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Research Article

Time-varying causality between dollarization and exchange rate

Dolarizasyon ve döviz kuru arasındaki zamanlar arası değişen nedensellik ilişkisi

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Abstract

Dollarization is evaluated under two subheadings in the literature: full dollarization and partial dollarization. In full dollarization, the country ultimately uses its currency and uses another currency. In contrast, partial dollarization corresponds to the axis dislocation of foreign currencies in asset purchases to protect the purchasing power of economic units in a country due to the devaluation of the domestic currency in a high inflation situation. From this point of view, Turkey has practised the concept of partial dollarization during periods of high inflation and sudden shocks over the years, and studies in this area have maintained their continuity. Therefore, there is strong evidence in the literature that there is a relationship between dollarization and inflation or the exchange rate. Based on the fact that the relationship may change over time, time-varying Granger causality analysis was used in this study. Unit root, non-linear unit root, and CMS break unit root tests were applied in this context. In this study, which investigates the asymmetric causality relationship between the dollarization index obtained by the ratio of the total foreign currency deposits in the banking sector (including the deposits of natural domestic persons) to the M2 money supply and the USDTRY nominal exchange rate, the monthly data of 12.2012 – 10.2021 were used. According to the findings obtained from the analysis, there is causality between the exchange rate and dollarization in Turkey, but it is not continuous. Depending on the cyclical fluctuations, the pass-through effect from USDTRY to Dollarization index and from Dollarization index to USDTRY has been determined in different periods. When the causality is decomposed, it is concluded that the variable-time Granger causality results. At the same time, dollarization is the cause of USDTRY in political tensions and uncertainty cases. USDTRY is the cause of dollarization in financial tensions and economic uncertainty cases.

Keywords: Foreign Exchange Rate, Dollarization, Financial Markets

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Öz

Dolarizasyon literatürde tam dolarizasyon ve kısmi dolarizasyon olarak iki başlık altında ifade edilmektedir. Tam dolarizasyonda ülke kendi para birimini kullanmayı tamamen bırakıp başka bir para birimini kullanırken, kısmi dolarizasyonda bir ülkedeki ekonomik birimlerin satın alma gücünü korumak için varlık alımlarında yabancı para birimlerini tercih ederek birimlerin eksen kaymasına tekabül etmektedir. Bu noktadan hareketle Türkiye, yıllar içinde yüksek enflasyon ve ani şokların yaşandığı dönemlerde kısmi dolarizasyon kavramını pratize etmiş ve bu alandaki çalışmalar sürekliliğini korumuştur. Literatürde dolarizasyon ile enflasyon veya döviz kuru arasında bir ilişki olduğuna dair güçlü kanıtlar bulunmaktadır. Bu çalışmada, ilişkinin zamanla değişebileceği gerçeğinden hareketle, zamana göre değişen Granger nedensellik analizi kullanılmıştır. Bu kapsamda öncelikle birim kök, doğrusal olmayan birim kök ve CMS kırılmalı birim kök testleri uygulanmıştır. Bankacılık sektöründeki (yurtiçi yerleşiklerin mevduatları dahil) toplam yabancı para mevduatının M2 para arzına oranı ile elde edilen dolarizasyon endeksi ile USDTRY nominal döviz kuru arasındaki asimetrik nedensellik ilişkisinin araştırıldığı bu çalışmada, 12.2012-10.2021 aylık verileri kullanılmıştır. Analiz sonucunda elde edilen bulgulara göre Türkiye'de döviz kuru ile dolarizasyon arasında nedensellik sürekli olmamakla birlikte vardır. Dönemlere ve konjonktürel dalgalanmalara bağlı olarak USDTRY'den Dolarizasyon endeksine ve benzer şekilde Dolarizasyondan USDTRY'ye geçişler görülmektedir. Nedensellik ayrıştırıldığında, değişken zamanlı Granger nedenselliğine göre politik gerilimler ve belirsizlik durumlarında USDTRY'nin nedeni dolarizasyonken, finansal gerilimler ve ekonomik belirsizlik durumlarında ise dolarizasyonun nedeni USDTRY olarak tespit edilmiştir.

Anahtar Kelimeler: Döviz Kuru, Dolarizasyon, Finansal Piyasalar

Jel Kodları: G10, F31

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Introduction

Financial dollarization is one of the main issues discussed by monetary authorities, policymakers, researchers, and other financial actors. Dollarization is also an important subject, whose volume has increased in various periods and shocks. Qualitative and quantitative studies have been conducted, especially in developing countries with inflation problems. In this respect, the problem may deepen in countries that have inflation problems, have current account deficits, and try to outsource their capital needs. Just as indebtedness affects dollarization, debt can arise due to dollarization. Dollarization, which is a threat to the financial-monetary dominance of many emerging and transition economies (Ize and Yeyati, 2003), can reach worried dimensions in Turkey when the tendency for hedging purposes increases and can be a driving force on the exchange rate. Moreover, the continuous decline in the value of the domestic currency against foreign currencies may compel individuals, institutions, and organizations, namely all economic actors, to buy dollars, which brings some macroeconomic problems (Ajide, Raheemi and Asongu, 2019).

Dollarization is evaluated under two subheadings in the literature: full dollarization and partial dollarization. In full dollarization, the country ultimately uses its currency and uses another currency. In contrast, partial dollarization corresponds to the axis dislocation of foreign currencies in asset purchases to protect the purchasing power of economic units in a country due to the devaluation of the domestic currency in a high inflation situation (Karakaya and Karoğlu, 2020). From this point of view, Turkey has practised the concept of partial dollarization in times of high inflation and sudden shocks over the years, and studies in this area have maintained their continuity. The partial dollarisation process may occur differently depending on the source of shock factors that create inflationary pressure, such as financial crises, banking crises, and debt crises. Because the dollarization of individuals and institutions are realized with different motives. However, as a result, the realization of dollarization and its problems do not make any difference in the economy. From this point of view, whether asset or liability dollarization, the economy will be under the pressure of foreign currencies. As a result, the inflationary situation may deepen, and the possibility of a potential crisis may be strengthened (Aninat, 2000). For this reason, considering the dollarization antecedents and successors in economies, policies that will prevent the factors that will lead to it should be preloaded, and policy changes that will eliminate them after they occur should be implemented rapidly (Taşseven and Çınar, 2016, Serdengeçti, 2005).

In developing countries, firms could borrow large amounts in foreign currency. This situation is known as credit dollarization and is considered rational. However, in periods of increased volatility in the exchange rate market, companies may demand a foreign exchange that will create additional pressure on the exchange rate in order not to experience repayment difficulties (Emsen, 2022). Similarly, households may dollarize their savings as a precautionary measure to protect their purchasing power and not be crushed by inflation. The pass-through effect on prices will accelerate with the fluctuation in the exchange rate (Berke, 2009). Although both situations are constantly monitored by the monetary policymakers of the countries, due to the balance sheet risk it brings, monetary authorities may try to introduce reverse dollarization policies. Although there may be periods when this is possible with orthodox and heterodox policies, it can be challenging to stand in front of it in some periods. On top of that, the fight against dollarization will be with the households and companies that have shifted to foreign currencies. In developing countries where the public debt is predominantly foreign currency, politicians may also face the necessity of dollarizing the state. Therefore, the local currency depreciation will make a name for itself as a spiral that negatively affects every economic actor in society. This perception may make dollarization even more chronic (Ize and Parrado, 2002). Moreover, the said depreciation will increase foreign debt interest payments. Still, since companies' incomes generally earn income in local currency cannot increase rapidly, it may also bring about the production problem in the real sector and deterioration in the employment market (Carranza, Cayo, and Sanchez-Galdon, 2003; Aguiar, 2005). As a result, firms' balance sheets would deteriorate with negative consequences for investment, output, employment and wages. In all these dollarization paradigms, it is vital to be proactive regarding which factors will increase the tendency to dollarization to predict the damage that may occur when the developing countries are exposed to dollarization negatively (Dalgic, 2018).

This study will investigate asymmetrically whether the fluctuation and rising trend in the exchange rate in Turkey affect the dollarization preference of economic actors. In this way, by determining the factors that will cause an increase in the demand for foreign currency in the country, the effectiveness of front-loading policies will be increased, and the basis for rapid reverse dollarization will be established. In determining the policies that will accelerate the reverse dollarization, it is essential to diagnose the dynamic that causes the problem. In this study, the fluctuating course of the exchange rate variable in

which periods increase the demand for foreign currency will be investigated with a time-varying causality analysis. Thus, it will be known to what extent exchange rate shocks, one of the critical factors in the diagnosis of dollarization, will cause dollarization. Parallel to this, it will be possible to get results quickly and effectively from the policies implemented.

Literature review

In general terms, dollarization can be defined as the ability of another foreign currency to fulfil every function of a country's national currency. However, a foreign currency is preferred over the national currency in functions such as being the said unit of account, mediating financial transactions, and storing value, causing it to be seen as a currency substitute (Calvo and Gramont, 1992). Aysun (2018) states that although there is economic instability and unofficial dollarization, it will not be possible to return to official dollarization in Turkey, where dollarization is rarely discussed. Yılmaz and Uysal (2019) state that the dollarization process results from unstable and high inflation in countries with a flexible exchange rate regime. The demand for a national currency decreases throughout the country and loses its dominant currency feature. They also argue that dollarization is the cause of exchange rate fluctuations.

Akçay, Alper and Karasulu (1997) investigated the effects of currency substitution on exchange rate instability in Turkey. Theoretical exchange rate determination models show that exchange rate instability increases with the degree of currency substitution. An exponential GARCH (E-GARCH) model for exchange rate depreciation was used, and evidence supporting this hypothesis was obtained. They also tested the extent of currency substitution in determining the short-run dynamics of accurate money balances using the expected depreciation series from the E-GARCH model. Corrado (2008) states that nominal exchange rate shocks dominate the real sector in a dollar-indexed economy with financial dollarisation. Therefore, exchange rate fluctuations may create output and production problems due to high costs. This situation may be an obstacle to a stable economy.

Uslu and Kapkara, S. (2019) investigated the factors affecting credit dollarization using the VECM model. Their study used 2006-2019 data on actual exchange rates, foreign currency deposits, leverage ratio, and loan interest rate. The results show that the real exchange rate variable affects credit dollarization negatively, but other variables affect it positively. Kal (2019) analyzed all other factors, including dollarization, that affect TL-Dollar exchange rate volatility, with the GARCH model, in his study, in which he argues that the rate of foreign currency deposit and loan utilization increased in line with exchange rate volatility as of 2011. The results draw attention to the fact that the use of foreign currency in the banking system, especially credit dollarization, affects the conditional exchange rate volatility upwards. At the same time, the short-term capital flows to the stock and debt securities markets affect the conditional exchange rate volatility downwards.

Sever (2012) determined Turkey's exchange rate and dollarization relationship with the Granger causality test for the 1989:12–2010:12 period and the 2001:02–2010:12 sub-period. The results indicate bidirectional causality between both variables. However, it is stated that the causality relationship from dollarization to exchange rate uncertainty is stronger. After the 2001 crisis, with the transition to the flexible exchange rate regime, a one-way causality relationship was found from dollarization to exchange rate uncertainty. In the study of Terzi and Kurt (2007), in which the effect of the pass-through from exchange rate to prices in the 1995-2006 period was investigated using data on foreign trade, money supply, exchange rate and dollarization in the low inflation period and dollarization in the inflationary period, it is emphasized that there is a Granger causality from the real exchange rate to inflation. The relationship has been demonstrated. Other findings show that in periods of high dollarization, the change in exchange rate passes into prices faster. In periods of low dollarization, the change in the exchange rate passes into prices more slowly. In addition, it was observed that the pass-through from exchange rates to prices decreased after 2001.

Çetin (2004) investigated the relationship between exchange rate uncertainty, inflation and dollarization, which became complicated after this period, with the Granger causality test between 1987-2003. It has been proven that there is a strong Granger causality relationship between inflation to exchange rate change uncertainty and exchange rate change uncertainty to dollarization. Karakaya and Karoğlu (2020) examined the dollarization positions in detail in the process that emerged after the 2008 mortgage crisis in Turkey. They investigated the determinants of dollarization, which has increased in recent years. In the study, which deals with the relationship between inflation and dollarization, it has been revealed that there is a cyclical process in which households tend to foreign exchange with the inflationary pressure that occurred in the post-crisis periods. This situation increases the pressure by increasing the prices of imported goods. Yalçıner and Mutlu (2018) sought to answer whether there was

a dollarization period or a de-dollarization process after the global financial crisis. Similar to the literature, it has been observed that the dominance of dollarization in developing economies has increased significantly after 2013. In this process, it has been observed that the demand for foreign currency is higher than the demand for national currency. In their study, Ize and Yeyati (2006), Is de-dollarization a realistic goal? Is it worth the effort? If so, how can it be tracked? They sought answers to their questions. They state that, under financial dollarization concerns, financial dollarization remained stable despite falling inflation and that dollarization could be the source of financial fragility in the pre-crisis periods.

Yinusa (2008) examined the relationship between nominal exchange rate volatility and dollarization in Nigeria by applying the Granger causality test for 1986 (1) – 2003 (4) periods, and it was seen that the empirical results of the test supported a two-way relationship. It has been determined that the causality from dollarization to exchange rate volatility is more assertive and dominant. This suggests that policies aimed at reducing exchange rate volatility in Nigeria should include measures explicitly addressing the issue of dollarization. An important factor is the supply of sufficient domestic currency assets to allow portfolio diversification and eliminate negative expectations about future inflation in the country. Mengesha and Holmes (2013) aimed to contribute to the limited research on African economies by investigating the consequences of dollarization on Eritrean exchange rate volatility. They conducted an E-GARCH analysis using quarterly official and black-market exchange rate data for the 1996-2008 study period. The results show that dollarization positively affects absolute exchange rate volatility.

Özkul (2021) investigated the relationship of financial dollarization with inflation and employment with the help of Toda-Yamamoto causality analysis using monthly data from December 2005 to November 2020. The study determined causality from deposit dollarization to inflation and unemployment. It was also found that there is causality from credit dollarization to inflation. Park and Son (2020) state that in countries where dollarization has decreased, the local currency appreciates in absolute terms, and this situation reduces dollarization. They also concluded that high dollarization increases inflation. Tufaner (2021) used monthly data for the period 2013M1 – 2021M2 in his study to investigate the determinants of dollarization. In the Granger causality test study, a positive relationship was determined between international reserves, returns on financial investment instruments, and dollarization. In addition, a one-way causality relationship from dollarization to exchange rate has been determined.

Kaya and Açdoyuran (2017) revealed causality from index return to deposit dollarization in the causality relationship between the BIST-100 index and deposit dollarization. They researched using monthly data from January 2000 to April 2017 for Turkey. Caglayan, Pham, and Talavera (2019) state that the conversion rate of banks' foreign currency deposits into loans is limited to 30%. This situation is difficult to compensate with off-balance-sheet activities. The authors pointed out that the depreciation of the Turkish Lira, together with the high exchange rate risk, is dangerous for the financial system and drew attention to the prevention of dollarization. In their study, Uslu and Kapkara (2019) aimed to determine the determinants of credit dollarization with the help of monthly data for the period of January 2006 – January 2019. According to the Vector Error Correction Model (VECM), while the increases in the real exchange rate affect the credit dollarization negatively, the inflation rate affects the credit dollarization positively.

When the studies mentioned above in the literature are evaluated in a general framework, it is seen that the determinants of dollarization and their interactions with the said determinants differ depending on the country, the method and the data set used. Based on these results, policy proposals and situation determinations were put forward in the mentioned studies. However, the relationship between dollarization and the parameters affecting it is not linear and may undergo structural changes depending on cyclical developments. From this point of view, this study aims to determine the time-varying causality of the series, based on the fact that the relationship between dollarization and exchange rate will not be linear.

Research methodology

Toda and Yamamoto (1995) proposed a Lag Augment VAR (LA-VAR) method that is not sensitive to the integration properties of the series. Another advantage of the LA-VAR model is that the stationarity structures of variables can be different. The LA-VAR model is based on estimating the VAR (p) model together with the maximum possible degree of integration (m) and is expressed as VAR (p+m). Thus, the Wald test is performed without considering the maximum degree of cointegration coefficients included in the model (Toda and Yamamoto, 1995; Tan, Mert, and Özdemir, 2016; Baum, Hurn, and Otero, 2021).

let y_t be the vector of an n-dimensional time series,

$$\gamma_t = \theta_1\gamma_{t-1} + \cdots + \theta_p\gamma_{t-p} + \varepsilon_t \quad (1)$$

according to the VAR(p) process, which has the form:

$$y_t = \alpha_0 + \alpha_1 t + \gamma_t \quad (2)$$

suppose that the vector y_t is generated using the model in the format. In this case, if $\gamma_t = y_t - (\alpha_0 + \alpha_1 t)$ is written instead of the expression y_t in Equality 1, for i=0.1 and j=1,...,p, the new equality of β_i where is a function of α_i and θ_j:

$$y_t = \beta_0 + \beta_1 t + \theta_1 y_{t-1} + \cdots + \theta_p y_{t-p} + \varepsilon_t \quad (3)$$

will be as above. Thus, a causality relation test for the possible integrated variable y_t can be estimated using the LA-VAR method proposed by Dolado and Lütkepohl (1996) and Toda and Yamamoto (1995) and given in Equation 4:

$$y_t = \beta_0 + \beta_1 t + \sum_{i=1}^{p} \theta_i y_{t-i} + \sum_{j=p+1}^{p+m} \theta_j y_{t-j} + \varepsilon_t \quad (4)$$

Also, if $Y = (y_1, \dots, y_T)'_{T\times n}$, $\tau = (\tau_1, \dots, \tau_T)'_{T\times 2}$, $\tau_t = (1, t)'_{2\times 1}$, $\Gamma = (\beta_0, \beta_1)_{n\times(q+1)}$, $X = (x_1, \dots, x_T)'_{T\times np}$, $x_t = \left(y'_{t-1}, \dots, y'_{t-p}\right)'_{nk\times 1}$, $\varphi = \left(\theta_1, \dots, \theta_p\right)_{n\times np}$, $Z = (z_1, \dots, z_T)'_{T\times nm}$, $z_t = \left(y'_{t-p-1}, \dots, y'_{t-p-m}\right)'_{nm\times 1}$, $\phi = \left(\theta_{p+1}, \dots, \theta_{p+m}\right)_{n\times nm}$, $\varepsilon = (\varepsilon_1, \dots, \varepsilon_T)'_{T\times n}$ ve $\theta_{p+1} = \cdots = \theta_{p+m} = 0$ then the expression is given in Equation 4:

$$Y = \tau\Gamma' + X\varphi' + Z\phi' + \varepsilon \quad (5)$$

can be written as above (Shi, Hurn, and Phillips, 2016). In this case, a Wald-type test statistic based on the Granger non-causal null hypothesis constrained in the form $H_0: R\psi = 0$ with $\psi = vec(\varphi)$ and R being $q \times n^2p$:

$$W = \left(R\hat{\psi}\right)'\left[R\left(\left(\frac{1}{T}\hat{\varepsilon}'\hat{\varepsilon}\right)\otimes(X'\Delta X)^{-1}\right)R'\right]^{-1}R\hat{\psi} \quad (6)$$

Determined as above. Here, $\Delta = \Delta_T - \Delta_T Z(Z'\Delta_T Z)^{-1}Z'\Delta_T$ ve $\Delta_T = \mathrm{I}_T - \tau(\tau'\tau)^{-1}\tau'$ and the OLS estimator of ψ is $\hat{\psi} = \mathrm{Y}'\Delta X(X'\Delta X)^{-1}$ (Shi et al. 2016).

Shi et al. (2016) proposed a new method based on "expanding window", "rolling window", and "evolving recursive window" approaches to determine causality relationships using the LA-VAR model proposed by Toda and Yamamoto (1995). In this step of our analyses, we utilize time-varying Granger Causality tests based on the LA-VAR model and recursive rolling window approach developed by Shi et al. (2016) to examine the non-linear dynamics between dollarization and USDTRY exchange rate.

The recursive rolling approach is a fixed window estimation method with window size τ_w (fixed window size). The endpoint is the sequence $\tau_2 = \{\tau_w, \dots, T\}$. The start point of the estimation considers all possibilities (1 to $\tau_2 - \tau_w + 1$). This procedure combines the sequence of endpoints $\tau_2 = \{\tau_w, \dots, T\}$ with the start point sequence $\tau_1 = \{1, \tau_2 - \tau_w + 1\}$. The recursive rolling statistics are the sum of the all-possible rolling statistics for the given point (Balcilar, Ozdemir, and Shahbaz, 2019).

Data

In this study, which investigates the asymmetric causality relationship between the dollarization index obtained by the ratio of the total foreign currency deposits in the banking sector (including the deposits of real domestic persons) to the M2 money supply and the USDTRY nominal exchange rate, the monthly data of 12.2012 – 11.2021 were used. All data were obtained from the TCMB-EVDS and were used in their raw form. Since the oldest available block data of monthly FX deposit accounts is December 2012, this date was used as the beginning of the study (EVDS2-TCMB, 2021).

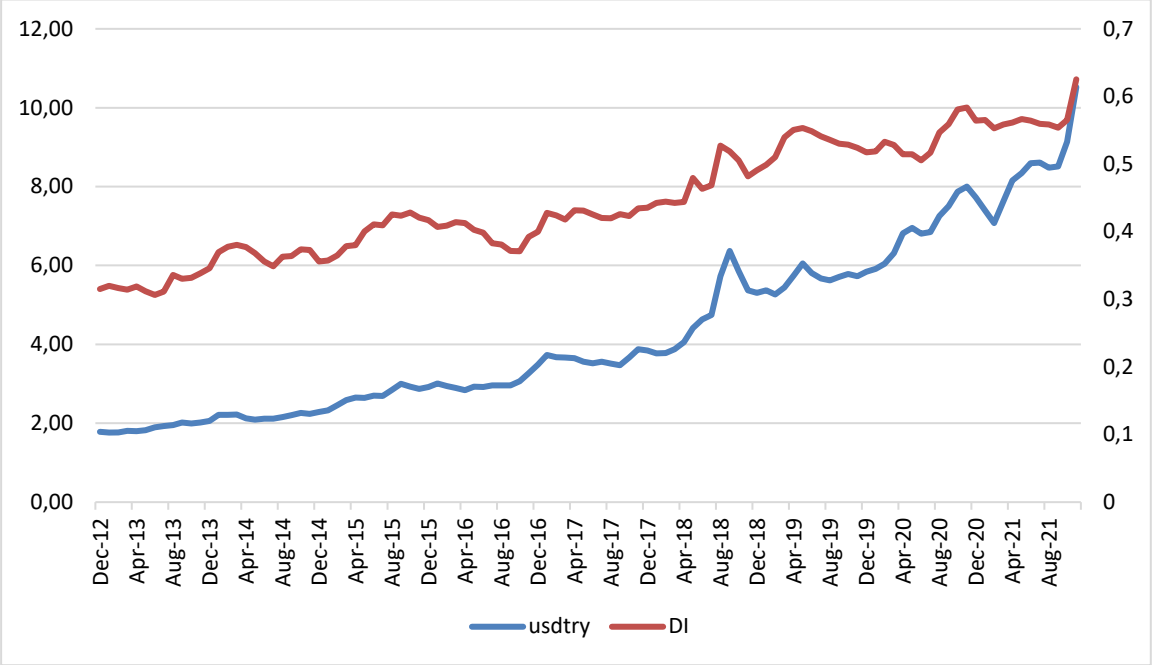

Figure 1: Data Graphs (Sources TCMB-EVDS)

In Figure 1, the manually created total foreign currency deposits/M2 are used as a proxy of the dollarization index (DI). The index data of the last day of the relevant month was used concerning sources. USDTRY (kur) parity was used as the nominal exchange rate, and the value of the last day of the month was also used (12.28.2012 – 11.30.2021).

Table 1: Descriptive Statistics and Correlation Matrix

	di(p-value)	kur	Obs.	Mean	St. Dv.	Min	Max
di	1	-	108	0,445	0,082	0,306	0,625
kur	0,9541(0,000)	1	108	4,313	2,176	1,763	10,523

Descriptive statistics of the series are given in Table-1. The maximum value is 0,625 in the dollarization index and corresponds to the rate with the country's highest dollarisation rate as of 9 years. It indicates approximately 105% foreign currency consolidation, according to the minimum level of dollarization. While the exchange rate took the minimum value of 1,763, it increased to 10,523 in the last months of 2021. Here, an increase of approximately 600% can be mentioned. The mean values of the series are given in the Table. The correlation matrix result shows a solid and positive relationship between the dollarization index and exchange rate (USDTRY- kur), and it is statistically significant.

Findings

This section will apply the time-varying Granger causality test of the above methodology. First, linear unit root tests were applied to the series. In order to obtain reliable predictions in time series models, the series should be stationary. That is, they should not contain unit roots. For this reason, it is determined whether the series contain a unit root to obtain significant relationships between the variables (Gujarati and Porter, 2012). In time series analysis, the null hypothesis of "There is a unit root in the series" is tested with the help of Generalized Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, which are generally suggested by Dickey and Fuller (1981) and Philips and Peron (1988).

Table 1: Unit Root Test Results

		Dollarization Index (di)		USDTRY (kur)	
		Constant	Constant Trend	Constant	Constant Trend
ADF Unit Root	Level	-0,138	-3,477	2,553	2,207
	First Dif.	-7,952*	-7,925*	-7,073*	-7,651*
	%1	-3,492	-4,046	-3,493	-4,047
	%5	-2,888	-3,452	-2,889	-3,453
	%10	-2,581	-3,151	-2,581	-3,152
Phillips-Perron Unit Root	Level	0,217	-3,077	4,637*	1,386
	First Dif.	-7,266*	-7,240*	-3,739**	-3,226***
	%1	-3,492	-4,046	-3,492	-4,046
	%5	-2,888	-3,452	-2,888	-3,452
	%10	-2,581	-3,151	-2,581	-3,151

The null hypothesis of H0 for the PP and ADF tests is that the series has a unit root. Since the series may contain trends, performing both trend and no trend analysis is appropriate. The test statistic is considered when the level values are more significant than the critical values. This means that the series has a unit root and is not stationary. The variable 'end' and 'set' are units rooted in I(0) for both tests (constant and trend) and are non-stationary. Proxy 'kur' is also stationary at a level with no trend for PP. However, when the difference of the series is taken, the null hypothesis is rejected. As a result, both series are stationary for 1% in I(1) (trend or no trend)

Table 2: BDS Test Results

BDS Test					
Variable	m=2	m=3	m=4	m=5	m=6
di	0,178(0,00)	0,302(0,00)	0,388(0,00)	0,445(0,00)	0,482(0,00)
kur	0,180(0,00)	0,304(0,00)	0,389(0,00)	0,446(0,00)	0,485(0,00)

Along with unit root tests, it is necessary to investigate whether the financial series has a linear structure regarding time. For this purpose, to determine the non-linear dependency structure in the series, Broock, Scheinkman, Dechert, and LeBaron (1996) proposed a test statistic (BDS). In the null hypothesis of the BDS test, it is assumed that the model's residuals are independent and identically distributed. The model is linearly dependent (Broock et al., 1996). After unit root tests, the BDS linearity test was applied to the series. As shown in Table-3, the Ho hypothesis, which states that the series is linear, was rejected because the probability value for all dimensions was less than 0.05. The series is not in an identical and independent distribution structure. The results confirm the presence of asymmetries in both series. Therefore, dynamic asymmetric models are a priority for analysing the non-linear relationship between index and currency. After this stage, asymmetric unit root and break unit root tests will be applied before the causality test.

Table 3: Non-Linear Unit Root and Structural Breaks Unit Roots

	Dollarization Index (di)		USDTRY (kur)	
	Constant	Constant Trend	Constant	Constant Trend
KSS [1]Unit Root				
Level	0,271	-1,952	3,732	1,504
First Differences	-6,259*	-6,322*	-2,688***	-3,074**
%1	-3,250	-3,616	-3,250	-3,616
%5	-2,675	-3,001	-2,675	-3,001
%10	-2,400	-2,700	-2,400	-2,700
Clemio2 Unit Root (with brekas)				
Level	-2,628		-0,692	
First Differences	-6,190**		-4,006	
%5	-5,49		-5,49	
Level (Breaks)	2014m12-2018m3		2018m1-2020m1	
First Differences (Breaks)	2016m12-2020m9		2018m7-2021m1	
Clemao2 Unit Root (with breaks)				
Level	-4,091		-1,740	
First Differences	-6,991**		-2,715	
%5	-5,49		-5,49	
Level (Breaks)	2015m7-2018m9		2018m10-2020m12	
First Differences (Breaks)	2016m11-2018m6		2018m6-2020m12	

Non-linear unit root tests should be used to determine the stationarity structures in non-linear models. For this purpose, a unit root test based on the exponential soft-pass autoregressive model was developed by Kapetenios, Shin, and Snell (2003) for non-linear series. With this test statistic, the existence of a unit root is compared with the null hypothesis and the alternative hypothesis that the series has a stationary structure. According to the non-linear unit root test results applied to the variables, both variables are stationary at the first difference. The results of the non-linear unit root test KSS (Kapetanious et al., 2003) are given in Table-4. The unit root H0 hypothesis confirms that the dollarization index and currency series are in the non-linear ESTAR process.

Depending on the financial developments, the structural changes that occur in the series during a specific period may cause misleading results about the stationarity of the series. For this reason, it is essential to consider structural breaks in stationarity tests for variables. In the study, Clemente, Montanes and Reyes (1998) used the CMR unit root test, which allows two structural breaks and allows to investigate of the existence of a unit root in series under structural breaks. In the CMR test, "Innovation outlier (Clemio2) and "Additive Outlier (Clemao2)" models are used for gradual and instant changes. According to the Clemio2 and Clemao2 tests, which take into account the breaks, the series have breaks in the years given in the Table. According to the unit root test results with breaks, the variable 'di' is stationary while 'kur' is non-stationary. When the breaking dates are analyzed, the

[1] KSS statistics and critical values are listed for all variables based on SIC criteria.

exchange rate shocks of 2018m1, 2018m6 and 2020m12 include structural breaks expected in the test results. The breaking dates of the dollarization index variable indicate months 2015m7, 2016m11, 2018m6 and 2018m9, when political fluctuations were experienced, and 2018 – 2020 when exchange rate shocks were experienced. After the unit root tests, the VAR lag length test was applied to determine the appropriate lag date for the variable time Granger test.

Table 4: VAR Lag Lenght

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	25,0314				,002122	-,479821	-,458226	-,426397
1	301,752	553,44	4	0,000	7,2e-06	-6,16149	-6,09671	-6,00122
2	313,009	22,514	4	0,000	6,2e-06	-6,31268	-6,20471	-6,04556
3	326,456	26,894	4	0,000	5,1e-06*	-6,5095*	-6,35833*	-6,13553*
4	329,183	5,4542	4	0,244	5,2e-06	-6,48298	-6,28862	-6,00216
5	332,25	6,135	4	0,189	5,4e-06	-6,46355	-6,22601	-5,87589
6	333,926	3,3516	4	0,501	5,6e-06	-6,41513	-6,1344	-5,72062
7	335,97	4,0872	4	0,394	5,9e-06	-6,37437	-6,05045	-5,57301
8	338,124	4,3082	4	0,366	6,1e-06	-6,33592	-5,9688	-5,42771
9	339,73	3,2112	4	0,523	6,5e-06	-6,28603	-5,87573	-5,27098
10	346,448	13,438*	4	0,009	6,1e-06	-6,34268	-5,88918	-5,22077
11	349,476	6,0544	4	0,195	6,3e-06	-6,32241	-5,82573	-5,09366
12	350,724	2,4976	4	0,645	6,7e-06	-6,26509	-5,72522	-4,92949

In the study, monthly data were used to determine the lag length, the maximum delay was 12, and the optimum length was determined as three delays. The LM test result shows no autocorrelation problem (p=0,218), and the stability condition is met.

Table 6: Wald Test Statistics

TVGC[2]	Wald Test Statistics Rolling Window	Wald Test Statistics Recursive Window	Wald Rolling %1 Critical Value	Wald Recursive %1 Critical Value
Δdi⇒Δkur	46,615*	55,217*	20,849	22,950
Δkur⇒Δdi	194,384*	194,384*	19,164	19,798

According to the Wald type test (Equation-6) statistics, the null hypothesis of no causality is rejected. According to the TVGC analysis Wald test results (Table-6), the test statistics obtained are statistically significant at 1% for Rolling Window and Recursive Expanding. Both series are stationary at first differences, according to Table 4. In the following periods, both Δdi is the cause of Δkur and Δkur is the cause of Δdi.

[2] Series at first differences and lag lenght is 3 with respect to ADF and VAR. Stata command is 'tvgc di kur (kur di) d(1) q(3) prefix(_Wald) graph'.

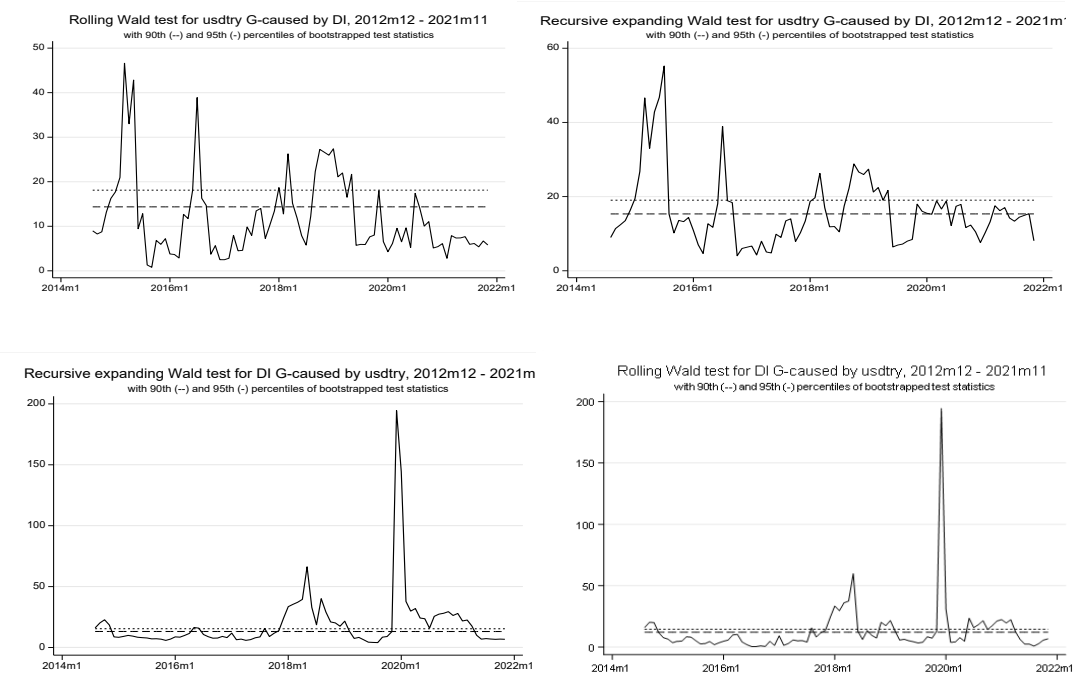

Figure 2: Time-Varying Granger Causality Results (Rolling and Recursive)

The Rolling(RO) Window and Recursive Expanding(RE) results obtained according to the time-varying Granger causality results are given in Figure-2. The effects of the dollarization index on USDTRY and the dollarization index effects on USDTRY are reported separately. According to panel a and b in Figure-2, in the last months of 2015 and the first months of 2016, in the 7th month of 2016, in the 3rd month of 2018 and the 7th, 8th and 9th months of the year, dollarization is the cause of the exchange rate. No causal relationship is observed in other months. According to panels c and d, USDTRY is a substantial cause of dollarization in the first three months of 2018 and 2000. When the causality between the variables is examined, no reciprocal causality presents continuity. Therefore, Time-varying Granger causality (TVGC) is confirmed. Furthermore, it is observed that there is no causality between the two variables in the periods when stability in the exchange rate is ensured, and political tensions are avoided.

Conclusion

Dollarization is also an important subject, whose volume has increased in various periods and shocks. Qualitative and quantitative studies have been conducted, especially in developing countries with inflation problems. Turkey has practised the concept of partial dollarization in times of high inflation and sudden shocks over the years, and studies in this area have maintained their continuity. However, the partial dollarisation process may occur differently depending on the source of shock factors that create inflationary pressure, such as financial, banking, and debt crises. This study will investigate asymmetrically whether the fluctuation and rising trend in the exchange rate in Turkey affect the dollarization preference of economic actors. In this way, by determining the factors that will cause an increase in the demand for foreign currency in the country, the effectiveness of front-loading policies will be increased, and the basis for rapid reverse dollarization will be established.

According to the findings obtained from the analysis, there is causality between the exchange rate and dollarization in Turkey, but it is not continuous. Depending on the cyclical fluctuations in different periods, a pass-through effect from USDTRY to Dollarization index and similarly from Dollarization index to USDTRY has been observed, and the results are consistent with Çetin (2004), Sever (2012), Karakaya and Karoğlu (2020) and Mutlu (2018). The time-varying Granger causality figures illustrate that there are causalities from dollarization to USDTRY at the end of 2015 (double Turkish parliamentary elections), on July of 2016 (The Fethullah Terrorist Organisation coup attempt), and the second half of 2018 (Brunson crises). These results suggest that domestic political tensions and uncertainty brings USDTRY appreciation through the dollarization channel. On the other hand, USDTRY appreciation is the Granger cause of dollarization in 2018 (tightening of global liquidity conditions and USA-China trade war) and 2020-2021 (Covid-19 Pandemic). These results suggest that global financial tensions and economic uncertainty cause dollarization with the channel of local currency appreciation on Turkey. In this context, the source of the policies to be produced by the

monetary authority in times of shock and crisis should be well determined. Depending on the source, whether a policy will be made for the exchange rate or the perception of dollarization should be determined. In the case of economic and financial shocks, an intervention to the perception of being dollarized in political and political shocks will have effective results.

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References

Ajide, K. B., Raheem, I. D., & Asongu, S. A. (2019). Dollarization and the "Unbundling" of Globalization in sub-Saharan Africa. Research in International Business and Finance, 47, 398-409.

Akçay, O. C., Alper, C. E., & Karasulu, M. (1997). Currency substitution and exchange rate instability: The Turkish case. European Economic Review, 41(3-5), 827-835.

Aninat, E. (2000). "Globalization as An Economic and Social Force: Opportunities and Risks from a Humanistic Perspective", (Ed: José Antonio Ocampo, Stefano Zamagni, Ricardo Ffrench-Davis and Carlo Pietrobelli), Financial Globalization and The Emerging Economies, Santiago, Chile, 2000, pp: 25-30.

Augiar M. (2005). Investment, devaluation and foreign currency exposure: The case of Mexico. Journal of Development Economics, 78(1), 95-113.

Aysun, Ö. (2018). Dolarizasyon olgusu: Teorik bir inceleme ve Türkiye örneği. Ekonomi Politika ve Finans Araştırmaları Dergisi, 3(1), 101-113.

Balcilar, M., Ozdemir, Z. A., & Shahbaz, M. (2019). On the time-varying links between oil and gold: New insights from the rolling and recursive rolling approaches. International Journal of Finance & Economics, 24(3), 1047-1065.

Baum, C. F., Hurn, S., & Otero, J. (2021). The dynamics of US industrial production: A time-varying Granger causality perspective. Econometrics and Statistics.

Berke, B. (2009). Tam Dolarizasyonun Makroekonomik Politika Yansımaları. Elektronik Sosyal Bilimler Dergisi, 8(27), 126-147.

Broock, W. A., Scheinkman, J. A., Dechert, W. D., & LeBaron, B. (1996). A test for independence based on the correlation dimension. Econometric reviews, 15(3), 197-235.

Caglayan, M, Pham, T & Talavera, O 2019, 'Dollarization, pass-through, and domestic lending: evidence from Turkish banking', Emerging Markets Finance and Trade.

Calvo, M. G., & Gramont, M. (1992). Currency substitution in developing countries: an introduction. IMF Working Paper 92/40: 3.

Carranza L.J., Cayo J. M., ve Sanchez–Galdon J.E. (2003). Exchange rate volatility and economic performance in Peru: A firm level analysis. Emerging Markets Review, 4(4), 472-496.

Clemente, J., Montañés, A., & Reyes, M. (1998). Testing for a unit root in variables with a double change in the mean. Economics letters, 59(2), 175-182.

Corrado, G. (2008), "An open economy model with currency substitution and real dollarization", Journal of Economic Studies, Vol. 35 No. 1, pp. 69-93.

Çetin, A. (2004). Enflasyon, Döviz Kuru Belirsizliği Ve Dolarizasyon Arasındaki Nedensellik İlişkisi: Türkiye Örneği. Iktisat Isletme ve Finans, 19(218), 99-110.

Dalgic, H. C. (2018). Financial dollarization in emerging markets: An insurance arrangement. University of Mannheim, 248.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. Econometrica, 49(4), 1057–1072.

Dolado, J. J., & Lütkepohl, H. (1996). Making Wald tests work for cointegrated VAR systems. Econometric reviews, 15(4), 369-386.

Emsen, H. S. (2022). Dolarizasyon Ve Borsa İlişkileri: Türkiye Üzerine İncelemeler. Uluslararası Ekonomi Siyaset İnsan ve Toplum Bilimleri Dergisi, 5(1), 29-48.

Gujarati, D.N., & Porter, D. C. (2012). Temel Ekonometri, (Çeviri: Şenesen, Ü. ve Günlük Şenesen, G., 5. Baskı). Literatür Yayıncılık, İstanbul.

Ize, A., & Parrado, E. (2002). Dollarization, monetary policy, and the pass-through.

Ize, A., & Yeyati, E. L. (2006). Financial de-dollarization: is it for real?. In Financial dollarization (pp. 38-63). Palgrave Macmillan, London.

Kal, S. H. (2019). 2003-2018 Dönemi Türk Ekonomisinde Dolarizasyon, Kısa Vadeli Sermaye Hareketleri ve Kur Oynaklığı İlişkisi. İstanbul İktisat Dergisi, 69(2), 357-377.

Kapetanios, G., Shin, Y., & Snell, A. (2003). Testing for a unit root in the non-linear STAR framework. Journal of Econometrics, 112, 359–379.

Karakaya, G. & Karoğlu, Y. (2020). Dolarizasyon olgusu:2008 finansal krizinden sonra Türkiye'de dolarizasyon incelemesi. Stratejik ve Sosyal Araştırmalar Dergisi, 4 (2) , 353-364. DOI: 10.30692/sisad.701696

Kaya, E. & Açdoyuran, B. (2017) Finansal Dolarizasyon Unsurları Olarak Kredi Dolarizasyonu Ve Mevduat Dolarizasyonu İle Hisse Senedi Getirileri Arasındaki İlişki. Dicle Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 7(14), 325-344.

Mengesha, L. G., & Holmes, M. J. (2013). Does dollarization alleviate or aggravate exchange rate volatility?. Journal of Economic Development, 38(2), 99.

Özkul, G. (2021). Türkiye'de Finansal Dolarizasyonun Enflasyon Ve İstihdam İle Olan Etkileşimi. İşletme Ekonomi ve Yönetim Araştırmaları Dergisi, 4(1), 59-79.

Park, H. ve Son, J. C. (2020). "Dollarization, Inflation and Foreign Exchange Markets: A Cross-Country Analysis". International Journal of Finance & Economics, 1-13.

Phillips, P. C. B. & Perron, P. (1988). Testing for a Unit Root in Time Series Regression. Biometrika, 75(2), 335–346.

Serdengeçti, S. (2005). Dolarizasyon/Ters Dolarizasyon. Ekim, Eskişehir.

Sever, E. (2012). Türkiye'de Dolarizasyon Süreci ve Döviz Kuru Belirsizliği İlişkisi. Sosyoekonomi, 17(17).

Shi, S., Hurn, S., & Phillips, P. C. (2016). Causal Change Detection in Possibly Integrated Systems: Revisiting the Money-Income Relationship.

Tan, B. K. , Mert, E. & Özdemir, Z. A. (2016). Kamu Yatırımları Ve Ekonomik Büyüme İlişkisine Bir Bakış: Türkiye, 1969-2003 . Dokuz Eylül Üniversitesi İktisadi İdari Bilimler Fakültesi Dergisi , 25 (1) , 25-39 .

Taşseven, Ö., & ÇINAR, S. (2015). Türkiye'de borç dolarizasyonunun belirleyicileri ve makroekonomik göstergeler üzerindeki etkileri. Sosyal Bilimler Araştırma Dergisi, 4(2), 121.

Terzi, H., & Serdar, K. U. R. T. (2007). Türkiye'de dolarizasyon sürecinde döviz kuru ve enflasyon ilişkisi. Ekonomik Yaklasim, 18(64), 1-22.

The Central Bank Of The Republic Of Turkey (TCMB), Electronic Data Delivery System(Evds), Https://Evds2.Tcmb.Gov.Tr/

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. Journal of econometrics, 66(1-2), 225-250.

Tufaner, M. B. (2021). The Determinants of Dollarization in Turkey: An Econometric Analysis. Econder International Academic Journal, 5(2), 108-118.

Uslu, N. Ç., & Kapkara, S. (2019). Kredi Dolarizasyonunun Belirleyicileri: Türkiye Örneği. Economics Literature, 1(2), 148-167.

Yalçiner, K., & Mutlu, A. A. (2018). Küresel Kriz Sonrası Gelişmekte Olan Ülkelerde Dolarizasyon Süreci. Third Sector Social Economic Review, 53(2), 450-462.

Yılmaz ve Uysal (2019). Türkiye'de dolarizasyon ve enflasyon ilişkisi. İktisadi İdari ve Siyasal Araştırmalar Dergisi, 4(10), 286-306.

Yinusa, D. O. (2008). Between dollarization and exchange rate volatility: Nigeria's portfolio diversification option. Journal of Policy Modeling, 30(5), 811-826.