Determinants of Dollarization of Savings in the Turkish Economy

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Abstract: This study aims to analyze the nature of the dollarization that takes place in the Turkish economy and to decompose the factors that have contributed to its increase in recent years. With this purpose, we first identify the events that have significantly affected the dollarization trend in Turkey using the Iterative Cumulative Sum of Squares (ICSS) and Markov Switching Dynamic Regression (MS-Dynamic) structural break models. Then, we proceed to analyze the relationship between the percentage of Forex deposits of the residents over total deposits of the residents and the TRY/USD exchange rate using the Johansen cointegration test. USD, EUR, and TRY interest rates are also added to the model as independent variables to account for the effects of the difference between exchange rates. Long-term and short-term effects are tested with the Vector Error Correction Model, and causality is tested using the Granger causality test. The results of the study indicate that speculative trading is not the cause of the dollarization of deposits in Turkey. Additionally, results suggest that the political events have a stronger influence over dollarization compared to economic events. Collectively, our findings suggest that domestic citizens dollarize their deposits with the motivation to protect against political ambiguity rather than economic volatility. The results of the study are in line with the literature in the sense that they support the claim that dollarization can be averted in the short run with an increase in interest rates.

Keywords: dollarization of deposits; macroeconomic policy; political factors; seigniorage tax; currency depreciation; interest rate; inflation rate

1. Introduction

The term “dollarization” was initially used to express foreign currency demand when considering the choice of the US dollar in Latin American countries. In the literature, the terms “currency substitution” and “dollarization” were used interchangeably during the 1970s and 1980s. However, in the 1990s, the term dollarization also started to be used to describe the acceptance of the US dollar as a legal currency in a country [1].

In general, dollarization refers to the unregulated process of preferring foreign currencies instead of the domestic currency in an economy, as a result of the financial decisions of its citizens. Residents of countries that have constantly depreciating currencies have a tendency to deposit their savings in foreign currencies in order to protect their wealth. This occurs as citizens of a nation prefer to use a foreign currency in their daily life transactions or as their saving deposits instead of their domestic currency. This unofficial transformation, however, does not take place as a planned government policy.
In the global economic environment that endorses a handful of dominant currencies as global reserve currencies, it is expected that every country has a certain level of foreign currency in circulation within its economy. While a certain percentage of dollarization within any economy is considered natural, a sudden change in its pattern is usually a response to various forms of economic or political distress.

By dollarization, we usually understand the substitution of the national currency by the US dollar as a store of value. Financial or partial dollarization refers to the holding of assets and liabilities in dollars by domestic residents [2]. In countries with a high inflation rate, the dollar deposit market has become massive [3]. Dollarization, in the context of this article, refers to the preference for the US dollar instead of the Turkish lira among Turkish citizens for daily life transactions or deposits of their savings.

In Turkey, the roots of the dollarization phenomenon started to form in the late 1960s and early 1970s, together with legislation about foreign currency deposits. Later, reforms about financial liberalization, changes in foreign exchange regulations, and macroeconomic developments in the 1980s and 1990s played important roles in the development of dollarization in Turkey. After that, Turkey was exposed to external factors such as the flow of capital to developing economies, increases in international inflation, and a global slowdown in growth. Furthermore, Turkey experienced high economic growth and achieved its targets on inflation and primary surplus between the years 2002 and 2005, which increased confidence in the economy [1]. In the year 2004, fresh financial and economic reforms that reinforced central bank independence were accompanied by the removal of six zeros from the Turkish lira, effectively equalizing 1 USD to 1 TRY. While being just a psychological factor, the combined effect of reforms and psychological factors stimulated the economic environment of Turkey until recent years. After experiencing a relatively stable and consistent rise in macroeconomic indicators for more than a decade, the Turkish economy suffered a foreign currency crisis during 2018. While the initial crisis can be attributed to a series of sociopolitical events, it did little more than expose the underlying regulatory and structural problems that plague the Turkish financial system.

During 2019, questions about the central bank were sparked again. Fiscal discipline was questioned [4], and the domestic currency faced decade-high inflation levels [5]. President Erdoğan repeatedly discussed the interest rate and monetary policy of the central bank in general on various platforms, which were mostly in favor of expansionary policies. While holding no direct sway over the chief of the central bank, the President’s involvement in monetary policy discussions sparked debates over the independence of the central bank. Especially after the dismissal of central bank chief Murat Çetinkaya on the 6th of July 2019, in both domestic and international media coverage, the central bank’s independence has been portrayed as a matter of great dispute in Turkey [6,7]. Following this event, several media outlets and social media raised questions concerning independence. However, there is no direct evidence that links this discussion with any movement in the market. The abundance of potential events that may have affected the dollarization behavior makes it obligatory for us to filter the statistically significant events before advancing to further research questions, and the prevalence of these questions and the influence these concerns may have on dollarization should be analyzed.

To be able to objectively define the events that may have affected the dollarization trends in Turkey, we conducted a preliminary research question focusing on the significant shifts in the variance structure of dollarization using the Iterative Cumulative Sum of Squares (ICSS) and Markov Switching Dynamic Regression (MS-DS) algorithms. As the preliminary study question was conducted before forming the main research questions, determining the events that have significantly affected the dollarization behavior, it is of crucial importance to be able to formulate appropriate research questions. The breaking points detected by the models are reported in Table 1.

| Breakpoint | ICSS     | MS-Dynamic |
|------------|----------|------------|
| Dollarization | 15.7.2016 | 15.7.2016  |
| Try/Usd Rate | 14.9.2018 | 2018-11-16 |
Series dollarization will be explained in detail in the following sections; however, for the preliminary research question, it represents the logarithmic change in deposits held in domestic currency. The variance structure in the series consistently points out two events that had a substantial impact on the dollarization trend in Turkey. 15.07.2016 is the exact day of a failed attempt for a military coup d’état in Turkey. As for the exchange rate, the last quarter of 2018 is pointed out as the breaking point, and this period represents the period following the Pastor Bronson crisis with the USA. Both of these events are major political events that affected the dollarization of savings. Both structural break models have the capacity to locate multiple breakpoints; however, both models stop at only one significant breakpoint for two of the series analyzed. Macroeconomic events that are generally thought to be of significant economic importance, such as the dismissal of the head of the central bank, have no variance break effect on the volatility of the market. For instance, there is no evidence that the discussions regarding central bank independence during 2019 had a significant impact on the dollarization trend. Collectively, these findings indicate that dollarization is mainly oriented towards protection from political risk rather than a reaction to macroeconomic events.

The high dollarization ratio over time has shown remarkable declines from time to time; however, dollarization maintains its importance in today’s Turkey as we can see in Figure 1.

![Figure 1. TRY vs. Forex savings (Source: Central Bank of the Republic of Turkey).](image)

We can notice the evolution of TRY total savings compared to Forex total savings between December 2012 and December 2018. The ascending trend of Forex total savings compared to the descending trend of TRY total savings in Turkey shows that the dollarization process is present.

Considering this trend of dollarization in Turkey, in this paper we aim to analyze the nature of this dollarization and to decompose the factors that contribute to this increase in recent years.

In the literature, dollarization of savings is frequently linked with comparative yields in currencies, persistence and consistency of central bank policies, and trust in monetary policy [8–10]. Hence, the research questions of our study are formulated by focusing on these three key aspects of the dollarization phenomenon.

A list of the research questions, test criteria, and methodology used is given in Table 2.

Research question 1 aims to address the question of the dollarization being speculatively motivated, or in other words, whether the dollarization is caused by the arbitrage between currency markets. As supported by the literature, in such a scenario, investors are expected to reposition as domestic yields increase; therefore, there should be a significant inverse relationship between dollarization and TRY interest rates [11].

Research question 2 is focused on the perception of central bank policies by investors. In this research question, the long-term and short-term effects of central bank policy changes are evaluated.
The literature supports that, in a central bank that is perceived as consistent, the short-term effects of policy decisions are expected to persist or not be reverted in the long run [12].

Table 2. List of research questions.

| Research Question | Test Criterion | Methodology |
|-------------------|----------------|-------------|
| What are the significant events that affected the dollarization trend in Turkey? | Significant shifts in variance trends are expected to be observed at the break dates. | ICSS algorithm and MS-DR methods are used to analyze the breaking points. |
| Is the arbitrage due to yield differences between currencies the reason for dollarization? | A negative and persistent relation between TRY interest rates and dollarization is expected. | Using the Johansen cointegration test, at least two cointegrated vectors between variables are found, followed by the Vector Error Correction Model (VECM) to differentiate short-term and long-term relationships between the variables. |
| Are central bank policies effective? | Short-term negative effects of central bank policies on dollarization are expected to persist or at least not to revert in the long term. | |
| Do investors trust in the consistency of monetary policy? | Both interest rate and exchange rate are expected to have two-way causality with dollarization. | Granger causality test is used to determine the relationship between dollarization and exchange rate or interest rates. |

The resilience of the economy also lies in its ability to recuperate after various shocks and crises, and in an efficient market, dollarization caused by the appreciation of foreign currency is expected to revert as domestic currency recuperates [13]. Though of course, this is valid only so long as there are no political factors at play. Granger causality is used to test for this in the third research question, and the results are expected to be two-way in a healthy economy.

The rest of the paper is organized as follows: In Section 2, the literature review about dollarization and elements that contribute to dollarization are presented. The data and methodology are presented in Section 3. The paper then follows with analyses of results on the Turkish economy and discussions in Section 4. Findings are then discussed in order to provide feedback to policymakers in Section 5.

2. Literature Review

When discussing macroeconomic events, in a country like Turkey, the first step of the literature review should be focused on sociopolitical and geopolitical events. Especially in the last 5 years, Turkey has been perhaps the most politically pressured country in the world, both internally and externally [14]. During the 2015–2020 period, Turkey has experienced a failed coup d’état in which the parliament was bombed with its own F-16s [15]; debunking of a religious shadow government organization; complete reinstitution of its governance system; tens of transborder military operations not only to Syria but also to Libya; several terrorist attacks by both communist and extreme Islamist groups; shooting of a Russian airplane; assassination of a Russian ambassador; volatile EU relations [16]; and the most directly relevant topic to our subject, weaponized financial attacks [17]. During August 2018, President Trump specifically threatened Turkey through Twitter with economic sanctions for the imprisonment of Pastor Andrew Brunson. This event is very significant for our dataset, and the dollarization and the exchange rate suffer extreme volatility and drastic changes during this period.

Dollarization has been an important topic in developing economies since the 1970s and is considered an important risk source. Many policies and measures are being developed to prevent dollarization in developing economies, with dollarization having significant effects on the real sector, government debt management, monetary policy, and financial systems. As a consequence of regulations about the liberalization of capital movements, exchange rate regime changes, political uncertainties,
and economic crises in the late 1980s, the use of foreign currencies as the store of value, the unit of account, and the medium of exchange has continued to deepen up to the present [1].

Dollarization is a complex phenomenon, with implications at the macroeconomic level, which is why it has been placed at the top of policy debates. Proposals to dollarize economies are based on two goals: monetary stability and trade integration [18]. Dollarization increases sharply during episodes of unduly macroeconomic instability, and it remains stubbornly high even long after successful stabilizations [19]. Financial dollarization in the presence of large exchange rate fluctuations can become a potential source of balance of payments and financial crises, and poses a serious threat to macroeconomic and financial stability [20].

Some authors [21,22] argue that the economic benefits of full dollarization depend positively on the initial degree of partial dollarization. Making a pertinent analysis of the benefits and costs of official dollarization, [23] found that the benefits and the costs can be identified in fiscal policy, interest rate, financial integration and banking system, trade, investment, and growth. Furthermore, full dollarization is a way of protecting from currency crashes and balance of payment crises, because in the absence of a local currency there are no possibilities of sharp depreciation and sudden capital outflows resulting from depreciations. The increasing confidence of international investors will reduce the fiscal cost of borrowing by decreasing the spreads in international borrowing and promote investment and growth [24].

Examining the dollarization phenomenon, while taking into account the globalization dimensions (social, economic, and political), Ajide et al. [25] concluded that globalization dimensions constitute the key dollarization amplifiers. Other authors examined the aspect of domestic financial dollarization, dollarization of bank deposits, and identified that the credibility of macroeconomic policy is an influential factor for variations in dollarization and that financial instability is specific to dollarized economies [26].

The literature on the topic can also be reviewed under three categories. The first category includes studies that support the effect of political factors in the dollarization of the economy. The second category contains studies that defend the thesis that dollarization is the result of a dependent central bank and its excessive seigniorage. The last category of studies defends that dollarization is the result of a mismatch within certain macroeconomic indicators, namely the exchange rate, inflation, and the interest rate.

Studies that focus on political factors in the dollarization of an economy are generally in the form of case studies, which evaluate the political distress and instability in a specific country. In a study that evaluates the dollarization process in Zimbabwe [27], it is suggested that extreme levels of political instability along with fear of military interventions were the main reasons for distrust in the domestic financial system. In cases such as Cambodia, the lack of a proper taxation and monitoring system also led policymakers to overinfluence the money supply, which in turn resulted in hyperinflation [28]. Hyperinflation strips the domestic currency’s ability to store value and eventually causes mass dollarization of deposits within an economy. A similar case has been studied for Ecuador [29]. In the 1990s, high public sector wages along with the extreme dependence on oil for taxation and exports triggered a financial crisis. In a crisis environment that has massive capital outflows and inflation rates close to 100%, Ecuador dollarized its whole economy. A salient feature of financial dollarization, arguably the one that causes most concern to policymakers, is its persistence: even after successful macroeconomic stabilizations, dollarization ratios often remain high [3].

According to Quispe-Agnoli and Whisler [30], measuring the level of dollarization in a country depends on the restrictions that monetary authorities impose on the use of foreign currency. In the study it is implied that monetary authorities might limit or prohibit the usage of foreign exchange in domestic transactions or as a financial instrument. In the case of no restrictions, as they mentioned, residents could use foreign exchange in circulation or hold foreign currency deposits within the country or abroad.
These examples, however, are a complete overhaul of entire financial and economic systems based on pegging the domestic currency to USD. In underdeveloped countries, there are a lot of factors that contribute to such crises on multiplicative levels. On the other hand, in developed and developing countries, pegging the whole monetary system on USD cannot be a viable option due to a number of factors. The first factor is the inability of the country to effectively collect seigniorage. Seigniorage is the most important income of developing countries beside taxes. In addition to that, the inability of a country to pursue its monetary policy is a substantial disadvantage that many countries cannot afford.

Imperfect independence of central banks is the second most studied reason for the dollarization of deposits [31]. The efficacy of monetary policy in small open economies with flexible exchange rates is compromised by the negative balance sheet effects generated by dollarization [32]. In an ideal economy, the objective of the central bank is to stabilize the price levels. Since the seigniorage ability of central banks can be exploited through the excessive supply of money to the treasury, central banks should be independent of the influence of ruling governments [33]. If the central bank is dependent on or at least under the influence of the ruling party, then the currency will be vulnerable to exploitation. This vulnerability can not only cause higher inflation but can also expose domestic financial markets to external manipulations. A significant study focused on the transfer of central bank profits to the government arrived at the conclusion that, as long as the asset structure of the central bank is independent and central banks evolve at a constant rate, the transferred central bank profits are economically irrelevant [34].

Along with taxation, seigniorage is the most significant income in a government model. Also referred to as inflation tax, seigniorage allows a government to indirectly tax the wealth of individuals that deposit their money in the domestic currency. In other words, residents who keep their money in domestic currency are volunteering for an extra wealth tax compared to those that store their wealth in other forms. However, as long as the money supply is regulated in a way that stabilizes the consumer prices, residents have no substantial reason to dollarize their deposits [35]. Avoiding dollarization in an economy is crucial for regulators not only because it limits their inflation taxing capability, but also because it limits policymakers’ capability of intervention in that economy. Even if there is a constant level of inflation within an economy, to switch to dollarization can be compensated by appropriate interest rates in accordance with the general level of prices and exchange rates [36].

A study predating the European monetary union discusses the independence and seigniorage model of a potential European central bank named “EuroFed”. The study argues that a European central bank has to retain its independence at a supranational level. Additionally, the study suggests that the seigniorage right must be completely exclusive to the central bank otherwise the domestic currencies of each member nation would fluctuate excessively [37]. Lange and Sauer [38] examine the seigniorage costs of official dollarization in 15 Latin American countries. They show that the total costs can be decomposed into two components: seigniorage transferred to the U.S. and seigniorage lost due to greater financial stability in the dollarized country. Results indicate that seigniorage costs and their components are significant, yet differ considerably across countries both in terms of the total effect as well as the relative shares of the two underlying components.

Moreover, maintaining a stable nominal exchange rate, therefore, becomes imperative for curtailing a high degree of currency substitution, which has a negative impact on seigniorage revenue of the government and monetary policy design and implementation [39].

Studies that focus on macroeconomic factors as the source of dollarization in an economy are mainly focused on “original sin” [40] or the mismatch of the exchange rate, inflation rate, and interest rate as the result of faulty government spending and monetary policy. A study on exchange rate policies in emerging markets categorizes three potential factors as the main determinants of dollarization: the moral hazard, the “original sin”, and the commitment problem hypothesis. Comments in the study lean towards supporting the problem of the “original sin” as the main cause of the dollarization process along with several macroeconomic problems [41]. Another study argues that a flexible exchange rate policy encourages banks to match dollar-denominated liabilities with corresponding assets. Therefore,
it is argued that corporate depositors of foreign currencies largely consist of financial institutions. According to the findings of the study, countries that follow a floating exchange rate regime are more susceptible to dollarization [2].

Mecagni et al. [42] established that inflation and nominal exchange rate depreciation were key drivers of dollarization, supporting the currency substitution thesis that foreign currencies are used to hedge against inflation risk and political instability. Domestic inflation converging to world inflation; disappearance of currency risk, resulting from the decreasing domestic interest rates; the provision of a better investment environment thanks to inflation stability and lower interest rates; removal of currency mismatch in the balance of payments; and diminishing country risk are considered as other advantages of full dollarization [43].

The study of Licandro and Mello [44] analyzes the cultural and financial dollarization process, considering that dollarization and financial fragility can appear in any economy open to external trade. They affirm that dollarization is one of the main weaknesses of the economy and generates high volatility in the real exchange rate, and argue that the state should have a specific policy to combat this situation in order to preserve financial stability.

Kokenyne et al. [45] and Garcia-Escribano [46] show that if two-way movements in the exchange rate are allowed, higher flexibility in the exchange rate could reduce dollarization. The rationale is that the possibility that the domestic currency may appreciate increases the risk of holding foreign currencies, which may lose value in terms of the domestic currency. Furthermore, Berkmen and Cavallo [29], among other studies, have supported that the causal relationship between exchange rate volatility and de-dollarization is generally weak.

Using an error correction model of peso money demand in Argentina, Kamin and Ericsson [47] found strong statistical evidence that higher inflation exerts a negative effect on the demand for pesos that is not fully reversed once inflation subsides. The difference between domestic and foreign interest rates followed a similar path with dollarization in Turkey since a rise in the interest rate difference shows an increasing risk perception about the domestic economy and gives acceleration to deposit dollarization [48].

The most important influencing factor for the evolution of dollarization processes is the gap between the growth rate of the dollar exchange rate and the rate of inflation [49]. Dollarization is specific for any transition economy and is caused by high inflation in the first step of economic reform. The negative impact of dollarization is materialized in low domestic investment and a high degree of uncertainty in the implementation process of monetary policies.

3. Data and Methodology

3.1. Data Description

The dataset consists of 316 observations at a weekly frequency from 14/12/2012 to 28/12/2018. Data were gathered from the electronic data delivery system of the Central Bank of the Republic of Turkey. The policy rate (O/N) gradually increased from approximately 5% to 23% during this period. Additionally, this period contains a significant number of external and internal shocks to the Turkish lira including the “Trump tweets”, which depreciated the Turkish lira by more than 35% in a matter of days [50]. These properties make this period ideal for the comparison of short- and long-term effects. Series used in the analysis are explained in Table 3.

| Dollarization | Domestic (Forex Deposits/Total Deposits) |
|---------------|----------------------------------------|
| Dollarer      | Exchange rate of TRY per USD            |
| Interesteur   | Interest rate of EUR for the given date  |
| Interesttry   | Interest rate of TRY for the given date  |
| Interestusd   | Interest rate of USD for the given date  |
3.2. Research Methodology

The ICSS algorithm used to model the structural breaks in the preliminary research question is based on the study of Inclan and Tiao [51]. This algorithm essentially uses model error terms and calculates the cumulative sum of squares. After normalizing and centering the series, the maximum centered cumulative sum of squares is calculated. Finally, it compares the value found with critical values to determine statistically significant breakpoints in the series. Similarly, the MS-Dynamic model is based on the methodology used in the study of Kenourgios and Dimitriou (2015) and is designed to allow for a two-stage estimation of the conditional covariance matrix.

The series used in the analysis are tested for stationarity using the Augmented Dickey–Fuller (ADF) test and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests. According to the results of unit root tests, our data consist of series that are nonstationary at the level; however, all the series become stationary at their first differences. This implies a possible long-term relationship between variables. Economics theory supports that there is a difference between short-term and long-term effects of macroeconomic decisions [52–54]. Since what we are modeling is the aggregate individual behavior in terms of saving decisions, the ideal method to use for modeling would be one that differentiates the short-term effects from long-term ones. Under the given conditions, the Johansen cointegration test is chosen as the most appropriate method.

The test results support the existence of a long-term cointegration between series. Following this, we used the Vector Error Correction Model (VECM) to analyze the series due to the model’s ability to measure the magnitude of relationships in both the short run and the long run. In addition to its capability of measuring the effects of given variables on dollarization in the long run and the short run, the method is also capable of indicating the nature of causality in the model.

3.2.1. Methodology of Cointegration Analysis

In order to be able to use nonstationary series in an econometric regression model, it is widely accepted that series must be first transformed. After conducting relevant transformations, the series that remain nonstationary must be converted to stationary series using differencing. At this point, however, rather than using the conventional Vector Autoregressive (VAR) method to model the series, a more advanced method can be implemented by factoring in the partial differences between the variables in a stationary model as suggested by Green [55].

\[ y_t = \beta x_t + \epsilon_t \]  

In a regression model, \( \epsilon_t \) is normally expected to be nonstationary if the \( x_t \) and \( y_t \) are nonstationary series. However, in a model without an autoregression problem, even if both variables are nonstationary, it is possible that their partial difference moves around a fixed mean. This indicates that they move together in the long term. The series that meet this criterion are considered cointegrated, and differencing the data would undermine the model by hiding the underlying relationship between \( x_t \) and \( y_t \).

3.2.2. Methodology of the Vector Error Correction Model

The cointegration vector derived in cointegrated series is called a cointegrating vector \([1, -\beta]\). In cases where variables are found to have cointegrating vectors, the VECM model is a widely accepted method of analysis. Through its use, we are able to distinguish between short-term and long-term changes in variables as well as deviations from equilibrium.

The model can be demonstrated as follows [56]:

\[ Y_t = \beta_{10} + \sum_{i=1}^{p} \beta_{1i} Y_{t-i} + \sum_{i=1}^{p} \beta_{12i} X_{t-i} + \theta_{11} ECT_{t-1} + \epsilon_{11,t} \]
In this model, $\beta$ represents the parameters, while $\varepsilon_{1,t}$ represents the error term and $ECT_{t-1}$ represents the error correction term. $\theta_{11}$ is the error correction coefficient. Lastly, $i$ represents the lag value, which is determined by evaluating the results of information criteria analyses. The main output of this method is the error correction term ($ECT_{t-1}$), which is expected to be negative and smaller than 1. In this case, the model indicates that the error corrects itself in the long term. $ECT_{t-1}$ represents the percent amount of corrections to the model in each period ($t$).

4. Research Results

Series used in this paper are tested for stationarity using, as we mentioned in the methodology, ADF and KPSS unit root tests. Accordingly, the first difference of all series is taken to provide stationarity [Figure S1]. The results are reported in Table 4.

Table 4. Unit root test results.

| Hypothesized | ADF | KPSS |
|--------------|-----|------|
|              | Constant | Constant and Trend | Constant | Constant and Trend |
| dollarization | $-1.4887 (2)$ | $-2.8959 (2)$ | $1.8625 (4)$ *** | $0.2146 (4)$ *** |
| $\Delta$dollarization | $-9.9068 (2)$ *** | $-9.8879 (2)$ *** | $0.0772 (14)$ | $0.0625 (14)$ |
| dollarer | $0.088570 (12)$ | $-2.748859 (12)$ | $2.102340 (15)$ *** | $0.182841 (15)$ ** |
| $\Delta$dollarer | $-4.255781 (16)$ *** | $-4.280110 (16)$ *** | $0.082065 (8)$ | $0.028351 (8)$ |
| interessier | $-1.7753 (7)$ | $-2.6154 (7)$ | $1.2058 (15)$ *** | $0.3729 (15)$ *** |
| $\Delta$intereiger | $-6.9098 (6)$ *** | $-6.8981 (6)$ *** | $0.0637 (10)$ | $0.0515 (10)$ |
| interesstry | $-0.2289 (10)$ | $-1.8458 (10)$ | $1.5577 (15)$ *** | $0.3040 (15)$ *** |
| $\Delta$intereister | $-3.9975 (10)$ *** | $-4.5354 (10)$ *** | $0.1885 (10)$ | $0.0463 (10)$ |
| interestsud | $1.7498 (5)$ | $-2.5096 (5)$ | $1.1846 (15)$ *** | $0.3841 (15)$ *** |
| $\Delta$interestusd | $-7.7180 (4)$ *** | $-7.7094 (4)$ *** | $0.0777 (6)$ | $0.0630 (6)$ |
| Critical Values | $5\%$ | $-2.8700$ | $5\%$ | $-3.4233$ |
| | $10\%$ | $-2.5713$ | $10\%$ | $-3.1346$ |

Critical Values

1% $-3.4497$ 1% $-3.9858$ 1% $0.7390$ 1% $0.2160$

5% $-2.8700$ 5% $-3.4233$ 5% $0.4630$ 5% $0.1460$

10% $-2.5713$ 10% $-3.1346$ 10% $0.3470$ 10% $0.1190$

Note: **, *** represent, respectively, significance levels at 5%, and 10%. Values in parentheses show lag length according to unit root tests. $\Delta$ represents the first difference.

As reported in Table 4, all series become stationary in their first differences. Due to this reason, the long-term relationship was analyzed using the Johansen cointegration test. This test is based on the vector autoregression model, which requires appropriate lag lengths to be determined first. Using Akaike and Schwarz information criteria, the best-fit lag length is determined as 6. Table 5 demonstrates the Johansen cointegration test results.

Table 5. Johansen cointegration test result.

| Hypothesized | Trace | 0.05 |
|--------------|-------|------|
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob. ** |
| None * | 0.155249 | 128.8402 | 69.81889 | 0.0000 |
| At most 1 * | 0.140752 | 72.65847 | 47.85613 | 0.0001 |
| At most 2 | 0.040710 | 22.14303 | 29.79707 | 0.2906 |
| At most 3 | 0.020830 | 8.302828 | 15.49471 | 0.4336 |
| At most 4 | 0.003876 | 1.293073 | 3.841466 | 0.2555 |

Note: * represents cointegration. ** represents significance level at 5%.

According to the results of the Johansen cointegration test, there are at least two cointegrated vectors between variables. This signifies the existence of a long-term relationship between these variables. Following this, long-term coefficients are estimated using the Vector Error Correction Model (VECM). The equation showing the long-term relationship between so-called variables is as follows:
\[
dollarization_t = \beta_0 + \beta_1 \text{dollarer}_t + \beta_2 \text{interesteur}_t + \beta_3 \text{interesttry}_t \\
+ \beta_4 \text{interestusd}_t + \epsilon_t
\] (3)

Table 6 demonstrates the estimated long-term coefficients.

| Variable   | Coefficient | Std. Error | t-Statistic | Prob.     |
|------------|-------------|------------|-------------|-----------|
| LDOLLARER  | -0.089043   | 0.022624   | -3.935719   | * 0.0001  |
| INTERESTEUR| 0.036536    | 0.009290   | 3.932660    | * 0.0001  |
| INTERESTTRY| 0.006188    | 0.001253   | 4.938988    | * 0.0000  |
| INTERESTUSD| -0.053514   | 0.006601   | -8.107233   | * 0.0000  |
| C          | 0.370643    | 0.018462   | 20.07565    | * 0.0000  |
| R-squared  | 0.894209    |            |             |           |
| F-statistic| 699.4523    |            |             |           |
| Prob(F-statistic)| 0.000000 * |          |           |

Note: * represents the significance level at 1%.

In the long term, 1% appreciation in the value of foreign currencies results in a 0.09% reduction in dollarization. A 1% rise in the policy rate of euro and Turkish lira results in, respectively, 0.04% and 0.006% increases in dollarization. On the other hand, a change of the same magnitude in the US dollar results in a 0.05% reduction in dollarization.

Long-term model estimations indicate that the interest rate of TRY and EUR has a positive relationship with dollarization, while the interest rate of USD has a negative relationship with dollarization. In addition, an increase in the exchange rate of USD reduces the dollarization in the long run. As for the relationship in the short run, results are reported in Table 7. The equation showing the short-term relationship between so-called variables is as follows:

\[
\Delta \text{dollarization}_t = \beta_0 + \beta_1 \Delta \text{dollarer}_t + \beta_2 \Delta \text{interesteur}_t + \beta_3 \Delta \text{interesttry}_t \\
+ \beta_4 \Delta \text{interestusd}_t + \beta_5 \text{EC}(-1) + \epsilon_t
\] (4)

Table 7. Short-term model estimation results.

| Variable   | Coefficient | Std. Error | t-Statistic | Prob.     |
|------------|-------------|------------|-------------|-----------|
| D(LDOLLARER)| -0.112564   | 0.019399   | -5.802672   | * 0.0000  |
| D(INTERESTEUR)| 0.000524   | 0.004425   | 0.118436    | 0.9058    |
| D(INTERESTTRY)| 0.002763   | 0.001304   | 2.118291    | ** 0.0349 |
| D(INTERESTUSD)| -0.004797  | 0.002565   | -1.870718   | *** 0.0623|
| EC(-1)     | -0.085310   | 0.022800   | -3.828922   | * 0.0002  |
| C          | 0.00000913  | 0.000406   | 0.224642    | 0.8224    |
| R-squared  | 0.120569    |            |             |           |
| F-statistic| 9.021073    |            |             |           |
| Prob(F-statistic)| 0.000000   |          |           |

Note: *, **, *** represent, respectively, significance levels at 1%, 5%, and 10%.

In the short term, 1% appreciation in the value of foreign currencies results in a 0.11% reduction in dollarization. A 1% rise in the policy rate of Turkish lira results in a 0.003% increase in dollarization. On the other hand, a 1% rise in the policy rate of the US dollar is expected to result in a 0.005% reduction in dollarization.

According to the findings of the short-term model estimation, the interest rate of TRY has a positive effect on dollarization in the short run, while the interest rate of USD has a negative effect. Additionally, as the exchange rate of USD increases, dollarization reduces.
EC(-1), which represents the error correction coefficient, has a negative notation, is a decimal above -1, and is statistically significant at 1% level of significance. This indicates that deviations in the system normalize by approximately 8% each period and completely normalize after approximately 10 periods. To support these findings, a Granger causality analysis was conducted. Results of the test are reported in Table 8.

Table 8. Granger causality test results.

| Dependent Variable: D (DOLLARIZATION) | Excluded         | Chi-sq  | Df | Prob.       |
|---------------------------------------|------------------|---------|----|-------------|
| D (LDOLLARER)                         | 6.8417           | 2       | ** 0.0296 |
| D (INTERESTEUR)                       | 5.516703         | 2       | *** 0.0634 |
| D (INTERESTTRY)                       | 8.318193         | 2       | ** 0.0156 |
| D (INTERESTUSD)                       | 1.248287         | 2       | 0.5357   |

| Dependent Variable: D (LDOLLARER)     | Excluded         | Chi-sq  | df | Prob.       |
|---------------------------------------|------------------|---------|----|-------------|
| D (DOLLARIZATION)                     | 22.60628         | 3       | * 0.0000 |
| D (INTERESTEUR)                       | 5.043102         | 3       | 0.1687   |
| D (INTERESTTRY)                       | 16.17557         | 3       | * 0.0010 |
| D (INTERESTUSD)                       | 0.729735         | 3       | 0.8662   |

| Dependent Variable: D (INTERESTEUR)   | Excluded         | Chi-sq  | df | Prob.       |
|---------------------------------------|------------------|---------|----|-------------|
| D (LDOLLARER)                         | 29.9051          | 2       | * 0.0000 |
| D (DOLLARIZATION)                     | 2.300444         | 2       | 0.3166   |
| D (INTERESTTRY)                       | 29.96001         | 2       | * 0.0000 |
| D (INTERESTUSD)                       | 15.72765         | 2       | * 0.0004 |

| Dependent Variable: D (INTERESTTRY)   | Excluded         | Chi-sq  | df | Prob.       |
|---------------------------------------|------------------|---------|----|-------------|
| D (LDOLLARER)                         | 66.9005          | 2       | * 0.0012 |
| D (DOLLARIZATION)                     | 1.862886         | 2       | 0.3940   |
| D (INTERESTEUR)                       | 16.89594         | 2       | * 0.0002 |
| D (INTERESTUSD)                       | 19.33189         | 2       | * 0.0001 |

| Dependent Variable: D (INTERESTUSD)   | Excluded         | Chi-sq  | df | Prob.       |
|---------------------------------------|------------------|---------|----|-------------|
| D (LDOLLARER)                         | 7.6532           | 2       | *** 0.0537 |
| D (DOLLARIZATION)                     | 0.797250         | 2       | 0.6712   |
| D (INTERESTEUR)                       | 7.928535         | 2       | ** 0.0190 |
| D (INTERESTTRY)                       | 18.30018         | 2       | * 0.0001 |

Note: *, **, *** represent, respectively, significance levels at 1%, 5%, and 10%.

Results of the causality test indicate that there is a one-way causality from interest rates of EUR and TRY to dollarization. Additionally, there is a two-way causality between dollarization and the USD exchange rate.

5. Conclusions

Findings regarding the research questions need to be collectively evaluated to be able to comprehensively discuss the economic events that took place in 2018. Table 9 demonstrates the individual findings regarding the research questions analyzed.
Table 9. Summary of the results regarding the research questions.

| Research Question                                                                 | Test Criterion                                                                 | Findings                                                                 |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1 Is the arbitrage due to yield differences between currencies the reason for dollarization? | A negative and persistent relation between TRY interest rates and dollarization is expected. | A positive relationship between the TRY interest rate and dollarization was found in the short term, while the USD interest rate has a negative effect. |
| 2 Are central bank policies effective?                                             | Short-term negative effects of central bank policies on dollarization are expected to persist or at least not to revert in the long term. | The positive relationship persists in the long run, with the addition of the EUR interest rate with a negative effect on dollarization. |
| 3 Do investors trust in the consistency of monetary policy?                         | Both interest rate and exchange rate are expected to have two-way causality with dollarization. | The exchange rate has two-way causality while interest rates have one-way causality. |

Under healthy market conditions, a certain level of dollarization in savings is a naturally occurring phenomenon due to arbitrage between currency markets, and it is a fundamental part of a successfully functioning market. However, in the Turkish market, the findings of research question 1 suggest that the capital that is dollarized does not return to the domestic currency even though domestic yields increase. While for a short period this may be due to the momentum of national risk premiums, the persistence of the fact over the 10 years of the period suggests that the primary reason for dollarization in the Turkish market is most likely a “run for quality” rather than currency market arbitrages. The negative relationship between the USD interest rate and dollarization of savings is also a finding that reinforces this suggestion. Resident dollarization increases even though the USD yield decreases. As in the last 10 years the main reasons for a reduction in the interest rate of USD were financial crises, this finding suggests that the domestic savers run for USD in order to hedge against inflation. Research question 3 supports this even further by presenting a one-way causality between the dollarization and interest rates.

The findings obtained from the second research question provide significant evidence that the central bank policies may be ineffective in achieving their desired results. The short-term effects caused by central bank policies not only neutralize in the long run but also deteriorate their original purpose, resulting in a net setback in the desired outcome. In this research question, we also find further evidence suggesting the store-of-value usage of foreign currency, as a reduction in the interest rate of EUR results in the dollarization of savings in the long run. On the other hand, the two-way causality between the exchange rate and dollarization in research question 3 may indicate that the result is a mix of both arbitrage and a run for quality.

Collectively, the most significant and strongly prevalent finding is that both in the short and long term, an increase in the TRY interest rate causes an increased level of dollarization in the economy. This one-way relationship strongly suggests that for the studied period, interest rate increases by the Central Bank of the Republic of Turkey (CBRT) are not enough to compensate for the loss of value or buying power, resulting in a net loss to lenders should they decide to stay in Turkish lira. In addition to this, findings also indicate that an increase in USD or EUR interest rates reduces the dollarization of deposits in the economy both in the short and the long run. This finding is in line with the findings of the study of Mecagni et al. [42]. Cumulatively, the findings strongly suggest that speculative trading is not the cause of dollarization of deposits in Turkey and that domestic citizens dollarize their deposits with the purpose of protecting their wealth. This finding supports the evidence suggested by Drazen [35]. In addition, the lender’s reaction to the central bank policy rate changes also suggests that the central bank’s interest rate policy decisions may be more expansionary than anticipated.

In Table 10, we present a comparative analysis between our results and results found in the previous literature.
Table 10. Comparison with the previous literature.

| (Author Date) | Country                  | Contradictory | Complementary |
|---------------|--------------------------|---------------|---------------|
| (Anh 2018)   | Vietnam                  | X             |               |
| (Bannister et al. 2018) | Emerging Markets         | X             | X             |
| (Caglayan and Talavera 2016) | Turkey                  | X             | X             |
| (Beckerman and Solimano 2002) | Ecuador                |               | X             |
| (Çaliskan and Karimova 2017) | Turkey                  |               | X             |
| (İSİK 2019)  | Turkey                   |               | X             |
| (Karamollaoglu and Yalçin 2019) | Turkey              |               | X             |
| (Kubo 2017)  | ASEAN                    |               | X             |
| (Licandro and Mello 2016) | Latin America           | X             | X             |
| (Marcelin and Mathur 2016) | Turkey + 19 Countries    |               | X             |
| (Marcelin and Ike 2018) | Emerging Economies      |               | X             |
| (Metin-Özcan 2017) | Turkey                  |               | X             |
| (Nidhiprabha 2017) | CLMV Countries          | X             | X             |
| (Odaijima 2017) | ASEAN                    |               | X             |
| (Okuda 2017)  | Cambodia                 |               | X             |
| (Ozsor and Rengifo 2016) | Emerging Markets        |               | X             |
| (Tasseven 2017) | Turkey                  |               | X             |
| (Urosevic and Rajkovic 2016) | CESE Countries         |               | X             |
| (Ybrayev 2018) | ASEAN                    | X             | X             |

The literature puts significant emphasis on the geopolitical factors that Turkey faces when discussing recent economic events. Geopolitical factors have great influence on the economic scale, especially for a country such as Turkey that has recently survived a coup attempt, has an ongoing war on its border, and has been the victim of a financial attack by the USA, as clearly declared by the President himself over the Pastor Bronson crisis [17]. The politically unique situation of Turkey makes it practically impossible to compare it with other countries in the literature or even with studies on Turkey for periods prior to recent crises.

Sociopolitical and geopolitical events that have occurred in recent years make it especially hard to advise regulatory institutions as there are too many unpredictable factors that may have a strategic role. For instance, the Pastor Bronson crisis, which is reflected by both ICSS and MS-Dynamic methods, resulted in more than a 30% change in the value of USD/TRY parity in a matter of days in 2018. Following another political tension with the USA, President Trump tweeted “I will totally destroy and obliterate the Economy of Turkey (I’ve done before!” on 7 October 2019. While this tweet itself would be considered an external shock, the “(I’ve done before!” part implies that the volatility in 2018 is due to political manipulation rather than macroeconomic dynamics. Events such as this clearly demonstrate the role of external factors in dollarization in the Republic of Turkey.

For the post-COVID-19 period, regulatory institutions are advised to heavily subsidize export-oriented sectors to fill in the gap that may have been left by Chinese goods. This would turn a bleeding wound of depreciating currency into an international price advantage and may end up benefitting the economy in the long run.

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