International
SOCIAL SCIENCES STUDIES JOURNAL
Open Access Refereed E-Journal & Indexed & Puplishing
e-ISSN:2587-1587
Research Article

Article Arrival : 02/12/2019
Related Date : 21/01/2020
Published : 21.01.2020
Doi Number http://dx.doi.org/10.26449/sssj.2084
Reference Gökçe, A. & Güler, H. (2020). "Determinants Of Household Currency Demand In Turkey", International Social Sciences Studies Journal, (e-ISSN:2587-1587) Vol:6, Issue: 55; pp:374-391.

DETERMINANTS OF HOUSEHOLD CURRENCY DEMAND IN TURKEY

Hane Halkı Banknot Talebinin Belirleyicileri

Assoc.Prof.Dr. Atilla GÖKÇE
Ankara Hacı Bayram Veli University, Department of Econometrics, Ankara/Turkey
ORCID ID: https://orcid.org/0000-0001-8287-4278
Dr. Halil GÜLER
Central Bank of the Republic of Turkey, Ankara/Turkey
ORCID ID: https://orcid.org/0000-0001-5346-55555

ABSTRACT

The main purpose of this study is to develop a currency demand model by investigating the existence of a long-term and stable relationship between currency demand and macroeconomic variables such as gross domestic product, interest rates, nominal exchange rate and nominal exchange rate volatility. In this regard, currency demand econometric models are examined from theoretical and emprical perspectives, unit root and cointegration tests are launched under multiple structural breaks and the existence of a long-run stable relationship between currency demand and the variables affecting currency demand is analyzed through dynamic least squares method. Additionally, an error correction model is developed to obtain short-run model estimates. The outcome of the study reveales empirical findings of a long-run stable relationship between real currency demand and gross domestic product, interest rates, nominal exchange rate and nominal exchange rate volatility. Evidence suggests that, in the long-run, there is a positive relationship between real currency demand and gross domestic product whereas there exists a negative relationship between real currency demand and deposit interest rates, nominal exchange rate, and exchange rate volatility.

Keywords: Currency Demand, Cointegration, DOLS, Error Correction Model, GARCH

ÖZET

Bu çalışmanın temel amacı, banknot talebini etkileyen gayri safi yurtiçi hasıla, faiz oranları, döviz kuru ve döviz kuru oynaklığı gibi değişkenler ile banknot talebi arasında uzun dönemli ve istikrarlı bir ilişkinin bulunup bulunmadığının araştırılarak banknot talebine ilişkin bir modelin oluşturulmasıdır. Bu doğrultuda para talebi modelleri teorik ve amprik çerçevede incelenmiş, çoklu yapısal kırılmalar altında birim kök ve eşbütünleşme testleri yapılmış ve dinamik en küçük kareler yöntemi kullanılarak banknot talebi ile banknot talebini etkileyen değişkenler arasında uzun dönemli bir ilişkinin bulunup bulunmadığı analiz edilmeye çalışılmıştır. Ayrıca, hata düzeltme modeli oluşturularak kısa dönem model tahminleri elde edilmiştir. Çalışma sonucunda, reel banknot talebi ile gayri safi yurtiçi hasıla, faiz oranı, nominal döviz kuru ve nominal döviz kuru oynaklığı arasında uzun dönemli ve istikrarlı bir ilişki bulunduğuna yönelik amprik bulgular elde edilmiştir. Uzun dönemde reel banknot talebi ile reel milli gelir arasında pozitif bir ilişki; reel banknot talebi ile mevduat faiz oranı, nominal döviz kuru ve nominal döviz kuru oynaklığı arasında ise negatif bir ilişki bulunmaktadır.

Anahtar Kelimeler: Banknot Talebi, Eşbütünleşme, DEKK, Hata Düzeltme Modeli, GARCH

1. INTRODUCTION

The usefulness of money as a policy instrument is conditional to a robust link between the nominal and real parts of the economy, as expressed by the money demand function. The money demand relationship links the monetary development to its fundamental determinants, such as the overall price level, real income, financial wealth and the opportunity cost of holding money. Therefore, understanding the precise nature of money demand and its determinants becomes a vital focus for monetary authorities, not only to examine the interaction between monetary aggregates and other economic variables but also to reveal the monetary policy transmission, the process called a "black box" by Mishkin (1995), Bernanke and Gertler (1995).

The transmission of monetary policy impulses to the economy starts with currency in circulation, which traditionally constitutes the largest liability of a central bank. While central banks have the exclusive right to issue banknotes and coins, changes in the currency in circulation are usually driven by the demand of economic agents. Therefore, as it constitutes the largest liability of central bank balance sheets and effects the liquidity needs of the financial system, money demand is a structurally important authonomous variable that needs to be estimated for accurate liquidity management. The main purpose of liquidity forecast is to create an information set of the projected evolution of autonomous factors that allow the central bank to smooth the future changes in liquidity conditions, either by liquidity injection or absorption operations. Smoothing liquidity fluctuations helps the central bank to steer a benchmark short-term money market rate, which is a precondition of an effective conduct of monetary policy.

Given the importance of understanding the precise nature of money demand, this paper aims to develop a currency demand model by investigating the existence of a long-term and stable relationship between currency demand and macroeconomic variables such as gross domestic product, interest rates, nominal exchange rate and nominal exchange rate volatility in Turkey. Quarterly data from 2001Q1 to 2018Q2 is used for real banknote demand, real national income, three-month deposit interest rate, nominal exchange rate and nominal exchange rate volatility.

In the study, stationarity properties of the series are investigated based on the unit root theory under multiple structural breaks developed by (Carrion-i-Silvestre et al. 2009). The multivariate cointegration under multiple structural breaks technique is used to test for the existence of long-run relationship, introduced by (Maki 2012).

The rest of the study is structured as follows. In section 2, the economic theory of money demand is analyzed and the demand for real currency issued is modeled. Section 3 explains the data. Section 4 presents the empirical results including unit root tests and cointegration tests. In section 5, error correction model that captures the short- run dynamic adjustment of the cointegrated variablesis estimated. Section 6 presents parameter constancy tests of long-run and error correction models. Finally, section 7 presents the conclusion and the summary of the findings.

2. LITERATURE REVIEW

The development of macroeconomic aggregates and their interaction with each other varydepending on the development level of countries. Therefore, literature review is decomposed for developed and emerging countries, primarily triggered by the concern about the impact of moving toward flexible exchange rate regimes, globalization of capital markets, ongoing financial liberalization, innovation in domestic markets, and the country-specific events on the demand for money.

2.1. Money Demand in Developed Countries

Lütkepohl et al. (1999) tested whether the demand for M1 in Germany was stable before and after the monetary union in 1990 by using error correction and smooth transition regression (STR) models. According to the results of the study, there was a stable relationship between M1 and real income, interest and inflation rates in Germany before 1990, but this relationship broke down after the monetary union.

Hayo (2000), studied demand for real M1, M2 and M3 in Austria, using quarterly data for the years between 1965 - 1996. This study, in which error correction model is used, concludes that the short and long-term narrow and broad real money demands in Austria are stable.

Pettursson (2000) analyzed the demand for broad definition of money M3 in Iceland. By using annual data for the period of 1962 - 1995, the effects of structural changes such as financial indexing, release of interest rates and commencement of secondary market transactions for financial instruments were investigated. Results of the study revealed that despite the stated structural reforms and financial innovations, the broad definition real money demand in Iceland was stable.

Grant et al. (2004) examined the relationship between narrow money demand and expenditures and short-term interest rates in the UK. This study shows that the developments in alternative payment instruments impacted the narrow demand for money, but this effect has been decreasing since the 1990s until it stabilizes in the last decade.

Perez (2014) used cointegration techniques to investigate real money demand and its determinants for 10 countries in the Euro Area. By using quarterly data for the period between 1995 and 2013, Perez (2014)found evidence of the existence of a long-run relationship when the aggregated Euro Area and six of the ten countries are considered. Perez (2014) also found out that these relationships are highly instable since the outbreak of the financial crisis.

2.2. Money Demand in Emerging Countries

Bredin (2001), studied the developments in the narrow and broad definition of money demand in the Czech Republic in the period following the disintegration of Czechoslovakia in 1993. By using monthly data for the 1992 – 1997 period, Bredin (2001) found out that the income elasticity of the narrowly defined money demand was 1.55. Moreover, the study revealed that there is a long-run relationship between monetary aggregates and real income and inflation.

In his study of the stability of the parameters of non-stationary variables, Gabriel (2003) examined the long-run effects of institutional and political changes on money demand. The results of the study shows that conventional cointegration methods may be inadequate to explain the effects of structural changes on economic aggregates.

Anglingkusumo (2005) conducted a study using quarterly data on whether the demand for real money (M1) in Indonesia between 1981 and 2002 was stable. Results of the study showed that there exists a stable Money demand in Indonesia before and after the Asian crisis.

In addition to these studies, Akyüz (1973), Olgun (1982), Ertugrul (1982), Keyder (1989), Yavan (1993), Metin (1994), Kogar (1995), Akinci (2003), Halicioglu and Ugur (2005) and Oskooee and Karacalı (2006) conducted studieson narrow and broad money demand in Turkey.

Keyder (1989) analyzed the demand for short and long-run M1 and M2 using annual data. According to this study, demand for M1 is stable during the period 1966 - 1979 and the real income elasticity of M1 demand is almost equal to 1. On the other hand, structural changes in 1980 have significantly changed the role of M1. Previously, M1 demand, which was prominent only for transaction purposes, was started to be demanded for speculation purposes due to the existence of positive real interest rates. The interest rate elasticity of the M1 demand, which was very small and statistically insignificant for the period before 1980, became negative marked and significant in the 1980- 1987 period.

According to the model in which Yavan (1993) predicted M2 money demand by using quarterly data with an error correction model, expected inflation rate stood out as an alternative cost of holding money. This study indicated to a stable M2 demand in Turkey.

Metin (1994) modelled the demand for narrow Money in Turkey and concluded that the income elasticity of money demand in the long-run was more than 1 whereas it was less than 1 in the short-run. Inflation flexibility of M1 demand is estimated almost close to 1 both in the short-run and long-run. On the other hand, Metin (1994) found out that while the interest rate variable was statistically insignificant in the long-run, it was significant in the short-run. Metin (1994)'s study also pointed out to a stable M1 demand in Turkey.

Koğar (1995) used cointegration method to the as whether Turkey has a long-term stable money demand function. According to the results of the study, the explanatory variables used were statistically significant and narrow and broadly defined money demand functions were stable in the long-run.

Akıncı (2003) analyzed the factors affecting the short and long-term real cash demand by using quarterly data for the period of 1987 - 2003. This study, which is based on cointegration analysis, demonstrated that there is a long-term relationship between real cash demand, private consumption expenditures, interest rates and exchange rate. According to the results of the test, the effect of interest rate movements on the cash demand in the long-run was more than the exchange rate movements. In the short-run, it was revealed that the changes in exchange rates had stronger effects on cash demand.

Halıcıoğlu and Ugur (2005) have used the ARDL method to analyze the stability of narrow (M1) demand using data for the1950 - 2002 period. In the model where the real money amount per capita is used as dependent variable; real income per capita, interest rate and nominal exchange rate are used as explanatory variables. According to the results of this study, there is a long-run relationship between the narrow-defined M1 demand and the national income, interest rate and nominal exchange rate affecting this monetary aggregate. CUSUM and CUSUMSQ stability tests used in the study indicated that the demand for money for the period 1950 - 2002 was stable.

Algan and Gencer (2011) analyzed the determinants of money demand and the stability ofmoney demand function in Turkey for the 1987-2010 period by the Johansen (1988) and Johansen and Juselius (1990) multivariate cointegration analysis. Money demand functions have been tried to be estimated by creating alternative models with narrow and broad (M1, M2, M2Y) monetary aggregates, income, interest, inflation and exchange rate variables. As a result of the implementation, the definition of the monetary aggregate has shown that the money demand function created with M1 is in a stable relationship with the income, interest and / or inflation variables.

3. MODEL

In monetary economics, the demand for real money is defined as the desired holding of financial assets in the form of money and expressed as a function of the alternative cost of holding money.

Even though money demand theories vary according to the functions of money as a means of exchange and store of value, they have some important variables in common.

Friedman (1956) defines money demand as a function of real income and the cost of holding money. In this context, it is possible to express the real money demand as follows:

$$\frac{M_d}{P} = F(IM, OC) \tag{1}$$

In the equation, M_d / P indicates real money demand, IM indicates the amount of transaction realized in the economy and OC indicates the alternative cost of holding money.

Depending onthe purpose of the study, the dependent variable can vary from the smallest monetary aggregate, which is currency in circulation, to the $M3Y$ which is the largest monetary aggregate.

According to Keynes (1936), there are three motives for individuals to hold money: the transaction motive, the precautionary motive, and the speculative motive.

Keynes agreed with the classical theory that money is used as a medium of exchange. To be more precise, economic agents' demand for money is for the purpose of transactions and as income rises, economic agents will hold more money to execute more transactions. In addition to holding money to carry out current transactions, Keynes observed that economic agents hold money to use in the future for unexpected needs and emergencies. Since this also depends on the amount of transactions economic agentsexpect to make, money demand is again expected to rise with income. Keynes suggested that people also hold money as a store of wealth. Because wealth is tied closely to income, the speculative motive for money demand is related to income. Keynes assumed that economic agents store wealth either as money or bonds. There is an inverse relationship between interest rates and the price of bonds; an increase in the price of a bond results in a lower interest rate. At a lower interest rate economic agents are willing to hold more money. Falling bond prices means a higher interest rate. As the interest rate increases, the opportunity cost of holding money rises, therefore money demand decreases. Demand for money goes down when interest rates rise, and goes up when interest rates fall. So under the speculative motive, money demand is negatively correlated with interest rate.

According to Mankiw and Summers (1986), gross national product, gross domestic product, disposable income, private consumption expenditures and total sales can be used as measures of the amount of transactions performed. However, as Goldfeld and Sichel (1990) pointed out, the use of sub-items that generate national income as a measure of the amount of transaction performed in money demand models significantly affects the results of the estimation.

According to Tobin (1958) and Klein (1974), the alternative cost of holding money consists of two parts: the return of money itself and the return of alternative assets. Threfore, Tobin (1958) and Klein (1974) asserted that these two rates of return should be included in the model.

Ericson (1998) argued that the return of money should be put into the models on demand for money, and stressed that the exclusion of this variable may lead to breaks in the estimated money demand model, especially in economies where financial innovations occur.

One of the variables included in the money demand models is the expected inflation rate. While the real value of money decreases with inflation, there is no change in the value of real assets. Therefore, in cases where inflation expectations are strong, demand shifts from money to real assets in conjunction with the risk perception of economic agents.

Wong (1977) stated, for example, that in money demand models of developing countries where the financial system is not fully developed, expected inflation rate can be used as the alternative cost of holding money.

Cagan (1956), Frenkel (1977), Ahumada (1992) and Honohan (1994) stated that the expected inflation rate should be used in money demand models due to the inflationary pressures on the returns of alternative financial assets in countries with high inflation history.

According to a study by Choudhry (1995a), it is stated that in countries where inflation is high, the money demand model should include a suitable exchange rate in addition to expected inflation. Dornowitz and Elbadawi (1987) emphasized the same fact by stating that if the exchange rate is excluded from the model, the effect of the inflation rate on the demand for money can be over estimated.

In light of the a for a mentioned studies, considering the financial and economic shocks causing volatility on exchange rate and banknote demand, nominal exchange rate and nominal exchange rate volatility variables are included in long-run banknote demand model.

As a result, long-run demand model for banknotes in Turkey can be expressed as follows,

$$Log(\frac{M_d}{P})_t = \beta_i + \beta_i \log Y_t + \beta_i I_{mt} + \beta_i \log EXR_t + \beta_i \log EXRV_t + \varepsilon_t \quad (2)$$

$$\beta_i ;\ i = 0,1,2,3,4\ \varepsilon_t \sim iid\ (0, \sigma_\varepsilon^2)$$

In the equation in (2), M_d / P is real banknote demand, Y_t is real GDP, I_{mt} is three-month weighted avarage deposit interest rate, EXR_t is nominal exchange rate, $EXRV_t$ is nominal exchange ratevolatility. In the equation, real money demand is expected to be positively correlated with real national income, negatively correlated with nominal interest rate, nominal exchange rate and nominal exchange rate volatility.

3.1. Data

Data used in the estimation of the money demand model are as follows. M is the currency issued by the CBRT (Turkish Lira, billion). Y is the real GDP (Turkish Lira, billion), I_{mt} is three-month weighted avarage deposit interest rate, EXR_t is nominal exchange rate, $EXRV_t$ is nominal exchange ratevolatility, EXR is the nominal bilateral exchange rate calculated as the Turkish lira per unit of US dollar (TL/$). All the series are quarterly and seasonally adjusted end of period figures and estimation sample extends from 2001:1 to 2018:2. Data is collected from the CBRT Electronic Data Distribution System. All variables but the three-month weighted avarage deposit interest rate are logarithmic in the model. Nominal exchange rate volatility is obtained by Exponential Generalized AutoRegressive Conditional Heteroskedasticity (EGARCH) method. All variables used in the study are seasonally adjusted with the Tramo/Seats method. The data set and the graphical representation of the series used in the cointegration analysis are presented as follows:

Figure 1 shows the developments in the real currency issued and deposit interest rates from the period 2001:1 to 2018:2. While the real curreency issued has been steadily increasing since 2001, the deposit rates are decreasing as expected in the economic theory.

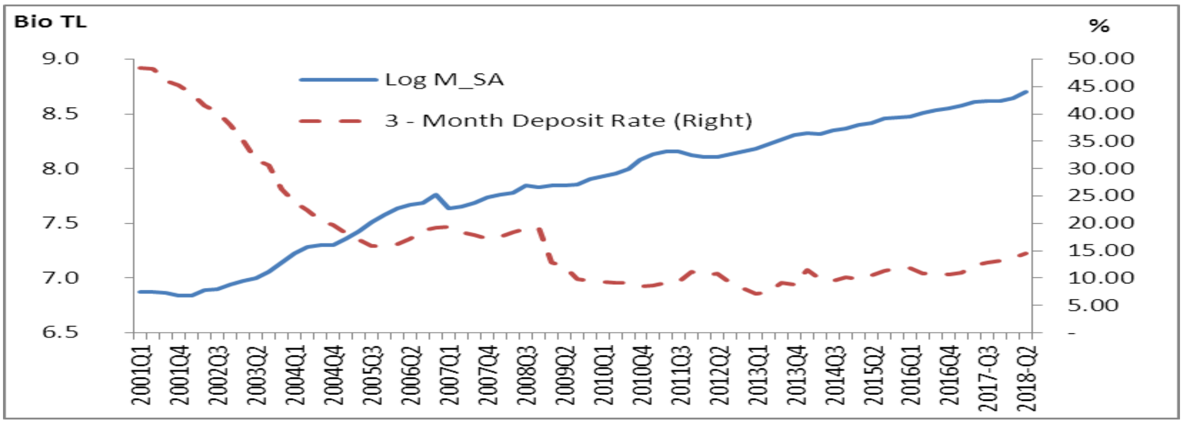

Figure 1. Real Banknote Demand and Deposit Rate
Source: CBRT

Highest growth rates of Turkish economy between 2002 and 2008 and between 2010 and 2011 describe the increase in the demand for real banknotes. On the other hand, the growth rate of real banknote demand is falling due to the slowdown in economic activity (Figure 2).

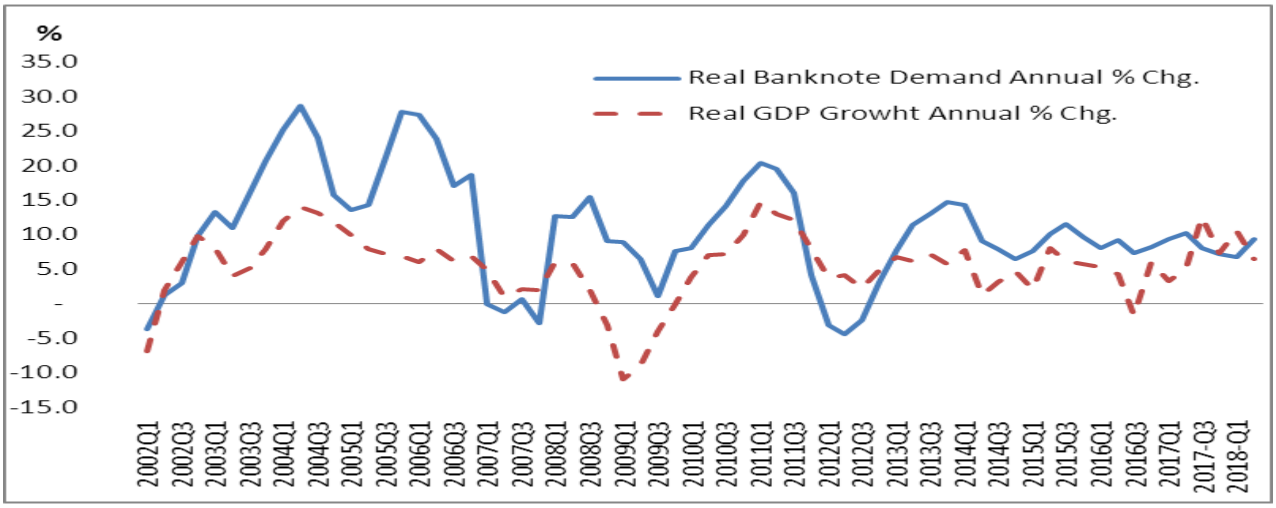

Figure 2. Real Banknote Demand and Real GDP Growth
Source: CBRT

The periods of the capital inflows to Turkey that maintain confidence and stability in Turkey is considered to accelerate the reverse currency substitution process. While the annual growth of exchange rate is falling, real banknote demand is increasing (Figure 3).

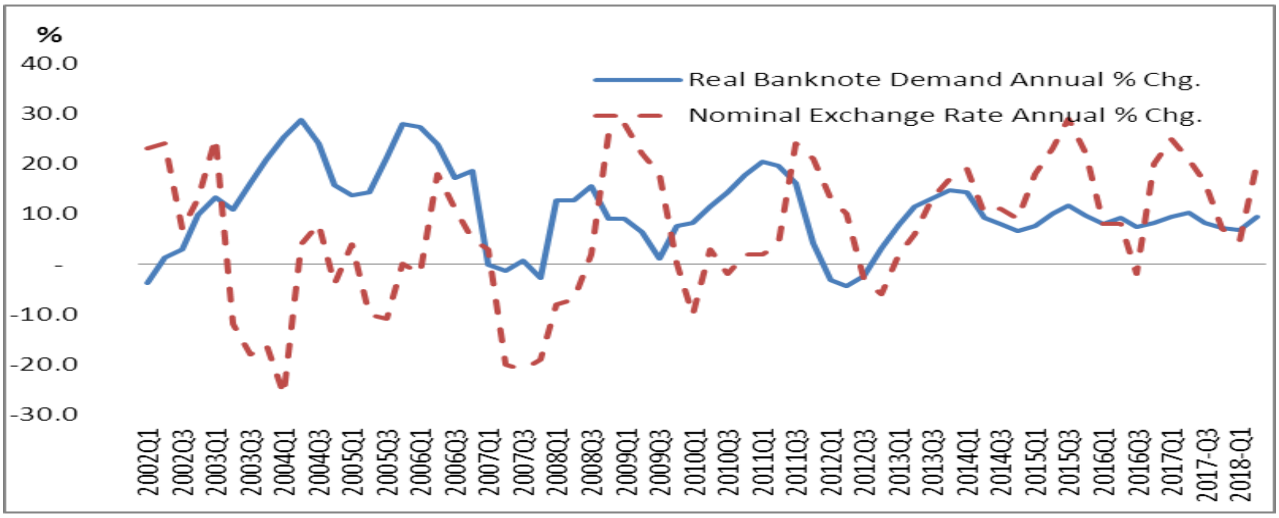

Figure 3. Real Banknote Demand and Nominal Exchange Rate
Source: CBRT

4. NOMINAL EXCHANGE RATE VOLATILITY (EXRV)

Econometricians often refer to the autoregressive conditional heteroskedasticity to investigate the volatility of the time series. The concept of conditional heteroskedasticity, which is subject to change, was first proposed by Engle (1982). In this model, the conditional heteroskedasticity of the time series is modeled as a function of past shocks and is called autoregressive conditional heteroskedasticity (ARCH). In other words, ARCH models accept the variation of time in the error term not as a problem to be solved, but as a variance of the time series that should be modeled, thus providing a convenient way to investigate the volatility of economic data (Engle, 1982).

EGARCH (1,1) model is used to obtain the nominal exchange rate volatility data.

Table 1. EXR Carrion-i-Silvestre et al. (2009) Unit Root Test

	Pr	MPT	MZα	MSB	MZt	SB Date
			Level			
L(EXR)	17.01	14.26	(15.17)	0.16	(2.67)	2006Q1 2007Q4
	[7.16]	[7.16]	[-32.28]	[0.13]	[-4.33]	2011Q4
			First Difference			
ΔL(EXR)	6.55	6.53	(25.34)	0.12	(3.83)	
	[7.12]	[7.12]	[-22.15]	[0.15]	[-3.25]	

From Table 1. the level values of EXR appear to be unit root under structural breaks. Therefore, the first difference of the logarithmic value of EXR is used as dependent variable in the process of EGARCH (1,1).

For EXR yield estimation,

$$\Delta \log(EXR) = \alpha_0 + \alpha_1 D_t + \alpha_2 \varepsilon_{t-2} + \alpha_3 \varepsilon_{t-2} \varepsilon_{t-11} + \varepsilon_t \tag{3}$$

$$\varepsilon_t = z_t h_t^{1/2} \tag{4}$$

Mean equation (3) is estimated with dummy variable (D_t);

$$D_t = \begin{cases} 1, & t = G_c \\ 0, & \text{others} \end{cases}$$

Here G_c refers to the global economic crisis. For autoregressive conditional heteroskedasticity,

$$\ln h_t = \theta + \delta \ln h_{t-1} + \phi \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \lambda \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \tag{5}$$

Table 2. EXR Estimation Resuls

Parameter	Estimation	Std. Error	*z*-statistics	*p*-value
		Mean Equation		
α_0	0.02	0.00	369.6	0.00
α_1	0.05	0.00	7.5	0.00
α_2	-0.40	0.00	-25.1	0.00
α_3	29.0	0.00	3405.0	0.00
		Variance Equation		
Θ	-4.50	0.00	-657.5	0.00
δ	-1.20	0.00	-810.2	0.00
φ	0.20	0.00	7.5	0.00
λ	0.50	0.00	1025.2	0.00

In Table 2, ϕ parameter is the effect of symmetry (GARCH effect). δ parameter is the persistence of the volatility in the exchange rate, in other words, a relatively large δ value means that it will take a long time to reduce the volatility in exchange rates after any crisis. λ parameter is asymmetry (leverage) effect. If $\lambda = 0$ then the model is symmetric. If $\lambda < 0$ then positive shocks cause lower volatility than negative shocks. If $\lambda > 0$ then positive shocks have more impact on volatility.

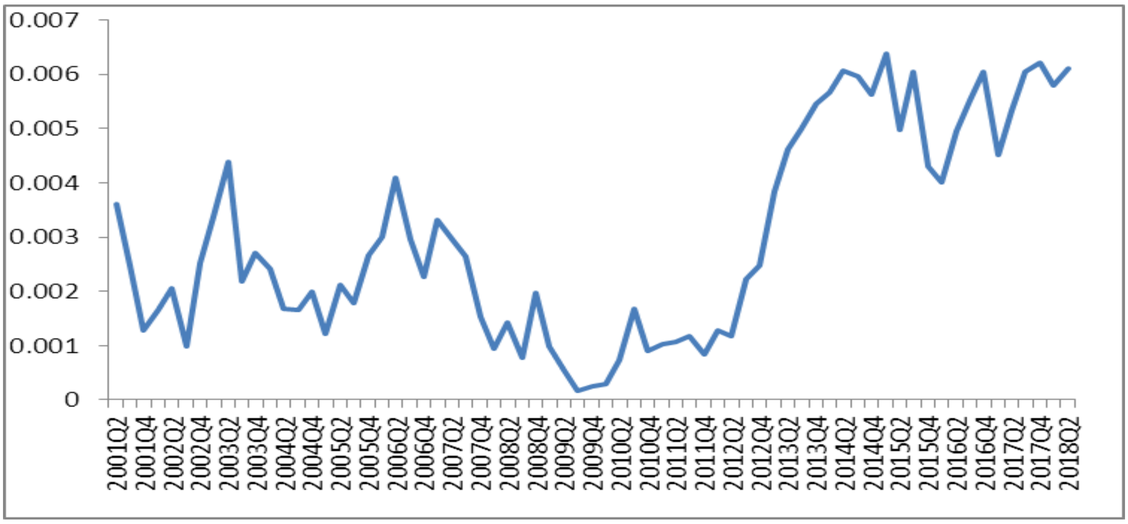

Figure 4. Nominal Exchange Rate Volatility

Figure 4 shows that the nominal exchange rate volatility increased significantly after the economic crises of 2001 and 2008.

5. INTEGRATION AND COINTEGRATION

Engle and Granger (1987) have proved that the analysis of the non-stationary time series in the periods before the 80s resulted in misleading regression. As a result of this finding, many of the previous qualitative studies have to be revised. The reason for misleading regression is that the non-stationary series contain a stochastic trend effect. When regression analysis is performed without considering the stochastic trend, it can be shown that the relationship that appears to exist between the two variables is actually based on a coincidental trend.

In this context, Carrion-i-Silvestre et al. (2009) unit root test is launched and the first differences of all variables are determined to be stationary. In the next stage, the cointegration relationship is determined by using Maki (2012) method which takes into account the multiple structural breaks. After the existence of cointegration relationship between the variables is determined, long-run banknote demand function is estimated by dynamic least squares method. In the next step, error correction model that captures the short-run dynamic adjustment of the cointegrated variables is estimated and the stability of real banknote demand is tested using the recursive error terms test, the one-step probability test, CUSUM and CUSUMSQ tests.

5.1.Carrion-i-Silvestre et al. (2009) Unit Root Test

The most advanced structural break unit root test is Carrion-i-silvestre et al. (2009), which examines the stability of the series by considering the structural breaks up to 5. Carrion-i-Silvestre et al. (2009) data generation process is as follows:

$$y_t = d_t + \varepsilon_t \qquad (6)$$

$$\varepsilon_t = \varepsilon_{t-1} + v_t \quad v_t \sim iid(0,\sigma_\varepsilon^2) \qquad t = 0,1,2,3\ldots\ldots,T$$

ε_t is a mean zero unobserved satationary process and $\varepsilon_0 = 0$.

Carrion-i-Silvestre et al. (2009) takes into account 3 different models. The model 0 is related to break in the mean, while the second shows the break in the slope. The last model is the equation that shows that a structural break changes both the mean and the slope.

Carrion-i-Silvestre et al. (2009) has developed five different test statistics. These are;

$$P_T\left(c,\bar{c},\lambda^0\right)=\left[S(\bar{\alpha},\lambda^0)-\bar{\alpha}S(1,\lambda^0)\right]/s^2(\lambda^0) \qquad (7)$$

$$MP_T\left(\lambda^0\right)=\left[c^{-2}T^{-2}\sum \tilde{y}_{t-1}^2+(1-\bar{c})T^{-1}\tilde{y}_T^2\right]/s(\lambda^0)^2 \qquad (8)$$

$$MZ_{\alpha}(\lambda^{0}) = T^{-1}\tilde{y}_{T}^{2} - s(\lambda^{0})^{2}\left[2T^{-2}\sum \tilde{y}_{t-1}^{2}\right]^{-1} \quad (9)$$

$$MSB(\lambda^{0}) = \left(s(\lambda^{0})^{-2}T^{-2}\sum \tilde{y}_{t-1}^{2}\right)^{1/2} \quad (10)$$

$$MZ_{t}(\lambda^{0}) = T^{-1}\tilde{y}_{T}^{2} - s(\lambda^{0})^{2}\left(4s(\lambda^{0})^{2}T^{-2}\sum \tilde{y}_{t-1}^{2}\right)^{1/2} \quad (11)$$

The null hypothesis of the test; “There is a unit root under structural breaks”.

The degree of integration of the variables used in the modeling of the demand for household banknote function is detected by Carrion-i-Silvestre et al. (2009) unit root test. Table 4.1 shows the results of Carrion-i-Silvestre et al. (2009) unit root test.

Table 3. Carrion-i-Silvestre et al. (2009) Unit Root Test Results

	Pr	MP_T	MZ_α	MSB	MZ_t	SB Date
			Level			
L(Md/P)	22.16	16.81	-15.18	0.14	-1.68	2006Q4 2008Q2
	[7.86]	[7.86]	[-34.55]	[0.10]	[-5.16]	2010Q1
L(Y)	21.11	17.39	-12.3	0.15	-3.12	2003Q2 2008Q2
	[7.87]	[7.87]	[-31.3]	[0.12]	[-4.48]	2014Q1
I_M	19.11	17.59	-15.13	0.18	-3.11	2003Q4 2005Q3
	[7.86]	[7.86]	[-33.12]	[0.13]	[-4.77]	2008Q4
L(EXR)	17.01	14.26	-15.17	0.16	-2.67	2006Q1 2007Q4
	[7.16]	[7.16]	[-32.28]	[0.13]	[-4.33]	2011Q4
EXRV	12.74	14.36	-21.20	0.14	-2.07	2003Q2 2006Q2
	[9.14]	[9.14]	[-33.25]	[0.10]	[-4.08]	2008Q4
			First Difference			
ΔL(Md/P)	7.15	5.95	-29.56	0.12	-3.82	
	[7.86]	[7.36]	[-23.13]	[0.15]	[-3.41]	
ΔL(Y)	5.94	6.37	-24.52	0.13	-3.55	
	[5.71]	[5.71]	[-21.36]	[0.15]	[-3.16]	
Δ I_M	6.43	5.95	-28.37	0.12	-3.84	
	[7.62]	[7.62]	[-22.73]	[0.14]	[-3.32]	
Δ L(EXR)	6.55	6.53	-25.34	0.12	-3.83	
	[7.12]	[7.12]	[-22.15]	[0.15]	[-3.25]	
Δ EXRV	5.25	5.22	-31.12	0.11	(3.77	
	[6.58]	[6.58]	[-22.59]	[0.14]	[-3.22]	

The values in parantheses in Table 3 refer to the stationarity at 5% significance level. Values in parentheses are critical values produced by using 1000 replicates using bootstrap. Structural breakpoint dates are determined by the test method and only the results in the test with level values are reported to indicate the breaks in the original level of the series.

P_T is the most appropriate point test statistic. Here; $S(\bar{\alpha},\lambda^{0})$ and $S(1,\lambda^{0})$ terms are sum of squared residuals from GLS regression. MP_T, MZ_α, MSB, MZ_T test statistics are the Ng and Perron tests developed by Perron and Ng (1996) and Ng and Perron (2001), which overcome the sample distortion occurring in errors when the root of the errors approached the unit circle.

According to Carrion-i-Silvestre et al. (2009) unit root test results, the level of real currency issued, real national income, three-month deposit interest rate, nominal exchange rate and nominal exchange rate volatility are not stationary at 5% significance level while the first order differences of these variables are stationary at 5% significance level.

It is concluded that the first-order differences of all variables are stationary and cointegration analysis can be performed.

5.2. Maki (2012) Cointegration Analysis

Engle-Granger (1987) and Johansen (1991) methods are the most commonly used methods in econometrics literature to reach long-run equilibrium parameters. However, if there are structural breaks in the series used in the analysis, cointegration tests carried out without considering this shortcoming tend to result in absence of cointegration between the series. Therefore, the effects of structural breaks should also be taken into account in cointegration tests. Major structural break cointegration analyses are Gregory and Hansen (1996), Carrion-i Silvestre and Sanso (2006), Westerlund and Edgerton (2006) and Maki (2012). While other test methods consider one structural break in the cointegration equation, Maki (2012) can test the existence of cointegration between the series under five structural breaks. In particular, when there are three or more structural breaks in the integration equation, this method is superior to the methods of Gregory and Hansen (1996) and Hatemi-j (2008) (Maki, 2012). Maki (2012) developed four different models.

Model 0: Break in constant term, without trend,

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + u_t \tag{12}$$

Model 1: Break in constant term and slope, without trend,

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \beta' x_i D_{i,t} + u_t \tag{13}$$

Model 2: Break in constant term and slope, with trend

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \beta' x_t + \sum_{i=1}^{k} \beta' x_i D_{i,t} + u_t \tag{14}$$

Model 3: Break in constant term, slope and trend,

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \beta' x_i D_{i,t} + u_t \tag{15}$$

$t = (1, 2, \ldots, T)$ y_t and $x_t = (x_{1t}, \ldots x_{mt})'$ observable $I(1)$ variables, $u_t \sim$ iid $(0, \sigma_u^2)$ error terms.

D_i, dummy variables, defined in Maki (2012) as follows:

$$D_t = \begin{cases} 1, & t > T_B \\ 0, & \text{others} \end{cases}$$

Here T_B indicates the structural break date. The null hypothesis for Maki (2012) is H_o: There is no cointegration under structural breaks. The critical values required to test this hypothesis are given in Maki (2012). Maki (2012) critical values are calculated with 10000 iterative Monte Carlo simulation allowing critical values of up to 5 breaks for T = 1000.

The test statistics in Table 4 are compared with the critical values in Maki (2012) study.

Table 4. Maki(2012) Multiple Structural Break Cointegration Test

		Critical Values			
	Test Statistics	**1%**	**5%**	**10%**	**SB Date**
Model 0	-6.56	-6.30	-5.83	-5.57	2008Q2 2014Q4 2018Q1
Model 1	-7.37	-6.55	-6.05	-5.80	2004Q1 2005Q2 2008Q2
Model 2	-7.68	-7.75	-7.24	-6.96	2006Q4 2008Q2 2018Q1
Model 3	-7.39	-7.40	-6.91	-6.64	2008Q2 2018Q1

According to the results in Table 4, the null hypothesis of no cointegration between the series is rejected at 5% significance level. In other words, there is a cointegration relationship between the series. The series move together in the short-run and the long-run analysis of these series with the level values will not include spurious regression. Thus, long-run cointegration coefficients between the series can be estimated. The structural breaks in Turkey are successfully determined. In particular, it is observed that the YTL transformation process in 2006 and the global economic crisis that started in 2008 affected household demand for currency. As a result; structural breakdates obtained from model 2 are included by dummy variables in the estimation of long-run cointegration coefficients.

5.3. Estimation of Long-Run Cointegration Coefficients

When there is a cointegration relationship between the series, the long-run cointegration coefficients can be estimated with dynamic least squares (DOLS) method. In this method, in order to overcome the deviations and endogeneity problems in the OLS estimator, the lags and leads of the differences are added to the model with the level values of the explanatory variables (Stock-Watson, 1993). A two variable DOLS model is presented in equation (16).

$$Y_t = \alpha_0 + \alpha_1 t + \alpha_2 X_t + \sum_{i=-q}^{q} \beta_i \Delta X_{t-i} + \varepsilon_t \qquad \varepsilon_t \sim \text{iid}(0,\sigma^2) \qquad (16)$$

Where, Y_t is dependent variable, X_t is explanatory variable. ε_t hasa zero mean constant variance white noise process. *q*; optimum lead and lag length which is determined by Schwatz Information Criteria (SIC). In the study, the long-run cointegration coefficients are estimated using the model given in (17) and the results are presented in Table 5.

$$Y_t = \alpha_0 + \alpha_1 t + \alpha_{2i} \sum_{i=1}^{3} D_i + X_{tj}\alpha_{3j} + \sum_{i=-q}^{q} \Delta X_{tj-i}\beta_{ij} + \varepsilon_t \qquad \varepsilon_t \sim \text{iid}(0,\sigma^2) \qquad (17)$$

In equation (17), Y_t = Log(M_d/P) is the dependent variable, *t* is time trend, D_i are the break dates obtained from Maki cointegration test, *X* explanatory variable matrix consisting of real national income, three-month deposit rate, nominal exchange rate and nominal exchange rate volatility. ε_t is a zero mean and constant variance normally distributed white noise process.

Table 5. Long-Run Cointegration Coefficients

Variable	Coefficient	*t*-statistics	*p*-value
Constant	4.0	3.7	0.00
L(Y)	0.6	6.0	0.00
I_M	-0.01	-4.9	0.00
L(EXR)	-0.2	-5.0	0.00
EXRV	-10.3	-3.0	0.00
Trend	0.0	15.3	0.00
D_1	0.1	4.0	0.00
D_2	0.1	7.3	0.00
D_3	-0.1	-5.3	0.00
	Standard Error of Regression	**SSR**	
DOLS	0.03	0.04	
FMOLS	0.04	0.08	
CCR	0.04	0.08	

The cointegration analysis in Table 5 shows that, 1% increase in the real GDP in the long-run increases the demand for banknotes by 0.6%, while the 1% increase in the nominal exchange rate volatility decreases the household demand for banknotes by 0.1%. Moreover, the 1% increase in the three-month deposit interest rate decreases the household banknote demand by 0.01%. The nominal exchange rate effect is in line with economic expectations. The 1% increase in the nominal exchange rate in the long-run reduces the demand for banknotes by 0.2%.

Additionally, the analysis reveals that when the regression standard error and sum of squared resiual values of the fully modified least squares (FMOLS) and canonical cointegrating regression (CCR) analyzes are compared, the DOLS model appears to be superior (Table 5).

Table 6. Comparative Long-Run Coefficient Estimates

	L(Y)	I_M	L(NDK)	NDKO	Constant	Trend	D_1	D_2	D_3
DOLS	0.60	-0.005	-0.18	-10.33	3.96	0.02	0.07	0.14	-0.08
FMOLS	0.58	-0.004	-0.21	-11.04	4.52	0.02	0.01	0.13	-0.09
CCR	0.55	-0.005	-0.21	-10.96	4.74	0.02	0.00	0.13	-0.09
ARDL	0.59	-0.004	-0.20	-10.02	4.27	0.02	0.06	0.15	-0.08
Johansen-VECM	0.64	-0.004	-0.20	-13.68	4.48				

The cointegration coefficients obtained from five different models are presented in Table 6. Results show that the long-run coefficient estimates are quite consistent in all models specified in the table.

The diagnostic tests of the long-run cointegration model are presented in Table 7 and Table 8.

Table 7. Diagnostic Tests

Breusch-Godfrey Autocorrelation Test			ARCH-LM Test	
Lag	**LM**	***p*-value**	**LM**	***p*-value**
1	1.10	0.39	1.85	0.22
2	1.17	0.55	2.27	0.37
3	2.55	0.71	2.85	0.51
4	2.37	0.85	3.33	0.67
The null: There is no autocorrelation			The null: There is no ARCH effect	

Breusch-Godfrey autocorrelation test results presented in Table 7 indicate that we fail to reject the null hypothesis that autocorrelation does not exist in error terms. ARCH test results that we fail to reject the null hypothesis that autoregressive conditional heteroskedasticity does not exist in error terms.

Table 8. Summary Statistics on Residuals and Normality

Sample Size	Mean	Median	Max	Min	Std.Dev.	Skewness	Kurtosis	Jarque-Bera	*p*-value
69	-0.00	-0.00	0.04	-0.04	0.03	-0.12	2.57	1.55	0.57

The null for JB: Residuals are normally distributed.

Lastly, summary statistics on residuals and normality presented in Table 8 shows that we fail to reject the null hypothesis that residuals are normally distributed.

Additionally, when homoscedasticity hypothesis tested by White test, the *F*-statistics comes out to be 0.84 [0.62], which results that residuals are homoscedastic.

6. ERROR CORRECTION MODEL

The error correction model examined by Engle and Granger (1987) concluded that cointegration is a necessary condition for the error correction model. Unlike cointegration, these models combined both long-run relationships and short-run imbalances.

Mathematical representation of the error correction model is presented in equations 5.1and 5.2:

$$\Delta X_t = \sum_{j=1}^{m} a_j \Delta X_{t-j} + \sum_{j=1}^{m} b_j \Delta Y_{t-j} + \alpha ECT_{1,t-1} + \varepsilon_t \qquad \varepsilon_t \sim \text{iid}(0,\sigma^2) \tag{18}$$

$$\Delta Y_t = \sum_{j=1}^{m} c_j \Delta X_{t-j} + \sum_{j=1}^{m} d_j \Delta Y_{t-j} + \beta ECT_{2,t-1} + \mu_t \qquad \mu_t \sim \text{iid}(0,\sigma^2) \tag{19}$$

According to Engle and Granger, there exists at least one long-run causality relationship if there is cointegration, which indicates the existence of at least one long-run equilibrium relationship between variables. In this case, error correction model based on X and Y dependent variables is established in order to reveal the deviation from long-run equilibrium, to overcome the short-run and long-run imbalances and to explain the short-run and long-run causality relationship.

In equations (18) and (19) $ECT_{1,t-1}$ and $ECT_{2,t-1}$ are error correction terms, α and β are the coefficients of error correction terms. $ECT_{1,t-1}$ $(X_{t-1} - \alpha_1 Y_{t-1})$ and $ECT_{2,t-1}$ $(Y_{t-1} - \beta_1 X_{t-1})$ are respectively the lag of the error terms obtained from the coigtegrating regressions in which *X* and *Y* are the dependent variables. α and β parameters represent the speed of adjustment to long-run equibilirium. For long and short-term causality relations, *t* and *F* tests are performed.

Based on the cointegration analysis test results, the nex tstep is to model the short-run dynamics for real banknotes in a single equation context using error correction model (ECM). The short-run model conceives the adjustment mechanism towards the equilibrium condition assuming that equilibrium is distorted by an exogenous shock. Thus error correction model in equation (20) that captures the short-run dynamic adjustment of the cointegrated variables is estimated.

$$\begin{aligned} \Delta \log(\frac{M_d}{P})_t = & \sum_{i=1}^{p-1} \alpha_{1i} \Delta \log(\frac{M_d}{P})_{t-i} + \sum_{i=0}^{p-1} \alpha_{2i} \Delta \log Y_{t-i} + \sum_{i=0}^{p-1} \alpha_{3i} \Delta I_{m(t-i)} \\ & + \sum_{i=0}^{p-1} \alpha_{4i} \Delta \log EXR_{(t-i)} + \sum_{i=0}^{p-1} \alpha_{5i} \Delta EXRV_{(t-i)} + \sum_{i=1}^{3} \alpha_{6i} D_i \qquad \varepsilon_t \sim \text{iid}(0,\sigma^2) \\ & + \alpha_{7i} ECT_{i-1} + \varepsilon_t \end{aligned} \tag{20}$$

The equation (20) is constructed as ARDL model. Optimum lag lenght of the model is determined by Schwartz Information Criteria (SIC). In addition, the break dates from the Maki cointegration analysis is included as dummy variables in the error correction model. The error correction model is estimated for the period 2001Q1:2018Q2.

Table 9 presents the parameters of the error correction model. The model has been constrained by taking into account the significance of parameter estimation. By the general to spesific method Hendry (1989), the re-parametrization and simplification procedures are performed to reach the simplest model.

Table 9. Error Correction Model

Variable	Coefficient	*t*-statistics	*p*-value
Constant	0.02	3.59	0.00
$\Delta L(M_d/P)_{-1}$	0.22	3.57	0.00
ΔL(Y)	0.18	3.17	0.00
ΔI_M	-0.003	-2.44	0.02
$\Delta L(EXR)_{-1}$	-0.13	-2.50	0.02
Δ EXRV	-6.55	-2.62	0.01
D_1	0.03	2.84	0.00
D_2	0.02	3.85	0.00
D_3	0.00	3.01	0.00
ECT_{-1}	-0.52	-3.27	0.00

According to the model, the error correction term is significant and less than zero: -0,52 [0,00]. The coefficient of error correction term is negative and statistically significant which confirms the existence of the cointegration relationship between the variables. The error correction coefficient indicates that 52% of the deviation in the long-run equilibrium, which resulted from an external shock, is eliminated in one period. Analysis of other parameter estimates shows that the effect of real national income and nominal exchange rate on the demand of real banknotes is decreasing in short- run.

The diagnostic tests of the error correction model are presented in Table 10 and Table 11.

Table 10. Diagnostic Tests

Breusch-Godfrey Autocorrelation Test			ARCH-LM Test	
Lag	**LM**	***p*-value**	**LM**	***p*-value**
1	0.02	0.85	3.20	0.12
2	1.62	0.60	3.39	0.24
3	2.15	0.55	3.80	0.36
4	3.43	0.34	3.96	0.54
The null: There is no autocorrelation			The null: There is no ARCH effect	

Breusch-Godfrey test results and ARCH test results indicate that we fail to reject the null hypothesis that autocorrelation and ARCH effect do not exist in error terms.

Table 11. Summary Statistics on Residuals and Normality

Sample Size	Mean	Median	Max	Min	Std.Dev.	Skewness	Kurtosis	Jarque-Bera	*p*-value
67	0.00	0.00	0.10	-0.07	0.03	0.18	3.31	0.03	0.99
The null for JB: Residuals are normally distributed.									

According to results from Table 11 we fail to reject the null hypothesis that residuals are normally distributed.

When homoscedasticity hypothesis is tested by White heteroscedasticity test, *F*-statistics comes out to be 1.23[0.38], which results that residuals are homoscedastic.

7. PARAMETER CONSTANCY TESTS OF LONG-RUN AND ERROR CORRECTION MODELS

Since a parametric econometric model is completely descriced by its parameters, model stability, which is necessary for prediction and econometric inference, is equivalent to parameter stability. Because of the well-recognized need for stable models, a large literature emerged developing tests of model stability. Stability tests developed by Chow (1960), Brown et al. (1975) and Hansen (1992) and Hansen-Johansen (1993) are among tests that can be used to test the stability of econometric models. One of the most common tests in econometrics is Chow's test which is designed to test the null hypothesis of constant parameters against an alternative of a one-time structural break in the parameters at some known time. Therefore, to apply the Chow stability test, structural break time in the prediction period should be known accurately. Stability test proposed by Hansen (1992) and Hansen-Johansen (1993), on the other hand, do not require a priori knowledge of the timing of the structural breaks. According to these tests, all variables used in the model must be of first order of stationary. In this study, the long-run and error-correction model parameters are tested by using "Recursive Residual Terms", "One-Step Probability","CUSUM" and "CUSUMSQ" tests.

According to the recursive residual terms test, outside the standard error band the recursive residual terms indicate that the parameters of the model are not stable. The recursive residual terms test results for the long run model are shown in Figure 5. Accordingly, in the long run model, the recursive residual terms do not go beyond the standard error band.

The "One-Step Probability" test gives the probability values of the sampling points where the hypothesis that the parameters of the model are constant can be rejected at 5%, 10% and 15% levels. From Figure 6.1, there is no evidence indicating that there may be instability in long-run model parameters. When CUSUM and CUSUMSQ test statistics are within the critical value band representing a 5% significance level, it can be concluded that the coefficients of the variables used in the model are stable. Graphical method is generally used for these stability tests. The results of CUSUM and CUSUMSQ stability test for long-run and error correction models are shown in Figure 5 and Figure 6 respectively.

As can be seen from Figure 5 and Figure 6, CUSUM and CUSUMSQ values are at critical values at 5% significance level.

After running parameter constancy tests of long run and error correction models, it can be concluded that household banknote demand model parameters are quite stable in Turkey.

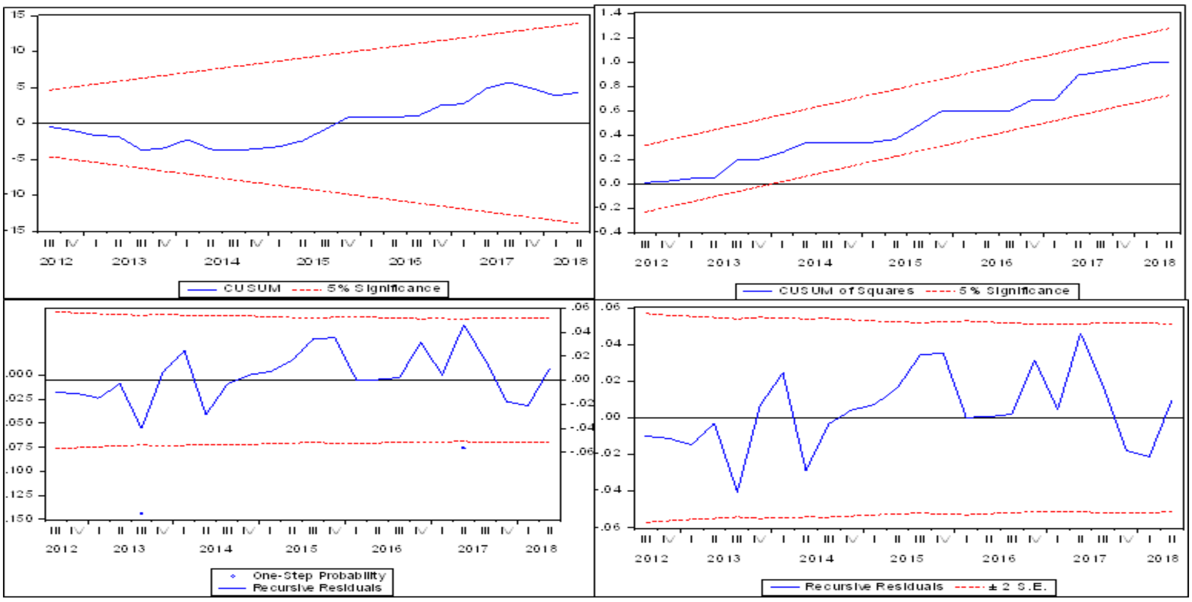

Figure 5. Long-Run Model Recursive Residual Estimates

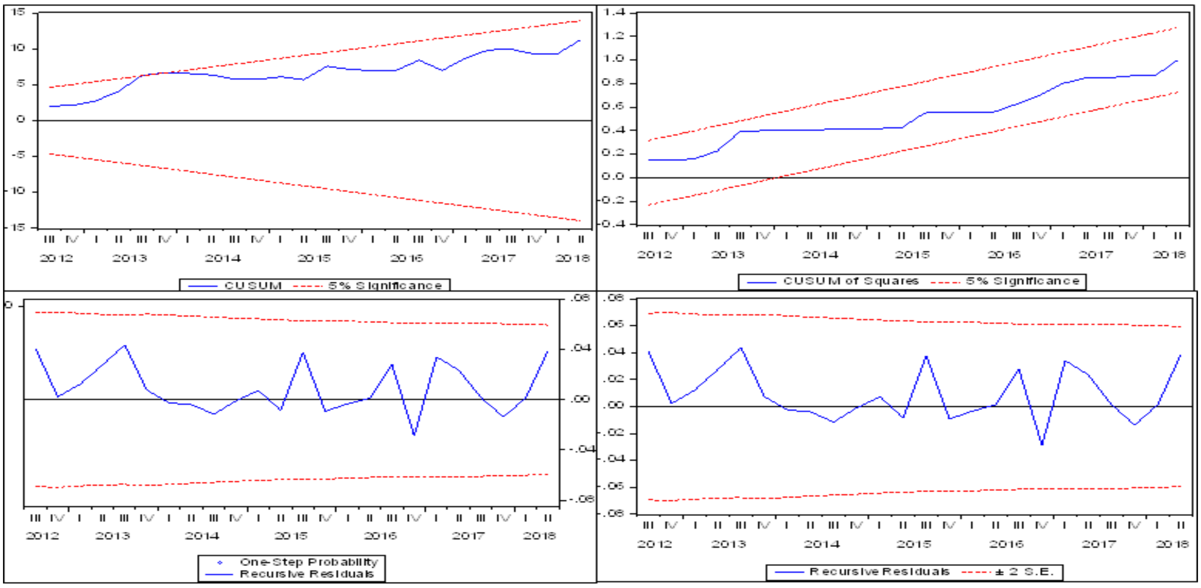

Figure 6. Error Correction Model Recursive Residual Estimates

8. CONCLUSION

In this paper, determinants of household banknote demand in Turkey for the period 2001Q1:2018Q2 is analyzed with the Carrion - Silvestre et al. (2009) multiple structural break unit root test and Maki (2012) multiple structural break cointegration method.

Carrion-i-Silvestre et al. (2009) unit root test results indicate that the level values of real banknote demand, real national income, three-month deposit interest rate, nominal exchange rate and nominal exchange rate volatility are not stationary at 5% significance level. On the other hand, evidence shows that the first differences of all variables mentioned are stationary at 5% significance level. Additionally, Maki (2012) multiple structural break cointegration analysis suggests that there is a cointegration relationship between the series. The series move together in the short-run and the long-run analysis of these series with the level values do not include spurious regression. The model developed in this paper is able to successfully determine the structural breaks in Turkey during the period 2001:Q1:2018Q2. To be more specific, the model specifies two breaking points as structural breaks that affected household demend for money; first one as the YTL transformation process in 2006 and second one as the global economic crisis that started in 2008. These structural break dates are included in the analysis with dummy variables in the estimation of long-run cointegration coefficients.

According to the results, there is strong evidence that real banknote demand shows a relatively stable structure in Turkey. The long-run real banknote demand model reveals that real income elasticity of demand for real banknotes is 0.6 in the long-run, indicating a positive correlation between real banknote demand and real income, as expected. On the other hand in the long-run, a 1% increase in the nominal exchange rate volatility decreases the household banknote demand by 0.1%. In addition, a 1% increase in the three-month deposit interest rate decreases the household banknote demand by 0.01%. In line with economic expectations, in the long-run a 1% increase in the nominal exchange rate decreases the household banknote demand by 0.2%.

Furthermore, the model indicates an error correction term of -0.52 [0.00], which is statistically significant. The negative sign and statistical significance of the error correction term confirms the existence of the cointegration relationship between the variables. The value of the coefficient indicates that 52% of the deviation in the long-run equilibrium, which is a consequence of an external shock, is eliminated in one period. When other parameter estimates are analyzed, the model concludes that both the effect of real national income and nominal exchange rate on the demand of real banknotes are decreasing in short-run.

REFERENCES

Ahumada, H. (1992). “A Dynamic Model of the Demand for Currency: Argentina 1977-1988”, Journal of Policy Modeling, (14)3, 335-361.

Akıncı, Ö. (2003). “Modeling Demand for Currency Issued in Turkey”, Central Bank Review, (3)1, 1-25.

Akyüz Y. (1973). “Money and Inflation in Turkey 1950-1968”, Ankara University Faculty of Political Science Publication, 361.

Algan, N. & Gencer, S. (2011). “Türkiye’de Para Talebi Fonksiyonunun Modellenmesi” Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, (20)1, 195-212.

Aren, S. (1989). 100 Soruda Para ve Para Politikası, Gerçek Yayınevi, İstanbul.

Angiingkusumo, R. (2005). “Stability of the Demand for Real Narrow Money in Indonesia”, Tinbergen Institute Discussion Paper, 51, 4.

Arize, A. (1994). “A Re-Examination of the Demand for Money in Small Developing Economies”, Applied Economics, (26)3, 217-228.

Baba, Y.; Hendry, D. & Starr R. (1992). “The Demand for M1 in the U.S.A., 1960-1988”, The Review of Economic Studies, (59)1, 25-61.

Bardsen, G. (1992). “Dynamic Modeling of the Demand for Narrow Money in Norway”, Journal of Policy Modelling, 14, 363-393.

Boeschoten, W. & Fase, M. (1992). “The Demand for Large Banknotes” Journal of Money, Credit, and Banking, (24), 319-337.

Boughton, J. M. (1992). “International Comparisons of Money Demand”, Open Economies Review, (3)3, 323-343.

Boughton, J. M. (1993). “The Demand for M1 in the United States: A Comment on Baba, Hendry and Starr”, The Economic Journal, (103), 1154-1157.

Brown, R. L.; Durbin, J. & Evans, J. M. (1975). “Techniques for Testing the Constancy of the Regression Relations Over Time”, Journal of the Royal Statistical Society, (37), 149-163.

Bredin, D. (2001). “Money Demand in the Czech Republic Since Transition”, Irland Central Bank Working Paper, No:3.

Browne, F. (1981). “Forecasting the Demand for Currency and its Denominational Mix”, Technical Report 1981, Dublin, Central Bank of Ireland.

Cagan, P. (1956). “The Monetary Dynamics in Hyperinflation. Studies in the Quantity Theory of Money”, The University of Chicago Press.

Carrion-i-Silvestre, J. L. & Sanso, A. (2006) “Testing the Null of Cointegration with Structural Breaks”, Oxford Bulletin of Economics and Statistics, 68(5): 623-646.

Carrion-i-Silvestre, J. L.; Kim, D & Perron, P. (2009) “GLS-Based Unit Root Tests with Multiple Structural Breaks Under Both the Null and the Alternative Hypotheses”, Econometric Theory, (25), 1754-1792.

Choudhry, T. (1995a). “High Inflation Rates and the Long-Run Money Demand Function: Evidence from Cointegration Tests”, Journal of Macroeconomics, (17)1, 77-91.

Choudhry, T. (1995b). “Long-Run Money Demand Function in Argentina During 1935-1962: Evidence From Cointegration and Error Correction Models”, Applied Economics, (27), 661-667.

Chow, G. (1960). “Test of Equality Between Sets of Coefficients in Two Linear Regressions”, Econometrica, (28)3, 591-605.

Davies, G. (1996). A History of Money, University of Wales, England.

Dekle. R., Pradhan, M. (1997). “Financial Liberilization and Money Demand in Asian Countries: Implications for Monetary Policy”, IMF working paper, no:36.

Drake. L., Chrystal, K.A. (1994). “Company-Sector Money Demand: New Evidence on the Existence of a Stable Long-Run Relationship tor the United Kingdom”, Journal of Money, Credit and Banking, (26).

Engel, R. F. (1982). “Autoregressive Conditional Heteroscedasticity with the Estimates of the Variance of United Kingdom Inflation”, Econometrica, (50)4, 987-1007.

Engle, R.F. & Granger, W.J. (1987). “Co-integration and Error Correction: Representation, Estimation and Testing”, Econometrica, 55, 251-276.

Ericsson, N.R.; Hendry, D.F. & Tran, H.A. (1994). “Cointegration Seasonality Encompassing, and the Demand for Money in the UK”, Oxford: Oxford University Press.

Ericsson, N. (1998). “Empirical Modeling of Money Demand”, Empirical Economics, (23)3, 295-315.

Fase, M. & Nieuwkerk. M. (1976). “The Banknote Circulation in the Netherlands Since 1900”, Central Bank of Netherlands Quarterly Statistics, 28-32.

Fase, M. (1981). “Forewsting the Demand for Banknotes: Some Empirical Results for the Netherlands”, European Joumal of Operations Research. (6)3, 269-278.

Frankel, J. (1977). “The Forward Exchange Rate Expectations, and the Demand for Money-The German Hyperinflation: Reply” American Economic Review, (70)4. 653-670.

Friedman, M. (1956). “The Quantity Theory of Money-A Restatement”, Studies in the Quantity Theory of Money, Chicago, University of Chicago Press.

Friedman, M. (1968). “The Role of Monetary Policy”, American Economic Review, (58)1, 1-17.

Friedman, B. M. (1999). “The Future of Monetary Policy: The Central Bank as an Army with Only a Signal Corps”, International Finance, (2)3, 321-38.

Gabriel, V. R.; Lopes, A. C. B. S., & Nunes, L. C. (2003). “Instability in Cointegration Regressions: A Brief Review with an Application to Money Demand in Portugal”, Applied Economics, (35), 893-900.

Grant, K.; Bridgen, A., & Vlieghe, G. W. (2004). “Assessing the Stability of Narrow Money Demand in the United Kingdom”, Spring, Bank of England Quarterly Bulletin.

Hansen, B. E. (1992). “Tests for Parameter Instability in Regressions with I(1) Processes”, Journal of Business and Economic Statistics. (10)3, 321-335.

Halıcıoğlu, F. & Ugur, M. (2005). “On Stability of the Demand for Money in Developing OECD Country: The Case of Turkey”, Global Business and Economic Review, (7)3, 203-213.

Haug, A. & Lucas, R. (1996). “Long Term Money Demand In Canada: in Search of Stability”, The Review of Economics and Statistics, (7)2, 345-348.

Hansen, H. & Johansen, S. (1993). “Recursive Estimation in Cointegrated VAR Models”, Institute of

Mathematical Statistics, University of Copenhagen, (2), 306-333.

Johansen, S. & Juselius. K. (1990). "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demad for Money", Oxford Bulletin of Economics and Statistics, (52)2, 169-210.

Johansen. S. (1991). "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", Econometrica, (59)6, 1551-1580.

Keynes, J. M. (1936). The General Theory of Employment, Interest and Money, U.K., Palgrave Macmillan.

Klein. B. (1974). "Competitive Interest Payments on Bank Deposits and the Long-Run Demand for Money", American Economic Review, (64)6, 931-949.

Koğar, Ç, (1995). "Cointegration Test for Money Demand: The Case for Turkey and Israel", The Central Bank of the Republic of Turkey, Discussion Paper, No: 9514.

Laidler. D. (1993). The Demand For Money: Theories Evidence and Problems, Harper Collins College Publishers, London.

Lim, G. (1993). "The Demand for the Components of Broad Money: Error-Correction and Generalized Asset Adjustment Systems", Applied Economics, (25)8, 995-1004.

Maki, D. (2012) "Tests for Cointegration Allowing for an Unknown Number of Breaks", Economic Modelling, 29(5): 2011-2015.

Mankiw, N. & Summers, L. (1986). "Money Demand and The Effects of Fiscal Policies", Journal of Money, Credit and Banking, (28)4, 415-429.

Mehra, Y.P. (1993). "The Stability of the M2 Demand Function: Evidence From an Error Correction Model", Journal of Money, Credit and Banking, (25)3, 454-460.

Metin, K. (1994). "Modelling the Demand for Narrow Money in Turkey", METU Studies in Development, 21(2), 231 -256.

Miyao, R. (1996). "Does A Cointegrating M2 Demand Relation Really Exist in the United States", Journal of Money, Credit and Banking, (28)3, 365-380.

Perez, A. S. (2014). "Cointegration Analysis of the Money Demand in the Euro Area", Working Papers, Universidad Del Pais Vasco.

Sarno, L (1999). "Adjustment Costs and Nonlinear Dynamic Adjustments in the Demand for Money: Italy, 1861-1991", Intemational Journal of Finance and Economics, (4), 155-177.

Tobin. J. (1956). "The Interest Elasticity of Transaction Demand for Cash" The Review of Economics and Statistics, (36)3, 241-247.

Wong, C. (1977). "Demand for Money in Developing Countries: Some Theoretical and Empirical Results", Journal of Monetary Economics, (3)1, 59-86.