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Dynamics of deposit dollarization in Turkey

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ABSTRACT

Deposit dollarization in Turkey has been on the rise, reaching record levels in 2022. This was caused by the worsening macroeconomic fundamentals along with the transition to the presidential system in 2018 and the associated deviation from the monetary policy stance afterward. The unique case of Turkey presents an excellent natural experiment to explore the dynamics of deposit dollarization and how it is affected by the changes in the institutional structure as well as various social, economic, and financial shocks in a relatively short time. This study examines the time varying reactions of deposit dollarization for the period between 2013 and 2022 based on rolling window maximum entropy bootstrap estimates. Our findings reveal that all the model variables had significant and sometimes asymmetric effects on deposit dollarization during the different stages of this turbulent period. In particular, we observe diminishing effects of real exchange rate, policy credibility and consumer confidence over time. The findings provide ample new evidence regarding the dynamics of deposit dollarization in general, and how it is affected by loss of monetary policy credibility.

KEYWORDS

Dollarization; maximum entropy bootstrap; time varying analysis; Turkey

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1. Introduction

Deposit dollarization, defined as the denomination of deposits in currencies other than the domestic currency, has been one of the main problems in the Turkish economy. Although Turkey enjoyed a phase of de-dollarization during the 2000's thanks to the stabilization programs and inflation targeting policy (Metin-Özcan and Us, 2009), the share of foreign exchange deposits began to increase rapidly after 2016, reaching a staggering 67.7 per cent at the end of 2021. This process took place over time, with a series of major economic and political shocks, such as the failed coup attempt in 2016, the switch to presidential system in 2018 along with two currency crises in 2018 and 2021. These developments are presented in Figure 1.

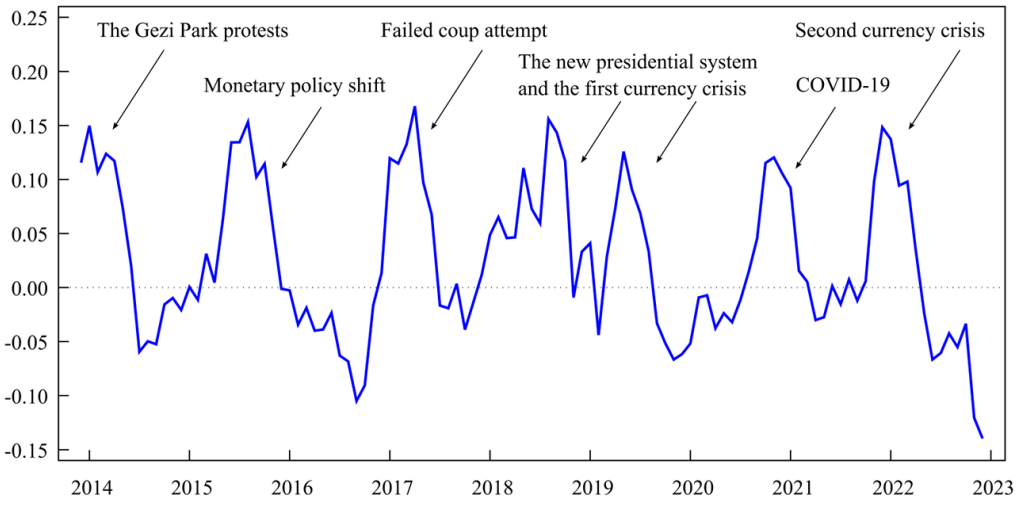

Figure 1. Moving 6-month per cent change in deposit dollarization in Turkey.

It is well documented in the literature that deposit dollarization can have adverse effects on the economy, such as a higher exchange rate pass through effect (Carranza et al., 2009), slower and volatile output growth and reduced effectiveness of monetary policy (Levy Yeyati, 2009), and increased vulnerability to external shocks (De Nicoló et al., 2003). Hence, it is crucial to assess the unique case of Turkey to understand the drivers of deposit dollarization, their time-varying effects, and association with the institutional changes in order to provide evidence for the other developing countries as well.

Due to the important implications of the question at hand, both theoretical and practical, there exist a body of literature on the determinants of financial dollarization (Calvo and Vegh, 1992; Alesina and Barro, 2001; Ize and Yeyati, 2003; De Nicoló et al., 2005; Honohan, 2007; Arteta, 2005; Luca and Petrova, 2008; Bocola and Lorenzoni, 2020; Park and Son, 2020). In these studies, three main views have been proposed for explaining deposit dollarization, namely the portfolio view, the market development view, and the institutional view (Levy Yeyati, 2006). According to the portfolio view, dollarization is mainly caused by unfavorable macroeconomic conditions such as a high inflation rate or home currency depreciation (Ize and Yeyati, 2003). Market development view, on the other hand, explains dollarization as a sub-optimal response to market imperfections. Thirdly, the institutional view, which has become popular in the recent years, emphasizes the role of institutional quality as well as monetary policy credibility (Levy Yeyati, 2006). There also exist several studies focusing specifically on dollarization in the Turkish economy (Civcir, 2005; Metin-Ozcan and Us, 2007; Dumrul, 2010; Barbuta-Misu et al.,2020; Kesimal, 2021; Yılmaz, 2022; Kolcu and Yamak, 2022).

Our study attempts to contribute to the literature in two ways: First, it examines the consequences of a deviation in the monetary policy stance after the adoption of the new presidential system by considering different sub-periods. Employing this analysis is especially important for Turkey, which experienced a major institutional

change and series of economic and political shocks in the recent years. The first of these is the failed coup attempt in 2016, which resulted in the deaths of more than 250 people. This historic event triggered not only thousands of arrests across the country, but also the dismissal of more than 130,000 civil servants, and damaged political and economic stability. Furthermore, in 2018 Turkey officially adopted Presidential Government System and underwent a major institutional change.

The new paradigm brought about changes in the organizational structure of many organizations including the Central Bank of the Republic of Turkey (CBRT), leading to concerns regarding its political independency and credibility in conducting monetary policy (Demiralp and Demiralp, 2019). In fact, between 2019 and 2021, President Erdogan not only publicly criticized CBRT's policies on numerous occasions, but also dismissed three governors, and kept urging the CBRT to reduce interest rates in spite of the rising inflation. As a result, in recent years, the central bank governors have been reluctant to increase interest rates, causing the actual inflation rate to deviate from the target rate by a large amount. This drastic change in the monetary policy stance led to a deterioration in macroeconomic fundamentals and eroded the confidence in the economy, making the economy quite fragile to external shocks such as Fed's decision to end expansionary monetary policies followed after Covid-19 and declining capital inflows to emerging markets (Akcay and Gungen, 2019).

Not surprisingly, Turkish economy faced with two currency crises in three years. The first currency crisis was in the summer of 2018, which was originated by the tensions with the U.S. due to a U.S. pastor held arrested in Turkey. The resulting sanctions were responsible for a record fall in the value of the Turkish Lira. More recently, the Turkish economy was deeply affected by the coronavirus pandemic as well. Being highly sensitive to global supply shortages and the price of imported oil and natural gas, the Turkish Lira continued to fall steadily after 2020. The situation took a turn for the worse in late 2021, when CBRT decided to reduce policy rate by 500 basis points in four consecutive meetings despite the rising inflation rate and the expectations of Fed's monetary tightening. Thus, a second currency crisis hit the economy, and the currency lost more than 60 percent of its value in two months after September 2021. With a central bank with no credibility and mandate to keep interest rates at low levels, the response of the government was to bring an "exchange rate-protected Turkish Lira deposit accounts" system.[1] This system seemed to ease the tensions on foreign exchange rate, bringing down dollarization from 67 per cent to 55 percent at the end of 2022. However, the long-term effect of this scheme still remains to be seen.

All in all, the unique case of Turkey presents an excellent natural experiment to explore the dynamics of deposit dollarization and how it is affected by various social, economic, and financial shocks as well as major changes in the institutional structure in a relatively short time. The second novelty of the paper is to examine the effects of these changes on deposit dollarization by adopting an advanced bootstrap inference based on the maximum entropy bootstrap (meboot) data generation process in a fixed width rolling window framework to capture the possible nonlinearities. This approach allows model parameters to evolve over time, making it feasible to investigate how deposit dollarization changes during different phases of the economy. Therefore, this approach is appropriate and useful in this particular case.

We will continue with Section 2, which provides a brief literature review. Section 3 explains the methodology used and describes the data. This is followed by Section 4, where we present the empirical results. Finally, Section 5 concludes with a discussion of the policy implications.

2. Literature Review

Because deposit dollarization has been one of the major problems in the Turkish economy, several studies have

[1] In this system, investors are encouraged to switch from their foreign exchange accounts to Turkish Lira paying accounts and they are compensated with higher interest rates if the exchange rate increases.

attempted to identify the causes of dollarization.

Civcir (2005) analyzes the long run determinants of deposit dollarization by conducting a linear cointegration analysis, and he finds that interest rate differential and expected exchange rates are the primary determinants of deposit dollarization. Metin-Ozcan and Us (2007) employ a VAR model to investigate whether macroeconomic uncertainty contributed to deposit dollarization in Turkey between 1985 and 2007. They show that inflation volatility and exchange rate depreciation volatility are the main determinants of dollarization. Using the bounds testing approach, Dumrul (2010) examines the relationship between dollarization and exchange rate and finds a positive relation between currency substitution and the exchange rate, interest rate differential, and the central bank reserves. Sever (2012) analyzes the relationship between dollarization and foreign exchange rate uncertainty using Granger causality analysis, and provides evidence for the connection between dollarization and foreign exchange rate uncertainty. In a recent study, Barbuta-Misu et al. (2020) investigate the determinants of deposit dollarization by applying a cointegration approach and conclude that political ambiguity causes deposit dollarization. Focusing on the influence of the recent monetary policies, Kesimal (2021) provides evidence for the existence of inertia in deposit dollarization in Turkey.

Some authors emphasize the role of foreign exchange rate on deposit dollarization. Yılmaz (2022) applies a time-varying Granger Causality analysis and concludes that there is asymmetrical causality between foreign exchange rate and dollarization. Kolcu and Yamak (2022) explore the effect of foreign exchange rate on deposit dollarization using linear and nonlinear ARDL models and provide evidence for the long-run cointegration between foreign exchange rate and deposit dollarization.

Although the aforementioned studies provide valuable information regarding the drivers of deposit dollarization in Turkey, they do not investigate the time varying dimension of its stimulants. Because of the major changes in the institutional structure as well as economic and financial shocks in recent years, time varying dynamics of deposit dollarization should be examined to capture possible nonlinearities.

3. Data

The dependent variable in our analysis is deposit dollarization, which is measured as the ratio of foreign currency deposits to the broad money supply. We choose our explanatory variables based on the existing research. The first of these is the real exchange rate, which is highlighted by the earlier studies as a main determinant. It is argued that as economic agents try to hedge against the depreciation of the home currency, dollarization increases. Therefore, a negative relation is expected between real effective exchange rate and deposit dollarization.[2]

The loss of monetary policy credibility has been identified as one of the key drivers of dollarization as well (Cowan and Do, 2003). As a result, following previous studies, we represent this by using the squared deviation of the 12 months ahead expected annual inflation from the target inflation. The expected inflation is calculated from the Survey of Market Participants data provided by CBRT (2022). The target rate, on the other hand, is announced by the CBRT on a yearly basis and has been fixed at 5 per cent over the sample period. Thirdly, volatility of interest rate is also employed as an indicator of dollarization. Consequently, we control this by using the standard deviation of the interest rates differential between the TL and U.S. dollar denominated deposits with different maturities from 1 month to 1 year and over. Finally, unlike the previous research on this topic, we also include the Consumer Confidence Index, which is computed from the Consumer Tendency Survey carried out by the CBRT in cooperation with the Turkish Statistical Institute.

All of our required series are retrieved from CBRT (2022). Using the available data, it was possible to construct

[2] According to the CBRT definition, which we use in this study, an increase in real exchange rate indicates an increase in the value of the Turkish Lira. This implies a negative relationship between dollarization and the real exchange rate.

a monthly dataset from January 2013 to December 2022.[3] Table 1 presents data definitions as well as data sources.

Table 1. Data Definitions and Data Sources.

Variable	Description	Source
Deposit dollarization (dollarize)	The ratio of foreign currency deposits to the broad money supply.	CBRT (2022)
Exchange rate (rExch)	Real effective exchange rate	CBRT (2022)
Monetary policy credibility (pDisc)	The squared deviation of the 12 month ahead expected annual inflation from the target inflation.	CBRT (2022)
Volatility of interest rate (İVola)	The standard deviation of the interest rates differential between the TL and U.S. dollar denominated deposits with different maturities from 1 month to 1 year and over.	CBRT (2022)
Consumer Confidence Index (cConf)	Computed from the Consumer Tendency Survey carried out by the CBRT in cooperation with the Turkish Statistical Institute	CBRT (2022)

The summary statistics of the model variables are given in Table 2. Also, Figure 2 presents the time-series plots. In the upper left panel of the figure, we see that deposit dollarization in Turkey has been steadily increasing due to the various shocks explained above. It almost doubled from about 35 % in 2013 to 68 % at the end of 2021, regressing partially afterwards. In 2012, dollarization was 35 %. However, it started to increase in 2013 following the Fed's signals to end unconventional monetary policies. While the comments made at the time by the Fed regarding the possibility of a policy reversal caused harsh reactions in the emerging market economies in general, the effects were more severe in Turkey, where both economic and political confidence deteriorated due to so-called "Gezi Park protests".[4]

Another major dollarization episode took place in 2015 and 2016. Fed's decision to raise interest rates and two political elections in 2015 caused turbulence in the economy and prompted investors to increase their holdings of foreign assets. Subsequently, dollarization reached 45%. After CBRT's attempts to ease the tensions by selling foreign exchange and by increasing the policy rate, dollarization went back to 40 % in 2016. Nevertheless, the measures were merely enough to calm the market for a short time. In 2017, deposit dollarization accelerated and hit a record level in April 2017 due to the presidential referendum. In July 2018 Turkey officially adopted the new presidential system, which led to changes in the structure of CBRT and undermined its independence. It is evident in the figure that dollarization episodes became more frequent after 2018 with the presidential system. Shortly following the transition, the first currency crisis erupted in August 2018, which was initiated by the tensions with the U.S. due to a U.S. pastor held in Turkey. Turkish economy faced with another currency crisis in late 2021 due to CBRT's insistence on reducing interest rates despite inflation. The result was a record dollarization level reaching 67 percent. The government's response was the introduction of "exchange rate-protected Turkish Lira deposit accounts" scheme, which seemed to reduce the turbulence in the money markets. Together with the other policies used to limit the depreciation of the currency, the foreign exchange rate stabilized, and dollarization receded to 55 percent at the end of 2022.

[3] In the literature, there exists several methods to measure monetary policy credibility as well as interest rate volatility. For example, it is possible to appraise policy credibility as the deviation of expected inflation from the realized value for different horizons. Similarly, interest rate volatility can be calculated using a GARCH model as well. In our study, we also employed such different methods and choose our final variables as those providing a better fit among the possible alternatives, based on the Akaike information criterion. Our results were not sensitive to using the alternative definitions, which are available from the authors upon request.

[4] Gezi Park protests began when several activists resisted the abolishment of a public park to build a shopping mall. After the police confronted with the protestors, the protests turned into massive demonstrations across the country.

To the right is the real exchange rate series, which interestingly shows an almost mirror image of the former, indicating its importance as an explanatory variable. Real exchange rate has been falling since 2014. However, the depreciation has accelerated after 2018 because of the weak monetary policy (Gurkaynak et al., 2022). The deteriorating macroeconomic conditions in Turkey over the sample period are evident in the other plots as well. In particular, the monetary policy discredibility variable, which shows the deviation of the expected inflation from the target rate, has been increasing. We see that, due to the new presidential regime and its push away from inflation targeting, the CBRT rapidly lost credibility in 2018. The process further accelerated with the President Erdogan starting to dismiss CBRT governors after 2020. Along with these developments, the consumer confidence has been falling, as is seen in the middle right panel. We especially see major drops with the start of the political disturbances in 2014, the new presidential system and the currency crisis in 2018, and more recently due to the rising economic problems after 2021. However, the consumer confidence started to improve gradually in 2022 with the stabilization of foreign exchange rate. Finally, the interest rate volatility, shown in the bottom panel, has been on the rise except 2022 thanks to the exchange rate-protected Turkish Lira deposit accounts scheme.

Table 2. Summary statistics

Variable	Mean	Std. Dev.	Min	Max
ln dollarize	3.898	0.166	3.539	4.215
ln rExch	4.385	0.233	3.866	4.688
ln pDisc	1.569	0.836	0.182	3.611
ln cConf	4.442	0.094	4.150	4.579
ln iVola	-0.376	0.488	-1.289	1.434

4. Methodology

For the empirical analysis, we adopt the following log linear econometric model:

$$lnDollarize_t = \beta_0 + \beta_1 lnrExch_t + \beta_2 lnDisc_t + \beta_3 lncConf_t + \beta_4 l\,n\,iVola_t + \epsilon_t$$

here β are parameters to be estimated, t denotes time, and ϵ_t is the error term.

In order to take into account the time-varying nature of the above relation, we employ a rolling window estimation procedure. This involves running sequential regressions of the model in sub-windows of observations of fixed length taken from the full sample. The advantage of rolling windows is the possibility of in depth analysis of the dynamics of dollarization on a monthly basis. The disadvantage, however, is the difficulty of obtaining robust and efficient estimates due to using only a subset of the data at each step. To overcome this difficulty, we employ an advanced empirical approach based on time-series bootstrapping. Simulation-based estimation is well-known for its ability to provide substantially more accurate results compared to the conventional methods especially in small samples, as shown by many studies including Vinod (1993), Horowitz (2003), and MacKinnon (2006). The bootstrap methodology that we specifically use in this study is the maximum entropy bootstrap (meboot) proposed by Vinod (2004). This relatively new bootstrapping technique, which is principally designed for time-series analysis provides robust statistical estimates under all forms of structural breaks and nonstationarity without the need for differencing or detrending the data. This approach is known to be substantially more reliable than those provided by older bootstrap alternatives such as the block bootstrap. It is discussed in detail and its accuracy is demonstrated with extensive simulations in recent studies such as Vinod (2015), Yalta (2016), Singvejsakul et al. (2018), and Macedo (2022).

The methodology is discussed in detail and its accuracy is demonstrated with extensive simulations by Vinod (2015), Yalta (2016), Singvejsakul et al. (2018), and Macedo (2022). More briefly, in order to estimate the rolling windows model, the meboot algorithm is first employed to construct J = 999 resamples of each series. This so-called

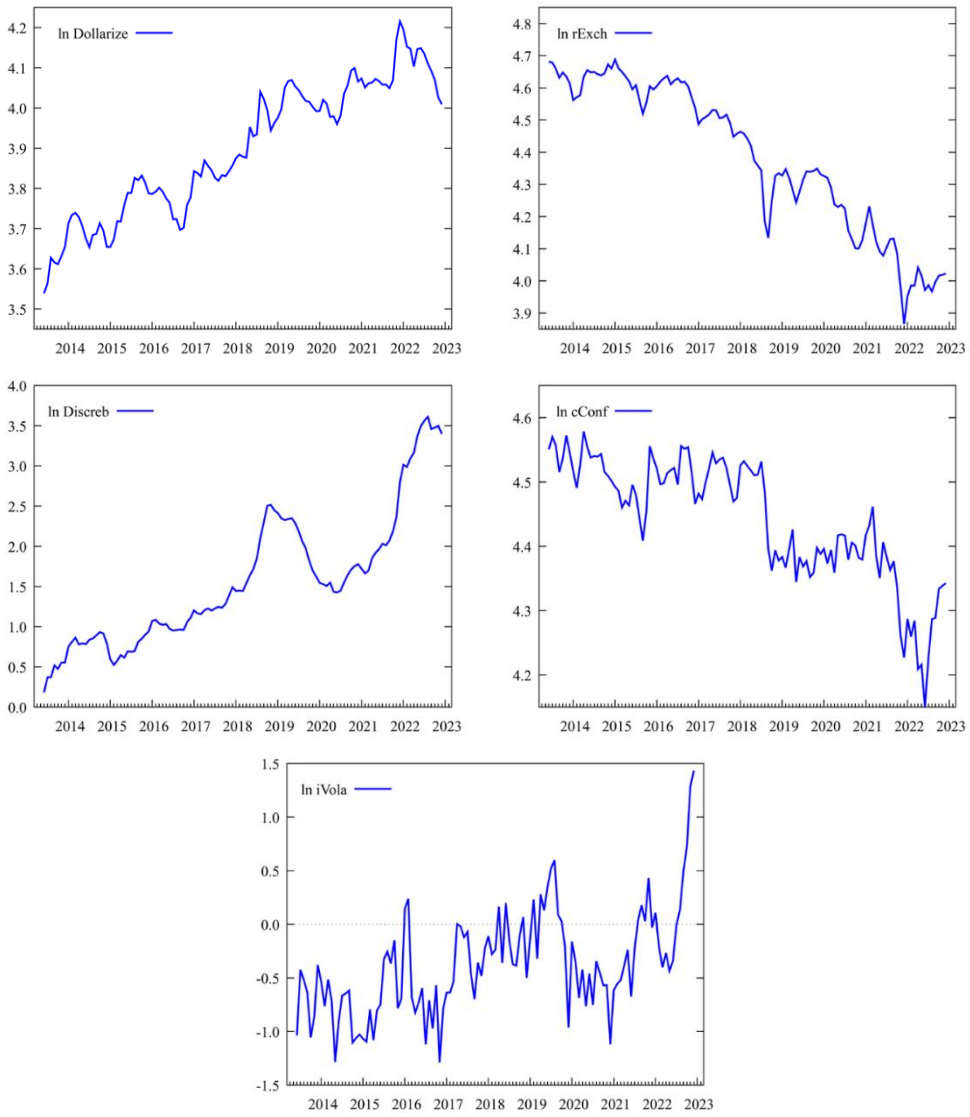

Figure 2. Time series plots of the logs of the dollarization, real exchange rate, monetary policy discredibility, consumer confidence, and interest rate volatility series.

"resampling cases", i.e. the resampling of the regressors as well as the regressand simultaneously, is the preferred approach in the meboot literature since it was also recommended by Vinod and de Lacalle (2009). The resulting "ensemble" provides a set of J independent least squares regressions for every parameter in each rolling window. By using these large numbers of estimates, simulated empirical probability density functions (EPDF) of the model parameters are constructed. Among the alternative methods to construct the EPDFs, the highest density region (HDR) method (Hyndman, 1996) is employed, which is recommended for use with meboot estimation (Vinod, 2015; Yalta, 2016). The point estimates, on the other hand, are obtained with the bagging method (Breiman, 1996) based on the modes of the parameter EPDFs. The above procedure is repeated by running the model for each window in order to obtain individual time series of parameter estimates. After estimating the model with different window widths namely 18, 24, 30 and 36, we chose the final window width as 30 observations (86 individual horizons) based on the Akaike information criterion averaged across all windows.5

The visual analysis of the data reveals that the variables under consideration display non-stationarity due to

[5] R version 4.0.3 was used. The code for rolling-meboot estimation is available from the authors.

the extraordinary economic and political conditions faced by Turkey over the sample period. Indeed, the Augmented Dickey Fuller Test (ADF) test results presented in Table 3 show that the model variables are a mixture of I(0) and I(1) variables, which can render invalid most variable parameter time-series methods such as Kalman filtering or Flexible Least Squares which depend on the Gaussian assumptions. This points out the usefulness of our simulation based estimation methodology using the meboot data generation process in this study. Furthermore, the large shifts and fluctuations observed in the data also indicate that the model parameters can be unstable and therefore the use of traditional full-sample regression methods may not provide robust and reliable results as well. This is evident in the CUSUM and CUSUMSQ plots presented in Figure 3. Here, we see that the both plots deviate from the reference lines, showing parameter inconsistency. These results once again underline the importance of the variable parameter approach that we employ in this study.

Table 3. ADF unit root test results.

Variable	Levels	First differences
ln dollarize	0.0482***	0.0000***
ln rExch	0.2577***	0.0000***
ln pDisc	0.5717***	0.0000***
ln cConf	0.0313***	0.0000***
ln iVola	0.1445***	0.0000***

*Note: ADF regressions include both intercept and trend. *, ** and *** denote rejection of the null hypothesis of unit root at the 10%, 5%, and 1% significance levels respectively.*

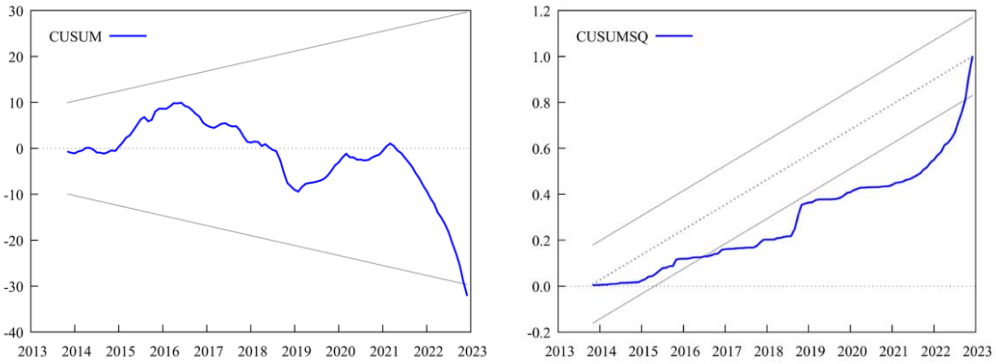

Figure 3. CUSUM and CUSUMSQ plots of the full-sample model estimation with 95 per cent confidence intervals.

5. Empirical Findings

The rolling window meboot coefficient intervals along with the bagged point estimates are given in Table 4. The table essentially shows summarized regression results for the 86 individual models estimated in this study, although the odd numbered months were omitted to save space. These results are presented graphically in Figure 4 as well.

It is seen in Figure 4 that deposit dollarization gives clear time varying responses to the changes in the model variables. In the case of real exchange rate, shown in the top right panel, the results indicate the existence of a negative relationship so that the depreciation of the Turkish lira causes an increase in deposit dollarization, as expected. These findings are also in line with that of Dumrul (2010) and Kolcu and Yamak (2022). However, we also see that this effect shows ups and downs over time. According to the parameter estimates, in 2016, a 1 percent depreciation leads to about 0.8 per cent dollarization on average. At the end of 2021, however, the effect declines to the 0.20 range. This can be due to the fact that, with the continued depreciation of the home currency, it would be more and more difficult for dollarization to increase after a certain level. Another explanation is provided by Kesimal

(2021), who argues that the lack of monetary policy credibility has muted the effect of exchange rate on dollarization in Turkey. Notwithstanding, we see that the effect of the real exchange rate started to increase once again in 2022 due to the monetary tightening of the Fed and the stronger U.S. dollar in particular.

Table 4. Rolling window meboot parameter interval estimates (every other window).

Horizon	β0 (*Const*)			β1 (*rExch*)			β2 (*pDisc*)			β3 (*cConf*)			β4 (*iVola*)		
	lower	point	upper	lower	point	upper	lower	point	upper	lower	point	upper	lower	point	upper
2015M12	8.61	9.36	10.11	-0.87	-0.73	-0.55	0.13	0.15	0.19	-0.64	-0.54	-0.46	-0.01	0.01	0.03
2016M02	8.62	9.26	9.92	-0.84	-0.71	-0.58	0.13	0.16	0.18	-0.63	-0.54	-0.44	0.00	0.01	0.03
2016M04	8.46	9.15	9.78	-0.81	-0.68	-0.56	0.13	0.15	0.17	-0.61	-0.53	-0.45	-0.01	0.01	0.02
2016M06	8.13	8.68	9.33	-0.81	-0.69	-0.57	0.10	0.12	0.15	-0.52	-0.41	-0.32	0.00	0.01	0.02
2016M08	8.58	9.21	9.90	-1.04	-0.91	-0.78	0.07	0.09	0.12	-0.43	-0.31	-0.19	0.00	0.01	0.02
2016M10	9.07	9.75	10.53	-0.97	-0.84	-0.73	0.08	0.11	0.14	-0.62	-0.51	-0.40	0.00	0.01	0.02
2016M12	8.03	8.41	9.00	-0.75	-0.63	-0.53	0.05	0.08	0.10	-0.52	-0.42	-0.33	0.02	0.03	0.05
2017M02	7.10	7.45	8.04	-0.68	-0.61	-0.49	0.03	0.05	0.07	-0.35	-0.26	-0.16	0.03	0.04	0.05
2017M04	6.75	7.18	7.68	-0.67	-0.58	-0.49	0.03	0.05	0.07	-0.28	-0.18	-0.07	0.04	0.05	0.06
2017M06	6.49	6.93	7.35	-0.61	-0.49	-0.39	0.03	0.06	0.09	-0.30	-0.19	-0.09	0.04	0.04	0.06
2017M08	6.40	6.75	7.10	-0.53	-0.45	-0.34	0.02	0.04	0.07	-0.32	-0.23	-0.13	0.04	0.05	0.05
2017M10	6.35	6.69	7.08	-0.53	-0.44	-0.35	0.00	0.03	0.05	-0.30	-0.21	-0.12	0.03	0.04	0.05
2017M12	6.14	6.45	6.81	-0.50	-0.40	-0.30	-0.01	0.02	0.05	-0.27	-0.20	-0.11	0.04	0.05	0.05
2018M02	5.86	6.25	6.67	-0.51	-0.40	-0.29	0.01	0.03	0.07	-0.23	-0.15	-0.07	0.04	0.04	0.05
2018M04	4.69	5.56	6.36	-0.45	-0.32	-0.18	0.03	0.07	0.14	-0.17	-0.08	0.03	0.02	0.03	0.04
2018M06	4.13	5.26	6.31	-0.31	-0.12	0.05	0.10	0.17	0.24	-0.36	-0.21	-0.05	0.02	0.03	0.04
2018M08	4.69	5.68	6.89	-0.31	-0.11	0.05	0.09	0.16	0.22	-0.55	-0.33	-0.14	0.02	0.04	0.07
2018M10	4.84	5.86	6.87	-0.55	-0.40	-0.25	0.00	0.06	0.11	-0.21	-0.04	0.11	0.02	0.04	0.06
2018M12	5.27	6.21	7.11	-0.66	-0.55	-0.41	-0.02	0.02	0.06	-0.15	0.03	0.13	0.01	0.04	0.06
2019M02	5.27	6.15	7.28	-0.60	-0.51	-0.37	-0.01	0.03	0.06	-0.22	-0.06	0.10	0.02	0.05	0.07
2019M04	4.23	5.52	6.81	-0.54	-0.44	-0.29	0.01	0.06	0.10	-0.18	0.01	0.22	0.02	0.03	0.05
2019M06	5.12	6.26	7.34	-0.55	-0.46	-0.33	0.00	0.04	0.08	-0.28	-0.10	0.07	0.03	0.04	0.06
2019M08	5.18	6.34	7.22	-0.52	-0.39	-0.30	0.01	0.04	0.08	-0.28	-0.12	0.04	0.04	0.05	0.07
2019M10	5.90	6.92	7.76	-0.56	-0.47	-0.33	-0.01	0.02	0.06	-0.33	-0.19	-0.07	0.04	0.05	0.06
2019M12	6.95	7.76	8.42	-0.63	-0.51	-0.39	-0.03	0.00	0.03	-0.45	-0.32	-0.19	0.02	0.04	0.05
2020M02	7.14	7.79	8.36	-0.62	-0.54	-0.43	-0.02	0.00	0.02	-0.45	-0.33	-0.20	0.02	0.04	0.05
2020M04	6.93	7.41	7.88	-0.54	-0.48	-0.38	-0.01	0.00	0.02	-0.42	-0.31	-0.21	0.03	0.03	0.05
2020M06	6.75	7.15	7.43	-0.39	-0.31	-0.23	0.00	0.01	0.02	-0.51	-0.38	-0.29	0.02	0.03	0.04
2020M08	6.56	6.88	7.34	-0.35	-0.29	-0.24	0.00	0.01	0.02	-0.49	-0.36	-0.28	0.02	0.03	0.04
2020M10	6.39	6.72	7.01	-0.38	-0.34	-0.30	-0.01	0.00	0.01	-0.35	-0.27	-0.21	0.03	0.04	0.05
2020M12	6.41	6.77	7.12	-0.43	-0.39	-0.35	-0.01	0.00	0.01	-0.33	-0.26	-0.17	0.03	0.04	0.05
2021M02	5.26	5.79	6.23	-0.41	-0.37	-0.33	-0.01	0.00	0.01	-0.14	-0.03	0.09	0.03	0.04	0.05
2021M04	5.24	5.75	6.25	-0.43	-0.39	-0.36	0.00	0.01	0.03	-0.13	-0.01	0.11	0.02	0.03	0.04
2021M06	4.56	5.01	5.41	-0.35	-0.32	-0.29	0.03	0.04	0.05	-0.02	0.08	0.17	0.01	0.02	0.02
2021M08	4.02	4.42	4.71	-0.27	-0.24	-0.20	0.07	0.08	0.09	0.03	0.10	0.20	-0.01	0.00	0.01
2021M10	3.53	3.94	4.37	-0.23	-0.19	-0.16	0.07	0.09	0.11	0.07	0.18	0.25	-0.02	-0.01	0.00
2021M12	3.99	4.84	5.67	-0.29	-0.22	-0.17	0.06	0.09	0.12	-0.16	0.01	0.17	-0.02	-0.01	0.00
2022M02	4.71	5.36	6.16	-0.34	-0.28	-0.22	0.03	0.05	0.08	-0.21	-0.05	0.08	-0.02	0.00	0.01
2022M04	4.85	5.47	6.14	-0.42	-0.34	-0.28	0.01	0.03	0.05	-0.14	0.01	0.13	-0.01	0.01	0.02
2022M06	5.15	5.65	6.39	-0.50	-0.43	-0.35	0.00	0.02	0.04	-0.10	0.04	0.14	0.00	0.01	0.03
2022M08	5.84	6.48	7.00	-0.61	-0.52	-0.43	-0.01	0.00	0.02	-0.14	-0.04	0.06	-0.02	-0.01	0.01
2022M10	6.57	6.87	7.49	-0.66	-0.53	-0.47	-0.03	-0.01	0.00	-0.24	-0.12	-0.03	-0.03	-0.02	0.00
2022M12	6.78	7.30	7.81	-0.63	-0.54	-0.43	-0.04	-0.02	-0.01	-0.34	-0.23	-0.12	-0.04	-0.03	-0.01

The policy discredibility parameter, presented in the middle left panel, also shows a declining effect over time. In 2016, a 1 percent increase in the deviation of expected annual inflation from the CBRT target rate was associated with a 0.15 per cent increase in deposit dollarization on average. We see that this effect slowly diminished, and become statistically insignificant with the confidence intervals including the point zero after 2020. Just like the real

exchange rate, it is possible to explain the decoupling of dollarization with policy credibility with the increasing level of dollarization in Turkey. This interpretation is also in line with De Nicolo et al. (2005), who find that the relation between inflation and dollarization weakens when monetary policy credibility decreases. However, what is interesting in this case is the two sudden peaks observed in mid-2018 and late 2021, which correspond to the currency crises experienced by Turkey in this period. These seem to suggest that the sensitivity of the economic agents to central bank's credibility increases during crisis times. As a result, perhaps a better explanation of the movements seen in this figure is that policy credibility has a larger impact on dollarization when there is an increased level of awareness and concern for it. Therefore, no credibility also means no effect.

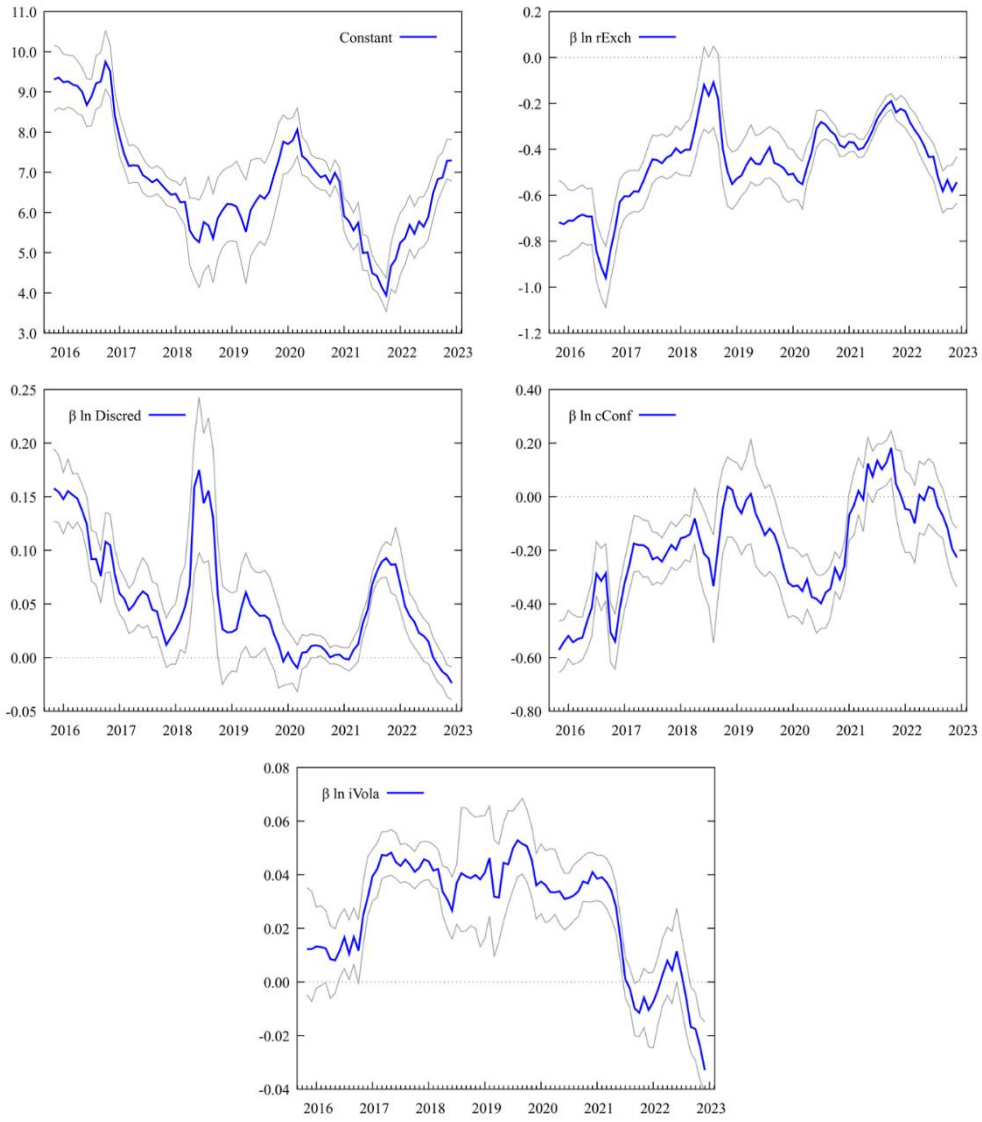

Figure 4. Rolling window coefficient estimates with 80 per cent meboot confidence intervals.

In the middle right panel, we observe that dollarization is negatively related with consumer confidence, as expected. In addition, we see that the size of this effect has also fallen over time. Before 2016, a 1 per cent decline in consumer confidence is estimated to cause about 0.6 percent increase in dollarization. With the increased level of dollarization as well as the plummeting consumer confidence levels in Turkey, the parameter estimates decline to zero, becoming insignificant after mid-2018 until late 2019. At this point, we see the effects of the coronavirus pandemic as well. During the Covid-19 lock downs in 2020, the parameter goes back to the -0.40 level only to go

back to being close to zero once again after 2021. As a result, one can say that, while the effects of the two currency crises are captured by the policy discredibility variable, the main channel for the pandemic influenced deposit dollarization has been the consumer confidence variable, which fell sharply in 2018 and late 2021 as a result of currency crisis.

Finally, unlike the other three variables, the interest rate volatility in the bottom panel displays an increasing effect on dollarization. At the beginning of the sample period, the size of this parameter estimate is close to zero and insignificant. However, it increases substantially after the failed coup attempt and the change in the political system, staying high during the pandemic as well. We see that this parameter finally declines after late 2021 and becomes insignificant afterwards. This can be due to "exchange rate-protected Turkish Lira deposit accounts" scheme brought by the government after the currency crisis, which effectively equalizes the returns on both Lira and foreign exchange deposits. Whether this situation will hold in the long run remains to be seen as the parameter has seemingly declined further during 2022.

6. Conclusion

Deposit dollarization has steadily increased in Turkey over the last decade, reaching record levels at the end of 2021. In order to formulate necessary policies to reduce dollarization, it is important to understand its dynamics and how it is affected by various political and macroeconomic shocks. Although several studies examine the determinants of deposit dollarization, they do not explore its time varying dimensions. However, since the failed coup attempt in 2016, and especially with the transition to the presidential system in 2018, there has been major changes in the institutional structure and the monetary policy in Turkey. Furthermore, the Turkish economy also faced two currency crises as well as the coronavirus pandemic during this period. Hence, there is a need to analyze how the process of deposit dollarization has been influenced by all these changes.

Using the case of Turkey as a natural experiment, we examine the time varying reactions of deposit dollarization by adopting a rolling window analysis based on the maximum entropy bootstrap data generation process. Our findings based on monthly data between January 2013 and December 2022 confirm earlier studies that the real exchange rate and monetary policy credibility are indeed important determinants of deposit dollarization. In addition, we observe that the changes in consumer confidence affect dollarization as well. Moreover, our results also reveal that the impact of these variables can diminish over time. It is important to note that the effects of the two currency crises are captured by the policy discredibility variable, while the impact of the Covid-19 pandemic is better reflected by the consumer confidence.

The evidence obtained in this study has significant policy implications for the formulation of monetary policies not only in Turkey but also in many developing countries having similar problems, especially in terms of monetary policy credibility. The results imply that preventing currency depreciation and reducing the volatility of interest rates while restoring economic confidence may help curtail deposit dollarization. However, these are also the results of declining monetary policy credibility in the recent years in Turkey. As a result, Turkey's first course of action should be to bring back central bank independence. Toward this end, a legislative change enforcing the job security of the CBRT governors should be the primary focus. In addition, the CBRT should improve its transparency and clarity regarding its monetary policies. In particular, as stated by OECD (2021), the bank "should maintain an active communication in terms of public concerns regarding the statistical methodology and data quality should be addressed." These are important recommendations as our study clearly shows that the loss of central bank independence and monetary policy credibility can result in rapidly deteriorating macroeconomic conditions leading to excessive dollarization. It is our understanding that unfavorable conditions such as the recent coronavirus pandemic can also magnify this process, leading to catastrophic outcomes even in a relatively advanced economy such as Turkey.

While our analysis provides interesting and robust results, in the future, it would be useful to perform a similar study using alternative variable parameter methods to provide further insights regarding the dynamics of deposit dollarization.

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Declaration of Competing Interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

Author contributions

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