Both foreign currency-denominated deposits and foreign currency-denominated credits continued to increase during this period. Moreover, asset dollarization and liability dollarization moved in the same direction while offshore dollarization followed a different pattern.

These findings suggest that as the Turkish economy started to stabilize after the crisis, both the asset dollarization and the liability dollarization ratios fell significantly; however the economic stabilization led to more external funding opportunities for banks, as indicated by higher offshore dollarization.

This finding is compatible with the recent finding by Luca and Petrova (2008) that states that emerging market and transition economies have in general insufficient domestic capital and use international markets to finance domestic production.

III. Empirical Analysis

The results of the earlier section leave us with several unanswered questions. Does offshore dollarization result in more asset dollarization and liability dollarization than would otherwise take place? Where does

dollarization originate? Does dollarization originate on the asset side or on the liability side or is it simply fed by external funding of the banking sector? Finally, the evidence suggests a reversal in asset dollarization and liability dollarization after the financial crisis. If so, the questions need to be asked separately for the pre-crisis and post-crisis periods since there are probably different factors affecting dollarization.

Barajas and Morales (2003) and Morón and Castro (2003) offer empirical evaluations to resolve the above questions. They study the relationship between asset dollarization and liability dollarization in a cointegrating relation and provide evidence about the direction of causality. They find that deposit dollarization is the source of loan dollarization; initially deposit dollarization causes liability dollarization but later on liability dollarization causes asset dollarization.

We would expect to find a similar result where dollarization is demand driven in the pre-crisis period but supply driven in the post-crisis period. We also expect to find causality between liability dollarization and offshore dollarization during the post-crisis period.

The reasoning is as follows: as more external funding became more available to banks in the post-crisis period, they were able to offer more funds denominated in foreign currency; this led to an increase in foreign currency-denominated deposits. However, in the pre-crisis period, we believe that dollarization originated on the asset side implying that when agents demanded more foreign currency for hedging purposes, this was reflected as an increase in foreign currency-denominated deposits. The increase in foreign currency-denominated deposits in turn resulted in an increase in foreign currency-denominated credits.

However, in the first sub-period (pre-crisis) there was a relatively low level of external funding opportunities and dollarization was demand-driven. Thus we would not expect to find direct links between asset dollarization and offshore dollarization, or between liability dollarization and offshore dollarization.

III. 1. Methodology and a search for appropriate variables

In the spirit of the above studies and our view about the source of dollarization as discussed above, we will conduct a co-integration analysis

to search for a relationship between the various forms of dollarization. More specifically, we would like to see whether there is a long-run relationship between asset dollarization and liability dollarization. Thus, we will study the dollarized assets and liabilities of the non-banking sector as well as offshore dollarization in the banking sector.

III.1.1. Data Considerations

Our data cover the period from 1996:06 to 2006:06. The asset dollarization of the non-banking sector is represented by the logarithm of the ratio of foreign currency-denominated deposits to M2Y. The liability dollarization is represented by the logarithm of the ratio of foreign currency-denominated loans to total loans. To denote offshore dollarization, we calculated the logarithm of the ratio of the borrowings of banks from abroad to banks' total borrowings excluding central bank credit. All data sources are publicly available through CBRT electronic data dissemination system (http://tcmbf40.tcmb.gov.tr/cbt.html).

III.1.2.Testing for Granger Causality

To analyze the econometric link between these various measures of dollarization, we first conducted Granger causality tests. Given the graphic evidence presented earlier about the reversal in trend of asset dollarization and liability dollarization after the 2001 crisis, the test is also run for sub-periods. Test results in Table 1 suggest that there is a pair-wise Granger causality between asset dollarization and liability dollarization throughout the analysis and in the first sub-period from 1996-2001. However, as expected, the direction of Granger causality between asset dollarization and liability dollarization changes in the second sub-period. In other words, liability dollarization Granger-causes asset dollarization but asset dollarization does not Granger-cause liability dollarization in the post-crisis period.

According to the test results, there is pair-wise Granger causality between liability dollarization and offshore dollarization in the post-crisis period; but in the first sub-period, there is no Granger causality between asset dollarization and offshore dollarization or between liability dollarization and offshore dollarization.

Table 1. P-Values for the Granger Causality Tests

Sample: 1996-2006[1]

Lags	AD_NBS→ LD_NBS	LD_NBS→ AD_NBS	LD_NBS→ OFFSHORE	OFFSHORE→ LD_NBS	AD_NBS→ OFFSHORE	OFFSHORE→ AD_NBS
1	0.304	**0.002**	**0.054**	0.938	**0.062**	0.670
2	0.597	**0.000**	0.125	**0.098**	0.122	0.524
3	0.629	**0.000**	0.166	0.211	0.242	0.432
4	0.159	**0.000**	0.419	0.282	0.222	0.328
5	**0.060**	**0.000**	0.465	0.139	0.250	0.112
6	**0.046**	**0.001**	0.608	0.243	0.193	0.182
7	**0.084**	**0.002**	0.685	0.383	0.266	0.178
8	**0.093**	**0.007**	0.675	0.497	0.374	0.226
9	**0.045**	**0.017**	0.755	0.620	0.388	0.313
10	**0.032**	**0.070**	0.796	0.739	0.486	0.218
11	**0.009**	**0.050**	0.855	0.718	0.441	0.257
12	**0.005**	0.121	0.810	0.796	0.537	0.159

Sample: 1996-2001

Lags	AD_NBS→ LD_NBS	LD_NBS→ AD_NBS	LD_NBS→ OFFSHORE	OFFSHORE→ LD_NBS	AD_NBS→ OFFSHORE	OFFSHORE→ AD_NBS
1	0.364	0.180	0.205	0.906	0.396	**0.030**
2	0.656	**0.019**	0.344	0.275	0.504	0.228
3	0.851	**0.032**	0.212	0.492	0.706	0.312
4	0.101	**0.048**	0.513	0.222	0.719	0.286
5	**0.013**	**0.097**	0.583	**0.097**	0.805	**0.084**
6	**0.023**	**0.062**	0.551	0.187	0.546	0.152
7	**0.036**	**0.017**	0.582	0.185	0.482	0.165
8	**0.015**	**0.031**	0.639	0.130	0.541	0.264
9	**0.025**	**0.077**	0.727	0.183	0.612	0.432
10	**0.045**	**0.075**	0.779	0.183	0.732	0.582
11	**0.079**	0.215	0.869	0.359	0.788	0.695
12	0.117	**0.084**	0.575	0.433	0.859	0.600

Sample: 2002-2006

Lags	AD_NBS→ LD_NBS	LD_NBS→ AD_NBS	LD_NBS→ OFFSHORE	OFFSHORE→ LD_NBS	AD_NBS→ OFFSHORE	OFFSHORE→ AD_NBS
1	0.896	**0.027**	**0.000**	0.320	**0.000**	0.269
2	0.714	**0.003**	**0.000**	0.112	**0.000**	**0.090**
3	0.303	**0.018**	**0.000**	0.254	**0.000**	0.243
4	0.353	**0.015**	**0.001**	0.201	**0.001**	0.352
5	0.391	**0.092**	**0.003**	0.107	**0.003**	0.449
6	0.614	**0.079**	**0.006**	0.117	**0.004**	0.239
7	0.558	0.220	**0.012**	0.179	**0.011**	0.308
8	0.499	0.263	**0.025**	**0.090**	**0.018**	0.137
9	0.448	0.324	**0.048**	**0.096**	**0.015**	0.211
10	0.565	0.446	**0.060**	0.193	**0.013**	0.133
11	0.515	0.288	**0.015**	0117	**0.014**	0.221
12	0.277	0.305	**0.027**	0.130	**0.031**	0.123

(1) A low p-value enables one to reject the null hypothesis that the variable x does not Granger cause the variable y.

As expected, in the pre-crisis period, foreign currency-denominated loans are offered by the banking system as long as individuals open foreign currency bank accounts. This conclusion is in line with the results in Morón and Castro (2003) indicating that before the crisis, dollarization was mostly driven by the preference of the non-banking sector to hold foreign currency in their portfolios.[5]

However, after the crisis, the causality changed: as banks borrowed from abroad, they also offered credits in foreign currency. As individuals borrowed in foreign currency, foreign currency-denominated bank accounts also increased. Therefore, dollarization in the economy has mostly been supply-driven in the form of offshore dollarization of the banking sector as well as liability dollarization of the non-banking sector.

III.1.3.Testing for Stationarity and Co-integration

Our empirical analysis proceeds by testing stationarity. The results of both Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests suggest that all the series are non-stationary and integrated of order 1 (Table 2). [6]

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[5] This study does not cover an analysis of the determinants of dollarization. Rather, it tries to give an idea about where dollarization originates, i.e. either on the asset side or the liability side of the banks' balance sheets. However, another study by Metin-Ozcan and Us (2005) and Metin-Özcan and Us (2006) provides a detailed analysis of the determinants of dollarization in Turkey.

[6] The ADF test for any series Xt involves the following regression:

$$\Delta x_t = \alpha + \beta x_{t-1} + \sum_{t=0}^{p} \delta_i \Delta x_{t-i} + e_t$$

If b is significant, the null hypothesis of non-stationarity is rejected. A significant ADF test statistic thus rejects the null, implying stationarity. The ADF test corrects for higher order serial correlation by assuming that the series follows an AR(p) process and adds p lagged differenced terms. The Phillips-Perron test is similar to the ADF test but uses a non-parametric correction for serial correlation; this is robust with regard to both heteroskedasticity and autocorrelation. For more detail on these tests, see Diebold (2000).

Table 2. Unit Root Tests

Variables		ADF		PP	
		Intercept	Intercept and Trend	Intercept	Intercept and Trend
AD_NBS	Level	-0.325	-0.524	-0.008	-0.537
	First Difference	-4.761*	-4.930*	-7.163*	-7.166*
LD_NBS	Level	0.245	-0.903	0.612	-0.933
	First Difference	-3.978*	-4.151*	-8.985*	-6.463*
Offshore	Level	-0.919	-1.388	-2.277	-2.989
	First Difference	-7.774*	-7.752*	-13.632*	-9.101*

*Significant at 1 percent. The optimal lag order is selected according to Akaike Information criteria. Bandwidth is selected according to Newey-West using Bartlett kernel.

The results of the unit root test thus imply that we should test for a cointegrating relationship among the series.[7] Table 3 shows the Johansen cointegration test results; these suggest that there is a cointegrating vector between asset dollarization and liability dollarization in the pre-crisis period. There also seems to be a cointegrating vector linking asset dollarization, liability dollarization and offshore dollarization, not just in the post-crisis period but also for the whole sample period.

After normalizing[8] for liability dollarization in the pre-crisis period and the whole sample, the cointegration test results suggest a positive long-run relationship between asset dollarization and liability dollarization (Tables 1-2 in the Appendix). In the post-crisis period, after normalizing for asset dollarization, the cointegration test results indicate that asset dollarization is positively related to liability dollarization and offshore dollarization.

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[7] More specifically, the finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time-series analysis. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

[8] Both the Granger causality test results and adjustment coefficients suggest that for the first sub-period and the whole sample, liability dollarization should be normalized whereas for the second sub-period, asset dollarization should be normalized.

Table 3. Johansen Cointegration Test Results

Sample: 1996-2006				
	Maximal Eigenvalue Statistic		Trace Statistic	
Eigenvalues	Statistic	5% critical value	Statistic	5% critical value
0.263	34.218	25.823	56.549	42.915
0.123	14.663	19.387	22.331	25.872
0.0.66	7.668	12.518	7.668	12.518
Sample: 1996-2001				
	Maximal Eigenvalue Statistic		Trace Statistic	
Eigenvalues	Statistic	5% critical value	Statistic	5% critical value
0.223	14.601	11.225	15.614	12.321
0.017	1.013	4.130	1.013	4.130
Sample: 2002-2006				
	Maximal Eigenvalue Statistic		Trace Statistic	
Eigenvalues	Statistic	5% critical value	Statistic	5% critical value
0.378	25.635	17.797	34.944	24.276
0.158	9.255	11.225	9.309	12.321
0.001	0.054	4.130	0.054	4.130

In the first sub-period, the long-run relationship between asset dollarization and liability dollarization means that a 1-unit change in asset dollarization is associated by a liability dollarization change of almost 1 unit in the same direction. In the second sub-period we see that for a 1-unit increase in liability dollarization, asset dollarization increases by almost 1.5 units; in response to a 1-unit increase in offshore dollarization, asset dollarization increases by more than 7 units. These results clearly indicate the higher sensitivity of asset dollarization in the second sub-period than in the first.

III.2. Error-Correction Modeling

We now proceed by specifying an error-correction model (ECM) in order to find the short-run impact effects, the feedback effects and the long-run responses between our dollarization variables. Error correction mechanisms have been widely used in economics (see Davidson et al, 1978; Hendry and von Ungern Sternberg, 1981; Currie, 1981; Salmon, 1982; Engle and Granger, 1987). The concept of cointegration,

introduced by Engle and Granger (1987), together with the corresponding error-correction models allows these two characteristics to be modeled simultaneously. In other words, if two or more time series each of which is I(1) are cointegrated, then there exists a stationary representation that is called the error-correction representation. The idea behind an error correction model is that a proportion of the disequilibrium from one period is corrected in the next period.

An error correction model in the spirit of the above-mentioned studies suggests that regressing the change in liability dollarization on the lagged values of changes in asset and offshore dollarization also including an error correction term which is obtained from the Johansen procedure, a constant and a political dummy, D1 can constitute a short-run specification for liability dollarization for the whole period. For the first sub-period, an error correction representation for liability dollarization can be established by regressing changes in liability dollarization on the lagged changes in asset dollarization, a constant, error correction term and a political dummy, D2. Finally, the error correction model for the second sub-period is the regression of the change in liability dollarization on lagged change in asset and offshore dollarization also including an error correction term, a constant and a political dummy, D3 (Tables 4-6 in the Appendix).

The model results show that the lagged error term from the cointegration vector is only significant in the equation for liability dollarization in the first sub-period whereas in the equation for asset dollarization in the second sub-period, the lagged error correction term is not significant. These results suggest that in the event of a shock that leads to a deviation in any of the variables from their equilibrium value, liability dollarization will adjust to re-establish this equilibrium while asset dollarization will not be able to converge equilibrium. Furthermore, the presence of a significant error correction term in the liability dollarization equation only, implies that Granger causality could only be verified from asset dollarization to liability dollarization.

These results suggest that if there were a shock leading to a deviation in any of the variables from their equilibrium value, liability dollarization would adjust to re-establish this equilibrium while asset dollarization would not be able to converge equilibrium. The error correction term

being significant only in the liability dollarization equation implies that Granger causality can only be verified from asset dollarization to liability dollarization.

VI. Concluding Remarks

This paper attempts to analyze dollarization by highlighting aspects of the subject that were previously ignored. Unlike earlier research, dollarization is analyzed not only from the demand side (asset dollarization) but also from the supply side (liability dollarization). It is analyzed not only domestically but also externally by introducing a new measure of dollarization - offshore dollarization - to capture the increased external funding opportunities for banks after the crisis. Thus we were able to study both the sources of dollarization and the interrelation between these dollarization measures, in the short-run and in the long-run for the Turkish economy.

Our results suggest that before the 2001 financial crisis, dollarization was mainly demand-driven in the Turkish economy and showed a continuously upward trend. The increasing demand for foreign assets resulted in an increase in foreign currency-denominated debt, thus causing an increasing liability dollarization. However, this story changed drastically after the crisis; both asset and liability dollarization changed direction following the crisis, and causality also changed. More specifically, the post-crisis period witnessed supply-driven and decreasing rates of dollarization. However, this period also saw more external funding opportunities for the banking system (the increase in offshore dollarization), which eventually fed into higher asset dollarization than otherwise would have occurred. Thus, the empirical evidence suggests that if it were not for the increasing rate of offshore dollarization, asset dollarization could have been lower.

What caused the dramatic increase in offshore dollarization in the aftermath of the crisis? The fundamentals of the Turkish economy improved significantly in the post-crisis period but there was also an increase in excess global liquidity, in the form of increased capital flows to emerging market economies, Turkey among them. The increase in global liquidity caused an increase in offshore dollarization. In the meantime, the monetary authorities conducted a tight monetary policy

under the Inflation Targeting framework; this resulted in more attractive external funding due to arbitrage opportunities arising from a relatively higher domestic rate of interest. At the same time, the relatively stable foreign exchange rate (despite free float) resulted in less currency risk exposure for the private sector, encouraging them to seek to external funds on an even larger scale. Thus, the post-crisis monetary policy in Turkey set the stage for lower asset dollarization through lower inflation and a more stable exchange rate; but it also motivated more external funding due to interest rate differentials and decreased currency risk.

The results of the study raise a number of questions that merit further study and analysis. First, it would be useful to repeat the same exercise on banking level data. More specifically, our anecdotal evidence suggests that banking sector data may not show homogeneity and the aggregation of the data may result in significant loss of information. In other words, even if the banking sector may be currency-balanced as a whole, it would likely be imbalanced at a micro level which implies that at the time of a real exchange rate adjustment, individual mismatches, rather than netting out, tend to lead to capital flight and even bank runs.

Second, a further study may also incorporate the government side since a sizeable amount of government debt is foreign currency denominated. Third, a future study should take into account of the effects of capital inflow. In other words, the post-crisis dollarization in Turkey should be analyzed in the light of mounting global liquidity. Even though, our offshore dollarization variable tries to capture this effect, a further study should attempt to develop other measures. Moreover, the effect of central bank intervention in the foreign exchange market is extremely likely to have affected the dollarization process. Thus, a future study should also incorporate these potential effects.

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Appendix

Table 1. Cointegrating Equation of Liability Dollarization

Dependent Variable: LD_NBS
Sample: 1996-2006

Variable	Coefficient	Standard Error		
AD_NBS	1.907968	0.16277		
OFFSHORE	0.637847	0.27126	LL	731.0252
TREND	-0.006653	0.00105		

Table 2. Cointegrating Equation of Liability Dollarization

Dependent Variable: LD_NBS
Sample: 1996- 2001

Variable	Coefficient	Standard Error		
AD_NBS	0.987611	0.00725	LL	731.0252

Table 3. Cointegrating Equation of Asset Dollarization

Dependent Variable: AD_NBS
Sample: 2002-2006

Variable	Coefficient	Standard Error		
LD_NBS	1.555985	0.14521	LL	401.0941
OFFSHORE	7.244624	1.23420		

Table 4. Short-run Specification of Liability Dollarization

Dependent Variable: DLD_NBS
Sample: 1996-2006

Variable	Coefficient	t-Statistic		
C	-0.102546	-2.019291	R^2	0.579357
DAD_NBS(-7)	-0.240240	-1.918938	LL	238.0523
DOFFSHORE(-10)	-0.151358	-2.270897	DW stat	1.619439
Error correction term*	-0.040983	-1.863828	F-stat	36.15450
D1	-0.095093	-11.55481	Prob (F-stat)	0.000000
			AIC	-4.237315

* Error correction term is the first lag of the residuals of the long-run specification.

Table 5. Short-run Specification of Liability Dollarization

Dependent Variable: DLD_NBS
Sample: 1996-2001

Variable	Coefficient	t-Statistic		
C	-0.001038	-0.332393	R^2	0.730922
DAD_NBS(-3)	-0.735689	-6.161693	LL	142.9780
DAD_NBS(-7)	-0.536642	-3.949262	DW stat	2.019598
Error correction term*	-0.050495	-1.929422	F-stat	36.67134
D2	-0.091600	-9.846152	Prob (F-stat)	0.000000
			AIC	-4.677220

* Error correction term is the first lag of the residuals of the long-run specification.

Table 6. Short-run Specification of Asset Dollarization

Dependent Variable: DAD_NBS
Sample: 2002-2006

Variable	Coefficient	t-Statistic		
C	-0.004817	-0.789846	R^2	0.491094
DLD_NBS(-1)	0.281160	4.968177	LL	149.5869
DOFFSHORE(-1)	0.224829	2.025633	DW stat	1.575020
Error correction term*	-0.002082	-0.145067	F-stat	11.57998
D3	-0.025091	-4.369676	Prob (F-stat)	0.000001
			AIC	-5.456108

* Error correction term is the first lag of the residuals of the long-run specification.