2008 CRISIS AND EFFECTS OF MONETARY EXPANSIONS ON EXCHANGE RATE DETERMINATION: THE CASE OF TURKEY

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ABSTRACT

With the recent economic crisis of 2008, global liquidity level increased tremendously which in return, gave rise to the concerns regarding the "Currency Wars" due to consecutive monetary expansions conducted by both advanced and emerging countries. This paper, on the one hand presents the related literature and regarding theories; on the other hand, investigates the dynamics of exchange rate determination through a monetary perspective and sets forth a combined framework of Keynesian Liquidity Preference approach and PPP model that explains the exchange rate determination in a statistically significant way. Finally, macroeconomic data of Turkey such as inflation rate, percentage change in monetary base M2 and GDP growth that acknowledge the results of regression and VAR analyses, are presented.

Key words: Keynesian Liquidity Preference, Purchasing Power Parity, Exchange Rates

2008 KRİZİ VE PARASAL GENİŞLEMELERİN DÖVİZ KURU ÜZERİNDEKİ ETKİSİ: TÜRKİYE ÖRNEĞİ

ÖZET

2008 ekonomik krizi ile birlikte küresel likidite seviyesi ciddi oranda artmış, gelişmiş ve gelişmekte olan ülkelerin uyguladığı parasal genişlemeler sonucunda ise "Kur Savaşları" ile ilgili kaygılar tekrar gündeme gelmiştir. Bu çalışma, bir taraftan ilgili literetür ve teorik altyapıyı ortaya koymaktayken; diğer taraftan döviz kuru oluşumunu istatistiksel olarak anlamlı bir şekilde açıklayan, Keynesyen Likidite Tercihi ve Satınalma Gücü Paritesini biraraya getiren bir model ortaya koymaktadır. Son olarak, bu modele ait VAR ve Regresyon test sonuçlarını destekleyen Türkiye'ye ait enflasyon, ekonomik büyüme ve parasal taban M2 gibi veriler gösterilmiştir.

Anahtar Kelimeler: Keynesyen Likidite Tercihi, Satınalma Gücü Paritesi, Döviz Kurları

INTRODUCTION

There is no doubt that effect of monetary expansion on interest rates and foreign exchange rates has been in the midst of the economic discussion for many years. Several economic models have been formed and abundant number of articles have been written on this topic. With the recent global financial crisis of 2008, central banks of several developed countries including Federal Reserve (FED) and European Central Bank (ECB) conducted expansionary monetary policies to minimize the negative effects of this crisis on domestic economies. FED, for example, implemented an expansionary monetary policy between the years of 2008 and 2014. However, this expansionary monetary policy induced certain distortions on foreign exchange rate markets due to the reserve currency role of US Dollar. Therefore, other developed and developing countries executed consecutive monetary expansions to neutralize these negative effects and to boost the economic activity which in return increased the concerns about the "Global Currency Wars".

In case of the emerging markets, countries such as Turkey have attracted certain amount of capital inflows with the help of the quantitative easing (QE) of advanced economies and increased risk appetite. Thus, increase in monetary base of developing countries stems from two sources; quantitative easing of the advanced economies and domestic monetary expansion.

Besides the "Quantitative Easing" of the advanced economies and capital inflows, emerging markets also have increased monetary base in terms of domestic currency. Thus, the amount of the liquidity in globally integrated financial markets has increased significantly and the economic models concerning the effect of money supply on interest rates and foreign exchange rates have been popular once again.

There are various economic models in economic literature that try to explain the relationship among the economic variables of money supply, foreign exchange rates and interest rates. Although each model has different assumptions depending on the economic conditions of the era; Keynesian approach of "Liquidity Preference", "Purchasing Power Parity", "Law of One Price" and "Uncovered Interest Rate Parity Condition" are the eminent economic models which investigate the determinants of the interest rates and foreign exchange rates.

Two basic models are used for the foreign exchange rate determination. On the one hand, Law of One Price (LoP) model which focuses on the price ratios of a particular good in different countries, on the other hand, *Absolute* Purchasing Power Parity (PPP) that takes price index ratios of the consumption baskets into account. Nonetheless, both models have a significant

drawback that they do not take the price of non-tradable goods into consideration whilst calculating foreign exchange rates (S) as formulated below (Copeland, 2005). Moreover, there are certain criticisms about PPP model such as Balassa-Samuelson and Iceberg approaches. While Balassa-Samuelson approach opposes PPP because of the non-tradable goods, Iceberg model refutes PPP due to the transportation costs. According to the LoP model which excludes the transaction costs, P_D accounts for the price of a standard tradable good in domestic market while P_F is the price of the identical good in the foreign market (Copeland, 2005). The same formula is used for *Absolute* PPP approach but this time these variables are used for price indices.

$$S = P_D / P_F$$

Relative PPP, however, expresses the same relation in terms of the changes in price levels, in other words inflation rates (π^t) as can be seen in the formula below (Copeland, 2005).

$$\% \Delta S_t = \pi_D{}^t - \pi_F{}^t$$

As far as the interest rate determination is concerned, however, Keynesian approach of "Liquidity Preference" is one of the pioneering models in the economic literature. According to Keynes, money demand is affected from three motives; transactions motive, precautionary motive and last but not least speculative motive (Keynes, 1936). Except for the speculative motive, other motives are dependent on the income level (Y) which is in positive correlation with money demand. Yet, money demand due to the speculative motive is sensitive to the changes in interest rate level. An increase in interest rates (r) causes money demand at all income levels to decrease or vice versa. Combining all three motives, Keynes came up with a liquidity preference function that is shown below (Mishkin, 2006).

$$M^d / P = L(r, Y)$$

However, Milton Friedman did cast doubts on the negative correlation between interest rates and money demand. Aside from Keynes, Friedman pointed out the fact that an increase in money supply[1], if it is an expected monetary expansion, does not always lead to a decrease in interest rates (Friedman, 1982). Thus, increasing money supply is a double-edged sword. On the one hand, it could stimulate a decline in interest rates regarding the increase in credit channel which gives rise to the amount of available credit. On the other hand, an expected increase in

[1] In steady state, money market equilibrium requires money demand and money supply to be equal.

money supply could escalate the overall price level, therefore, the nominal interest rate in the economy due to the rise in overall income level. In other words, if it is an expected expansion then the effect of a change in monetary base will lead overall price levels to rise.

Last but not least, Uncovered Interest Rate Parity (UIRP) unlike LoP and PPP models, investigates the dynamics of exchange rate (S_t) determination[2] relatively for shorter periods through capital flows and interest rate differentials (r^D-r^F) of the financial instruments (Mishkin, 2006). The driving force of this model depends mainly on the fact that the trade volume of the financial instrument transactions is far more than import-export volume of the tradable goods. Hence, the volume of the asset market transactions is the dominant factor in short-run determination of the exchange rates.

$$r^F = r^D - (S_{t+1}^e - S_t) / S_t$$

This paper aims to analyze the effects of a change in money supply of Turkey on interest rates and foreign exchange rates via PPP and Keynesian approach of Liquidity Preference. To sterilize the distortions in foreign exchange rates caused by the quantitative easing of FED that took place between 2008 and 2014, the monetary base of Turkey and Eurozone are denominated in US Dollars (USD). Thus, change in money supply of both economies would be comparable in USD terms and the real effects of monetary expansions on interest rates and exchange rates can easily be investigated.

The remainder of the paper is organized as follows: Section II covers literature review regarding the economic models which investigates the exchange rate and interest rate determination through PPP and Liquidity Preference Framework. Section III presents the related data used in Section IV where a combined and statistically significant framework of related economic theories is presented and tested via regression and VAR analyses. Finally, leading macroeconomic indicators of Turkey that strengthen and support the results in Section IV are displayed in Section V.

[2] In the UIRP model, S_{t+1}^e accounts for the expected exchange rate in the future while S_t is the spot exchange rate.

1. Literature Review

Many studies have been conducted on monetary policy and its effects on real economy that can be viewed through the interest rates and price level (King & Watson, 1995; Levin, 1997). Needless to say, monetary expansion has significant effects on the output level of an economy, therefore, the economic activity and also overall price level depending on the economic model and its assumptions. Although, different meanings have been assigned to quantity theory of money (QTM), it is one of the widely accepted models that sets forth the relationship between money and prices (McCallum & Nelson, 2010; Dornbusch, 1985; Thornton, 2012; Friedman, 1968).

As McCallum and Nelson (2010) mentioned, an exogenous monetary expansion would lead to changes in prices due to the long-run "neutrality of money" assumption. This phenomenon brings to mind the PPP model. Although temporary deviations occur in PPP model due to monetary disturbances; aggregate changes in money supply, prices and exchange rates are closely related (Dornbusch, 1985; McCallum & Nelson, 2010). Many papers have been conducted on PPP model throughout the years such as Balassa (1964), Dornbusch (1980), Frenkel (1981), Edison & Melick (1992), Froot & Rogoff (1994), Frankel & Rose (1995), Rogoff (1996), Pakko & Pollard (2003), Taylor & Taylor (2004) and Lopez (2008).

Some studies such as Froot & Rogoff (1994), Alba & Park (2004), Taylor & Taylor (2004) and Lopez (2008) confirm the long run convergence of exchange rates to PPP while others, for example, Balassa (1964); Frenkel (1981); Dornbusch (1980, 1985); Baum, Barkoulas and Caglayan (1998) could not verify the validity of PPP model.

Edison and Melick (1992), for instance, used quarterly data of G-10 countries for the period of 1974-1990 to investigate the relationship among interest rates, exchange rates and prices through the Johansen cointegration analysis by using PPP and UIRP models. Although PPP model could not be confirmed by the data except for the German-US bilateral exchange rate, Edison and Melick (1992) found one cointegrating vector among the variables of interest rates, exchange rates and prices.

Another study investigated whether PPP model holds for real exchange rate of German Mark (DM) and Turkish Lira (TRY) or not, by using the monthly data for the period of 1973-2004 (Alba and Park, 2004). According to the same study in which threshold autoregression (TAR)

methodology developed by Caner and Hansen (2001) was applied, PPP did hold for DM and TRY exchange rate as the exchange rate followed a stationary process in this threshold regime.

In addition, Coakley, Flood, Fuertes and Taylor (2004) also studied the correlation between relative PPP and inflation rate differentials of 19 advanced and 26 developing countries, including Turkey. Coakley and others (2004), used yearly inflation rates in panel data analysis that covers a period from 1970 to 1998. According to Coakley et.al. (2004), inflation rate differentials and long run nominal exchange rates had a significant correlation, in other words, *relative* PPP did hold.

Likewise, Taylor and Taylor (2004) found the similar results in the study that used the same statistical data with Coakley et.al. (2004) and pointed out the fact that real exchange rate follows a remarkable mean reverting path; even though the short run PPP does not hold (Taylor &Taylor, 2004).

As mentioned earlier, exchange rate determination takes time to converge to the fundamental level of which PPP model asserts (Froot and Rogoff, 1994). However, a panel data analysis that covers the period 1972-2008 and investigates 26 OECD countries, including Turkey, presented that a shock to PPP does not last as long as it was claimed by the earlier studies (Holmes, Otero and Panagiotidis, 2011). Even though Baum, Barkoulas and Caglayan (1998) claimed the fact that half-life of PPP deviations takes from three to five years, the results regarding the lifespan of PPP deviations in the study of Holmes and others (2011) is significant especially due to the signal it possesses.

In a world of growing financial integration, it is more probable than before that PPP holds even in the short run according to the studies dealing with more recent data. Taylor and Taylor (2004), for example, claimed that half-life of a disturbance to PPP should take from one to three years if the magnitude of the shock is moderate.

However, a more recent article that investigated validity of *relative* PPP in selected Balkan countries and Turkey with respect to Germany through different methodologies contradicts the general belief regarding the lifespan of PPP (Findreng, 2014). Findreng (2014) applied the Dickey-Fuller test without a time trend on monthly real exchange rates from January 1999 to May 2013 and found no evidence of *relative* PPP for any country pairs. However, half-life of Dickey-Fuller without a trend of Turkey is 9.3 months while test result of Dickey-Fuller with a time trend was 3.8 months which is significantly shorter than past studies (Findreng, 2014).

Last but not least, Findreng (2014) used Engle-Granger cointegration test that verifies the *relative* PPP which has a lifespan of 6.2 months.

In case of the monetary disturbances, however, certain deviations from PPP condition can be viewed. Change in money supply in the absence of "Long-run neutrality of money", regarding the QTM model ($MV=PY$), will lead to a rise in economic activity and output level (Y) at least for a short period of time due to the sticky prices (Friedman, 1968). Despite the fact that QTM reveals the possible results of a monetary policy on price level and real economy, one can question how relevant it is to explain the dynamics of interest rate determination. Yet, QTM is a theory of money demand more than being a theory of output and price level (Friedman, 1956; Friedman & Schwartz, 1982). Likewise, liquidity preference theory of Keynes which claims the negative correlation between the interest rates and money demand is a different interpretation of QTM.

As far as Keynesian liquidity approach is concerned, following the money supply increase and holding everything else constant, interest rates will decline (Mishkin, 2006). Yet, Keynesian money demand function and liquidity preference approach have been discussed vastly by many economists such as Modigliani (1944), Friedman (1957), Baumol (1952), Modigliani and Brumberg (1954), Tobin (1956; 1958), Friedman (1956; 1968), Modigliani and Ando (1963), Whalen (1966), Friedman & Schwartz (1982), Sriram (1999), Bibow (1998, 2005), Tily (2007) and Bertocco & Kalajzic (2014). However, Keynes and his liquidity preference approach have contributed immensely to the economic literature and have been in the midst of economic discussions for several decades.

Friedman came up with several criticisms to Keynesian Liquidity Preference Framework and money demand function. First of all, Friedman did cast doubts on Keynesian money demand motives and claimed that economic actors, as ultimate wealth owners, do aim to maximize their utility function which consists of different forms of wealth (Friedman, 1956). Aside from bond return (r_b) as the only financial asset that yields return according to Keynes, Friedman included equity return (r_e), physical goods that cannot provide cash flows except for the cash flows based on the changes in prices ($1/P*dP/dt$), human capital (w), tastes and preferences (u), prices (P) and permanent income[3] (Y) which is the sum of the all cash flows generated by the different forms of wealth (Friedman, 1956).

[3] See Friedman (1957) for further information.

$$M = f\left(P;\ r_b;\ r_e;\ 1/P*dP/dt;\ w;\ Y;\ u\right)$$

Friedman acquired the money demand equilibrium shown below by rewriting the above formula.

$$M/P = f\left(r_b;\ r_e;\ 1/P*dP/dt;\ w;\ Y/P;\ u\right)$$

In a similar vein, Tobin (1958) opposed the Keynesian money demand that rests on speculative motive and made criticisms about the negative correlation between money demand and the interest rates. He refuted Keynesian liquidity preference approach by indicating that, depending on the risk attitudes, economic actors would have a well-diversified portfolio of cash and financial assets at the same time (Tobin, 1958). Therefore, market participants would hold some part of their wealth in money due to the risk associated with expected return of the financial assets. In other words, economic actors would still have money demand regardless of the interest rate level, even though expected return of financial securities is positive.

In accordance with Tobin, Baumol (1952) stood against the Keynesian money demand that stems from the transactions motive. Although Keynes (1936) mentioned that money demand due to the transactions motive is affiliated with income, he drew attention to the fact that individuals adjust even the amount of money they hold for transactions with regard to change in the interest rates. He formulated the money demand function of transactions which is called "Square Root Rule" where (*C*), (*T*), (*b*) and (*r*) denote for; amount of cash holdings for transactions at the beginning of the period, amount of money required for transactions, transaction cost and fixed interest rate, respectively (Baumol, 1952).

$$M^d = C/2 = \sqrt{bT/2r}$$

According to the formula[4], amount of money demanded because of the transactions motive is, indeed, influenced from level of interest rates.

Last but not least, Whalen (1966) refuted the Keynesian approach of precautionary money demand which is affiliated with the income. With the help of Tchebycheff's inequality function, he proved the optimum amount of money that firms should hold for precautionary reasons. According to this formula below, (*M*) is the amount of the precautionary money demand, (*r*) is

[4] We will not examine how the formula was derived in details. To have a better understanding of it see Baumol (1952).

the rate of opportunity cost that firms are exposed to, (c) is the expected cost of illiquidity and (σ) is the standard deviation of net expenses[5] (Whalen, 1966).

$$M = \sqrt[3]{2\sigma^2 c/r}$$

As can be seen from the formula above, money demand due to precautionary motive is dependent on interest rates contrary to the Keynesian view because of the opportunity cost of money held for precautionary reasons (Whalen, 1966).

2. Data

The economic variables analyzed in the paper are; money supply (M2) of Turkey and Eurozone both in terms of U.S. Dollars, exchange rates, credit default swap (CDS) of Turkey and finally interest rate of Turkey. All variables are expressed as percentage changes and the data are obtained from Bloomberg, Federal Reserve Economic Data (FRED), The World Bank-IBRD; websites of Central Bank of Turkey (CBRT), Central Bank of Hungary, Central Bank of Russia and Central Bank of Poland. Monthly basis time series are seasonally unadjusted and cover the period 2009:01-2014:09. The underlying reason of choosing that specific interval is due to the fact that FED launched three consecutive Quantitative Easing programs in that period.

As for the exchange rates; *EURTRY* is the Turkish Lira value of the EURO while *BASKET* is used for the currency basket which is arithmetic average of EURO/TRY and USD/TRY exchange rates. To show the percentage changes in the *EURTRY* exchange rate data, *DEURTRY* is used. In similar vein, *DBASKET* denotes for the percentage changes in *BASKET* exchange rate.

Monetary aggregates *M2* in local currencies of Turkey, USA and Eurozone are respectively denoted by *TRM2*, *FEDM2* and *EURM2*, whereas *TRM2USD* and *EURM2USD* stand for money balances of Turkey and Eurozone expressed in terms of USD. Moreover, real money balances of Turkey (M/P), nominal money balances adjusted by consumer price index (CPI), is shown as *REALTRM2* whilst *DREALTRM2* indicates the percentage changes in real money balances of Turkey.

In the same vein, percentage changes in *TRM2*, *EURM2*, *FEDM2*, *TRM2USD*, and *EURM2USD* money balances are expressed as *DTRM2*, *DEURM2*, *DFEDM2*, *DTRM2USD* and *DEURM2USD* respectively.

[5] Amount of expenses minus precautionary money balances.

Five year-Credit Default Swap of Turkey, *TRCDS*, is used to include the country risk of Turkey into the analysis, while *DTRCDS* shows the percentage changes of the 5 Year-CDS data of Turkey compared to the preceding month.

Nominal interest rates mentioned in the study, *R*, is the interbank rate of Turkey while *DR* is used to express the percentage changes in the interbank rates. In similar fashion, *DLR* stands for the percentage changes of the interbank rate which is expressed in natural logarithms.

3. Methodology and Results

Many advanced economies, particularly United States of America (USA), applied expansionary monetary policies to sterilize the negative effects of the 2008 financial crisis on the real economy. Those expansionary monetary policies came to an end in the last quarter of 2014. Yet, change in money supply has certain impacts on the economy especially on price levels due to the long run neutrality of money as mentioned earlier.

Based on Liquidity Preference framework of Keynes, an increase in money supply has several time-dependent effects on interest rates and price levels. In the short run, for instance, a change in money supply would prompt interest rates to decline in case of the sticky prices. However, a monetary expansion leads price level to increase in the long run while leaving the output and income level constant according to the aggregate demand and aggregate supply approach (Mishkin, 2006). As far as medium term is concerned, other economic variables such as inflation expectations, price level, liquidity effect and income effect come into the picture according to Mishkin (2006).

Notwithstanding, effects of an increase in money supply may cause changes in price levels, income level or interest rates; one should keep in mind that interest rate is not the time value of the money but the price of the available credit. Hence, monetary expansion does not always lead to a decrease in interest rates unless the amount of available credit increases.

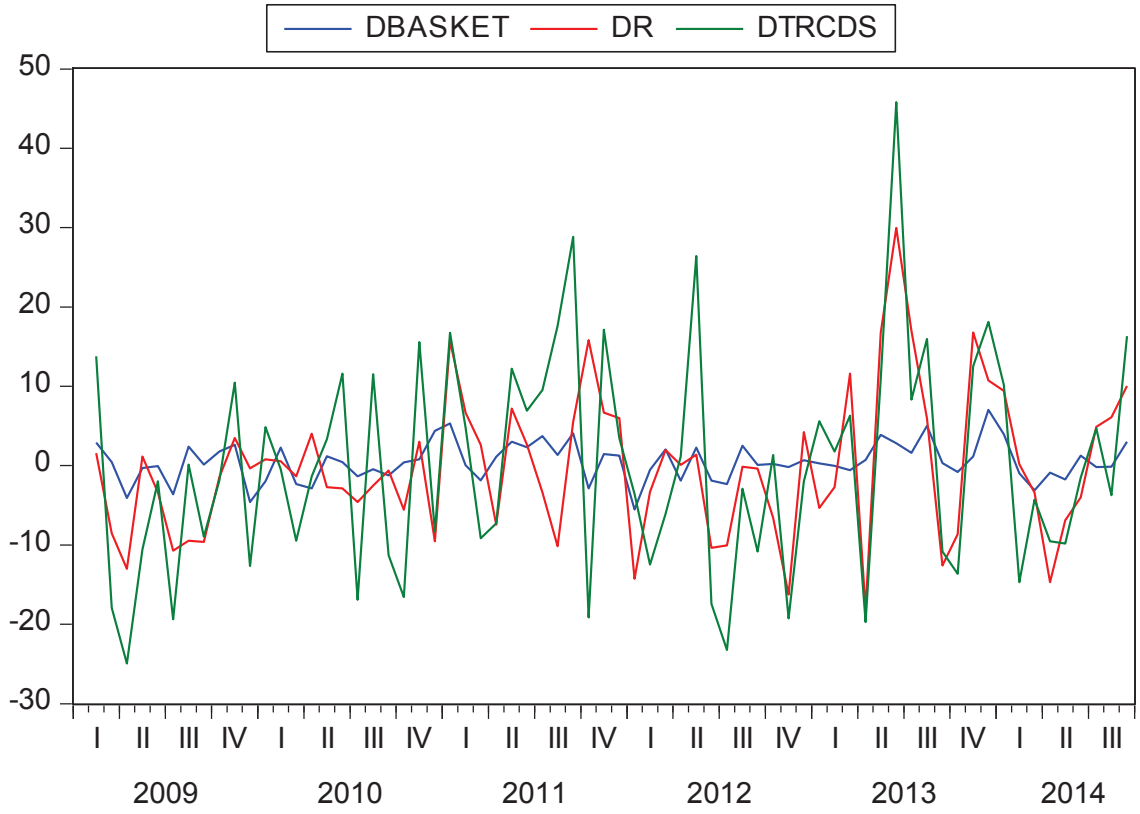
To discover the effects of monetary expansion on interest rates and foreign exchange rates, several regression analyses have been conducted on monthly data of Eurozone and Turkey. To sterilize the distortions due to the expansionary monetary policy of FED, monetary aggregates (M2) of Turkey and Eurozone are denominated in USD. Moreover, to represent the risk level of Turkey, CDS data is also included into univariate and multivariate regressions.

As can be seen from the assumptions of the UIRP condition, exchange rate is formed in accordance with the rate of return on financial assets of two countries which are similar in terms

of liquidity and risk level. Therefore, risk level of a country is a very vital economic variable especially for the international investors.

Moreover, investors do not make rational decisions in the presence of extreme risk level, in other words, uncertainty in which a probability distribution cannot be assigned (Ellsberg, 1961). Hence, the risk level of Turkey cannot be disregarded while investigating interest rate and exchange rate determination. As can be seen from the Figure 1, there is a significant correlation between *DTRCDS* and *DR*.

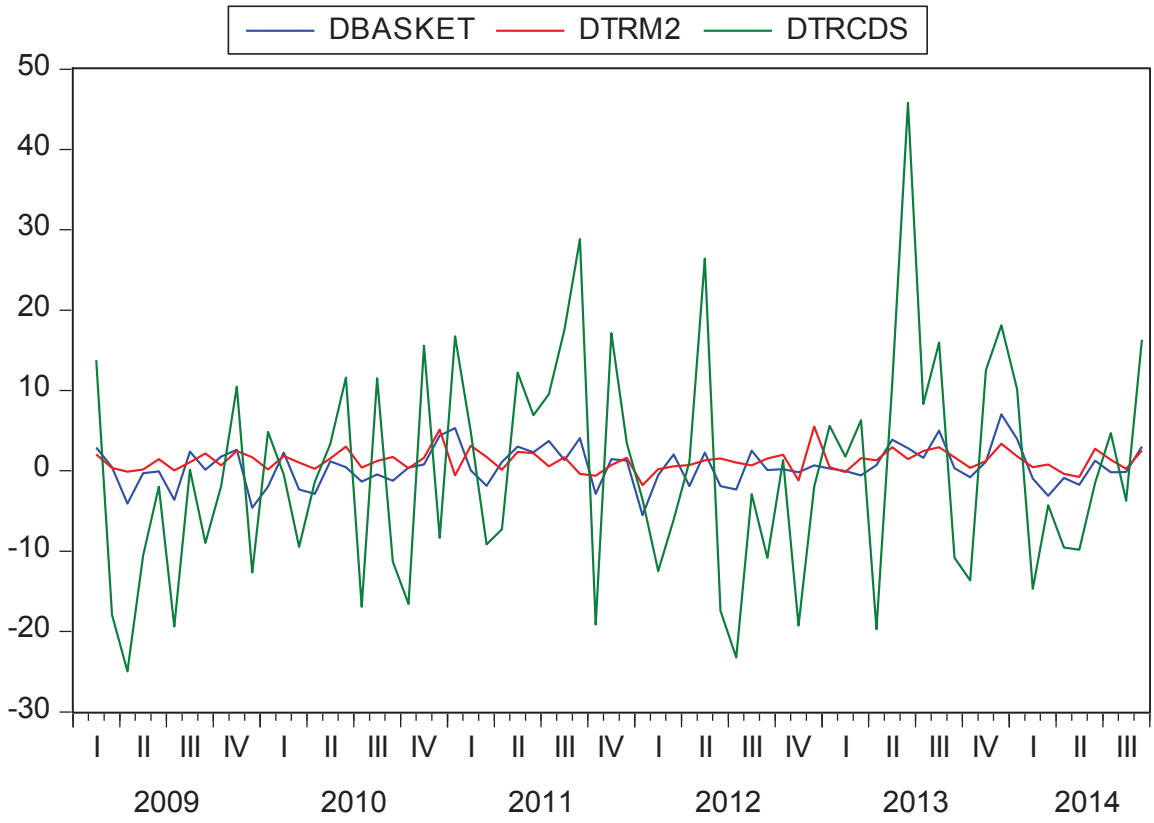
FIGURE 1: Percentage Change in CDS, Interest Rate and Currency Basket of Turkey (2009:01-2014:09)



Source: Bloomberg, CBRT

Likewise the *DTRCDS-DR* relationship, percentage change in currency basket follows a similar pattern with *DTRM2* data that can be seen below in Figure 2.

FIGURE 2: Percentage Change in Currency Basket, Monetary Aggregate M2 and CDS of Turkey (2009:01-2014:09)



Source: Bloomberg, CBRT

As the Figure 1 and Figure 2 present, percentage change in CDS data is more volatile than changes in money supply, interest rate and currency basket data. With the recent financial crisis of 2008, CDS became one of most significant leading indicators especially for the developing countries and international investors. Decrease in CDS data which means a decline in country risk, therefore, would lead local currency to appreciate and interest rates to decline due to the capital inflows or vice versa.

One can question this phenomenon by referring the UIRP condition and point out the negative correlation between the interest rate and exchange rate. However, an increase in CDS gives rise to both interest rates and exchange rates in emerging markets, at least in Turkey inasmuch as the same risk level assumption of UIRP condition is violated. Table 1 shows this relationship among the economic variables albeit it contradicts what UIRP condition states.

TABLE 1: Correlation Matrix

	DBASKET	*DTRCDS*	*DTRM2*	*DR*
DBASKET	1	**0.627862**	**0.449211**	0.413348
DTRCDS	0.627862	1	0.286313	**0.645149**
DTRM2	0.449211	0.286313	1	0.256262
DR	0.413348	0.645149	0.256262	1

Value of the currency basket is more likely to change rather than the level of interest rates when money supply increases according to the correlation matrix in Table 1. Results of both univariate and multivariate regression analyses are also in agreement with Table 1. According to the regression results, *DTRCDS* and *DBASKET* data are undoubtedly correlated as can be seen in Table 2 below.

The probability values of t-statistics are presented in Table 2 in accordance with the order of the independent variables. Correspondingly, the probability values of F and Chi-square statistics are listed respectively in each of the analyses. All regression analyses use a sample of sixty nine observations except for the ones that include the variables in terms of percentage changes. Therefore, only the analyses using *BASKET* and *R* as dependent variables cover a sample of sixty nine observations.

As can be seen from the adjusted R-squared values of the univariate and multivariate regressions, there is no doubt that a change in monetary aggregates is more influential on the foreign exchange rates than it is on interest rates. Moreover, regression results in Table 2 approve the significance of the CDS data on both interest rates and exchange rates in consonance with the correlation matrix in Table 1.

As far as Table 2 is concerned, adjusted R-squared values of regressions which take *R* and *BASKET* as dependent variables are higher than the others. However, Durbin Watson test statistics of those regressions show that there are significant autocorrelations ($cov(u_i, u_j)=0$ where $i=j$) in the residuals. In case of autocorrelation among error terms is corrected by expressing the variables in terms of percentage changes, the adjusted R-squared values of the regressions seen in Table 2 drop sharply.

TABLE 2: Regression Analyses and Test Statistics

Adjusted R^2	Dependent Variable	Independent Variable	Prob. t-statistics	Durbin Watson Stat.	Prob. Jarque-Bera	Heteroskedasticity Test-White / Prob. F and Chi-Square
0.38	*DBASKET*	*DTRCDS*	0.00	1.94	0.69	0.86, 0.85
0.41	*DBASKET*	*DTRCDS, DREALTRM2*	0.00, 0.0448	1.98	0.97	0.1471, 0.1449
0.925	*BASKET*	*EURM2, FEDM2, TRM2*	0.00, 0.00, 0.00	0.69	0.37	0.10, 0.11
0.22	*DBASKET*	*DEURM2, DTRM2, DFEDM2*	0.04, 0.00, 0.28	2.22	0.50	0.1278, 0.1321
0.45	*DBASKET*	*DTRM2, DTRCDS*	0.0002, 0.00	2.15	0.81	0.0398, 0.0439
0.05	*DR*	*DTRM2*	0.0349	1.55	0.01	0.0212, 0.0285
0.11	*DLR*	*DTRM2USD*	0.0024	1.63	0.75	0.6031, 0.5916
0.40	*DR*	*DTRCDS*	0.00	1.86	0.06	0.4028, 0.3914
0.41	*DR*	*DTRM2USD, DTRCDS*	0.17, 0.00	1.87	0.06	0.7202, 0.6993
0.77	*R*	*TRCDS*	0.00	0.59	0.37	0.3887, 0.3776
0.78	*R*	*TRCDS, TRM2USD*	0.00, 0.038	0.61	0.51	0.3655, 0.3498

Monetary aggregates are not denominated in USD except for the regressions where *R* is expressed as the dependent variable. One can question how relevant to denominate the monetary aggregates in U.S. Dollars is. The main concern here is that monetary authorities of USA, Turkey and Eurozone did implement expansionary monetary policies during the period of 2009:01-2014:09. Moreover, QE's of FED are more influential than the expansionary monetary policies of Turkey and Eurozone since USD is considered to be the world's most dominant reserve currency.

Thus, it is logical to express the monetary aggregates of Turkey and Eurozone in terms of USD both to sterilize the possible distortions caused by QE programs of FED and to observe the relative increases in monetary aggregates of Eurozone and Turkey. Denoting monetary aggregates in terms of USD would also lead to a better comparison and understanding the impact of the relative changes in M2 aggregates of Turkey and Eurozone on bilateral exchange rate of *EURTRY*.

The logic behind that statement is formulated below. As stated in Keynesian money demand function, real money demand can be represented as a function of income and interest rate. Furthermore, money market equilibrium necessitates money demand to be equal to money supply in steady state.

$$M/P = L(r,Y)$$

$$M^S / L(r,Y) = P$$

$$\Delta[M^S / L(r,Y)] = \Delta P$$

Assuming that the PPP condition holds, the formula can be rewritten as follows were *S* denotes for the exchange rate.

$$S = P_D / P_F$$

$$[M^S_{TL} / L_{TL}(r,Y)] / [M^S_{USD} / L_{USD}(r,Y)] = P_{TL}/P_{USD}$$

$$[(M^S_{TL} / L_{TL}(r,Y)) / (M^S_{USD} / L_{USD}(r,Y))]^{-1} = (P_{TL}/P_{USD})^{-1}$$

$$[M^S_{USD} / L_{USD}(r,Y)] / [M^S_{TL} / L_{TL}(r,Y)] = P_{USD} / P_{TL} = 1/S_{\$/TL}$$

Applying the same logic to EURUSD exchange rate, following formula is acquired.

$$[M^S_{USD} / L_{USD}(r,Y)] / [M^S_{Euro} / L_{Euro}(r,Y)] = P_{USD}/P_{Euro} = S_{\$/€}$$

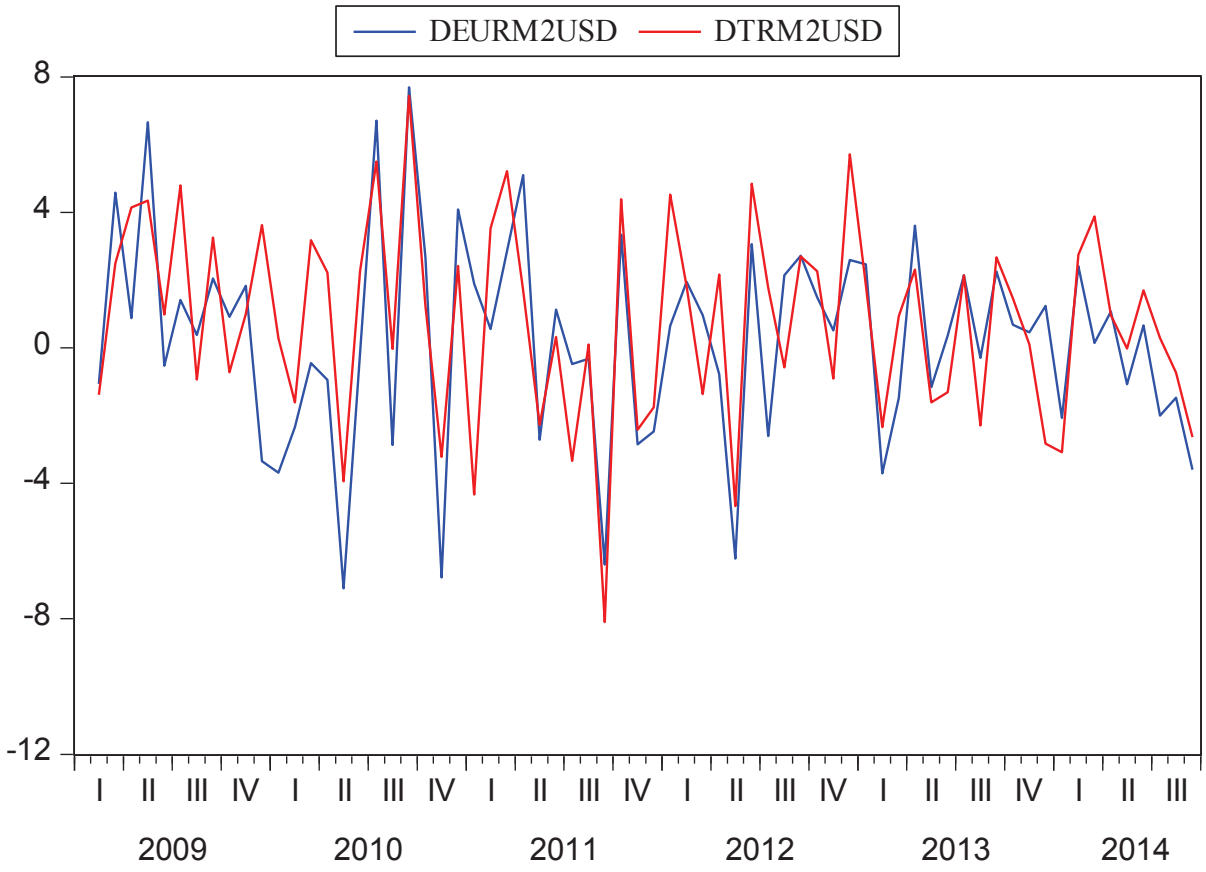
As far as PPP functions that are derived from the Keynesian money demand approach are concerned, EURUSD and USDTRY exchange rate functions can be combined to obtain the *EURTRY* exchange rate.

$$[(M^{S}_{TL} / L_{TL}(r,Y)) / S_{\$/TL}] / [(M^{S}_{Euro} / L_{Euro}(r,Y))\, S_{\$/€}] = P_{TL}/P_{€} = S_{TL/€}$$

$$\Delta\,[(M^{S}_{TL} / L_{TL}(r,Y)) / S_{\$/TL}] / [(M^{S}_{Euro} / L_{Euro}(r,Y))\, S_{\$/€}] = \Delta\,(P_{TL}/P_{€}) = \Delta\, S_{TL/€}$$

Therefore, using the monetary aggregates expressed in USD as explanatory variables is, indeed, a better way to analyze the formation of *EURTRY* ($S_{TL/€}$) exchange rate; at least for being consistent with the theory. Figure 3 shows the monetary aggregates (M2) in terms of percentage changes compared to the prior month.

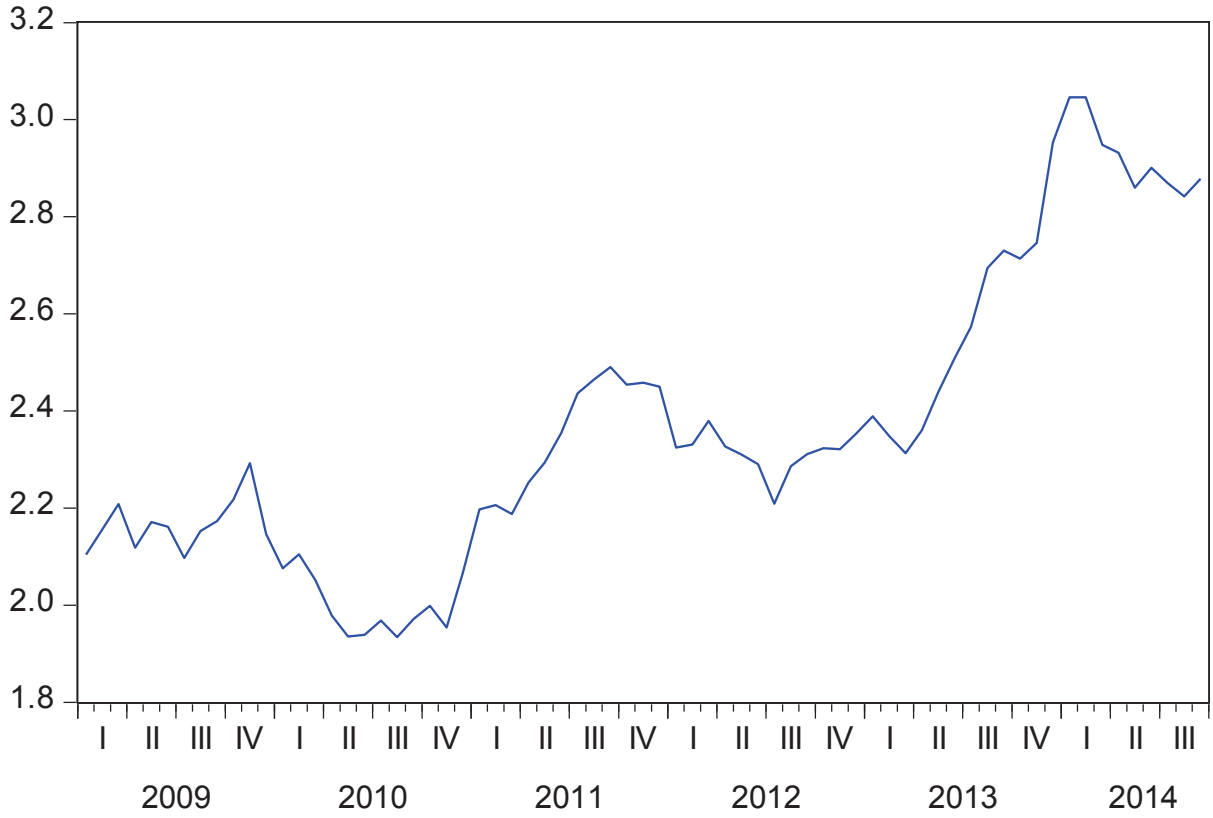
FIGURE 3: Percentage Change in Monetary Aggregates (M2) of Turkey and Eurozone



Source: Bloomberg, CBRT

Evidently, magnitude of the percentage change in *TRM2USD* data exceeds *EURM2USD* as can be seen from the Figure 3. Needless to say, TRY should depreciate against EURO as a result of the increase in monetary aggregate *TRM2USD* that outpaces rise in the monetary base *EUROM2USD*.

FIGURE 4: EURTRY Exchange Rate



Source: Bloomberg, CBRT

Figure 4 approves the fact that monetary expansion seen in Figure 3 leads to a depreciation in local currency[6]. In agreement with Figure 4, regression analyses formulated below is meant to give the similar result.

$$\Delta S_{TL/€} = c + \beta_1 \Delta(M^S_{TL}\, S_{\$/TL}) + \beta_2 \Delta(M^S_{Euro}\, S_{\$/€})$$

$$\Delta S_{TL/€} = c + \beta_1 \Delta(M^S_{TL}\, S_{\$/TL}) + \beta_2 \Delta(M^S_{Euro}\, S_{\$/€}) + \beta_3 \Delta TRCDS$$

It is beneficial to bear in mind that adjusted R-squared values in Table 2 show a dramatic fall if the variables are expressed in terms of percentage changes to correct the Durbin Watson test statistics. Thus, none of the regressions in Table 2 put forth a significant relationship between the variables since the assumptions of regression need to be satisfied.

Yet, regressions on the variables that are expressed in terms of percentage changes in Table 3 not only satisfy all of the assumptions but also have statistically significant and high adjusted R-squared values. Moreover, CDS data of Turkey has little impact on *EURTRY* exchange rate

[6] It is Turkish Lira (*TRY*) in case of Turkey.

as the adjusted R-squared value increases only a small portion when CDS data is included into the analysis.

One possible reason may stem from the fact that monetary aggregates are denominated in USD, thus, CDS premiums have already been taken into account in exchange rate determination of USDTRY and EUROUSD.

TABLE 3: Regression Analyses and Test Statistics

Adjusted R^2	Dependent Variable	Independent Variable	Prob. t-statistics	Durbin Watson Stat.	Prob. Jarque-Bera	Heteroskedasticity Test-White / Prob. F and Chi-Square
0.77	*DEURTRY*	*DEURM2USD, DTRM2USD*	0.00, 0.00	2.04	0.37	0.29, 0.28
0.65	*EURTRY*	*EURM2USD, TRM2USD*	0.00, 0.004	0.348	0.64	0.1413, 0.1395
0.82	*DEURTRY*	*DTRM2USD, DEURM2USD, DTRCDS*	0.00, 0.00, 0.00	2.10	0.42	0.3469, 0.3297
0.10	*DEURTRY*	*DTRCDS*	0.00	1.81	0.92	0.8879, 0.8832
-0.03	*R*	*DTRM2USD, DEURM2USD*	0.9860, 0.9926	0.18	0.00	0.7609, 0.7412
0.09	*DR*	*DTRM2USD, DEURM2USD*	0.02, 0.69	1.62	0.04	0.5153, 0.4941

There is no doubt that monetary expansion has significant effects on the exchange rate determination. However, it is necessary to make a comprehensive analysis to exhibit the dynamics among the variables that influence the *EURTRY* exchange rate. Hence, the Johansen Cointegration test and, if necessary, Vector Autoregression (VAR) methodology will be applied to the data.

Except for the variables expressed in terms of percentage changes and *TRCDS*, rest of the variables are non-stationary as can be seen in Table 4. Even though non-stationary condition of Johansen cointegration test is satisfied, test results show that there are not any cointegration vectors among the variables. That is most probably because of the sample size as the data covers a short period of time. Hence forth, the prerequisite for VAR analysis is fulfilled due to the absence of cointegration.

TABLE 4: Augmented Dickey-Fuller (ADF) Unit Root Test Statistics

Variable	ADF t-Statistic Prob. Value	Variable	ADF t-Statistic Prob. Value
EURTRY	0.8947	DEURTRY	0.0000
TRM2USD	0.3227	DTRM2USD	0.0000
TRCDS	0.0078	DTRCDS	0.0000
EURM2USD	0.0970	DEURM2USD	0.0000

Two VAR analyses have been applied to the data; first one includes *TRCDS* data while the second one excludes it. According to both VAR analyses of the variables that are expressed in terms of percentage changes, optimum lag intervals that satisfy the minimum Akaike criteria are "1-1".

Maximum adjusted R-squared value of VAR analysis which includes the *TRCDS* data is obtained if Cholesky ordering starts with *TRCDS*. In case of excluding TRCDS data, maximum R-squared value is achieved in an order where *DEURTRY* takes the lead. It is worth noting that Cholesky ordering is important for both impulse responses and variance decompositions.

As far as the causality relationship among variables is concerned, there is causality from *TRCDS* to *DEURTRY* at ten percent significance level whereas no causality is observed in opposite direction. Besides *DEURTRY*, *TRCDS* data has also causality effects on *DTRM2USD* and

DEURM2USD at ten percent and almost ten percent significance levels, respectively. Granger causality relationship among variables is presented by Table 5. However, VAR analysis that excludes *TRCDS* data does not put forth any statistically significant causality among variables.

One should keep in mind that Granger causality is a chronological ordering of movements (Brooks, 2008). Therefore, absence or existence of causality cannot be taken into account as an absolute cause and effect relationship since the simultaneous movements in the series are disregarded.

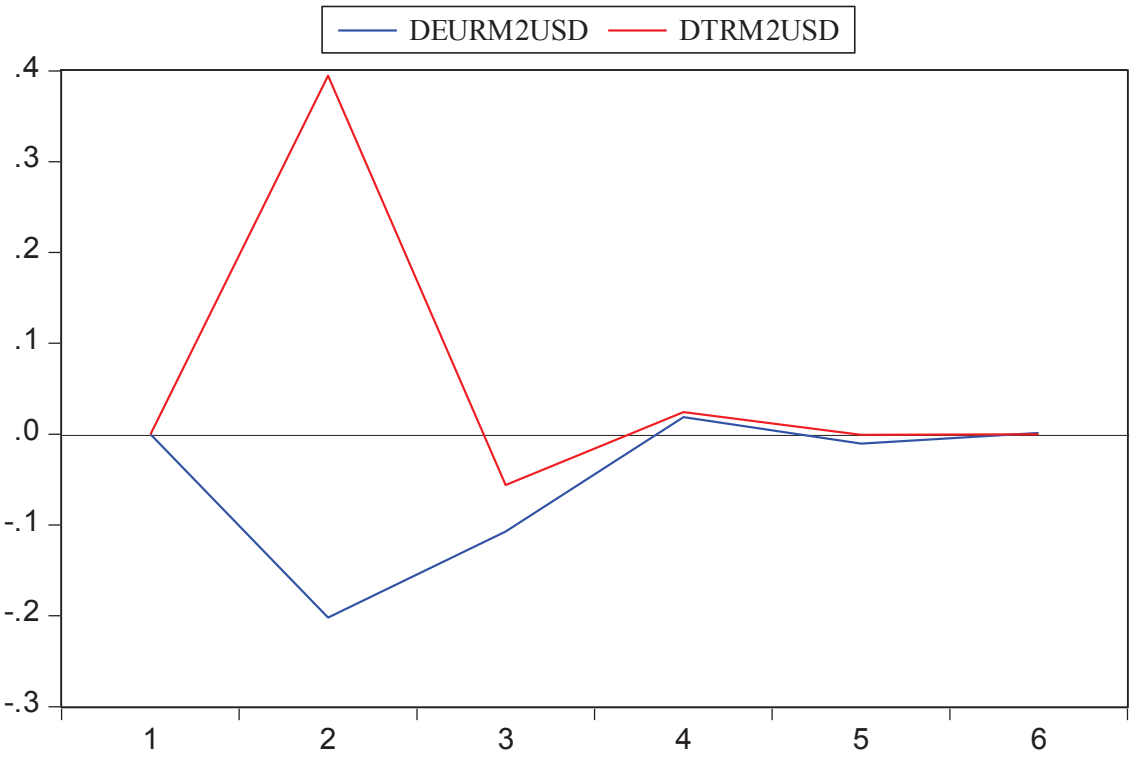
TABLE 5: Granger Causality Test Statistics

Dependent Variable	Variables	Chi-sq. Prob. Value
DEURTRY	*DEURM2USD*	0.1981
	DTRM2USD	0.2915
	TRCDS	0.091
DEURM2USD	*DEURTRY*	0.1100
	DTRM2USD	0.1334
	TRCDS	0.1200
DTRM2USD	*DEURTRY*	0.8602
	DEURM2USD	0.7381
	TRCDS	0.0798
TRCDS	*DEURTRY*	0.9448
	DEURM2USD	0.6492
	DTRM2USD	0.4983

Impulse responses and variance decompositions, however, present the response of each dependent series to one standard deviation shock of the variables and relative importance of each shock which also include simultaneous movements. Figure 5 represents the impulse responses of the *DEURTRY* to the shocks of the variables except for *TRCDS* whereas Figure 6 exhibits the impulse responses to innovations to variables including *TRCDS* data.

In accordance with what the economic theory suggests, monetary expansion of Turkey results in depreciation of TRY against EURO whilst an increase in Eurozone M2 leads to an appreciation in *EURTRY* exchange rate as can be seen in Figure 5 and Appendix A-Table A1.

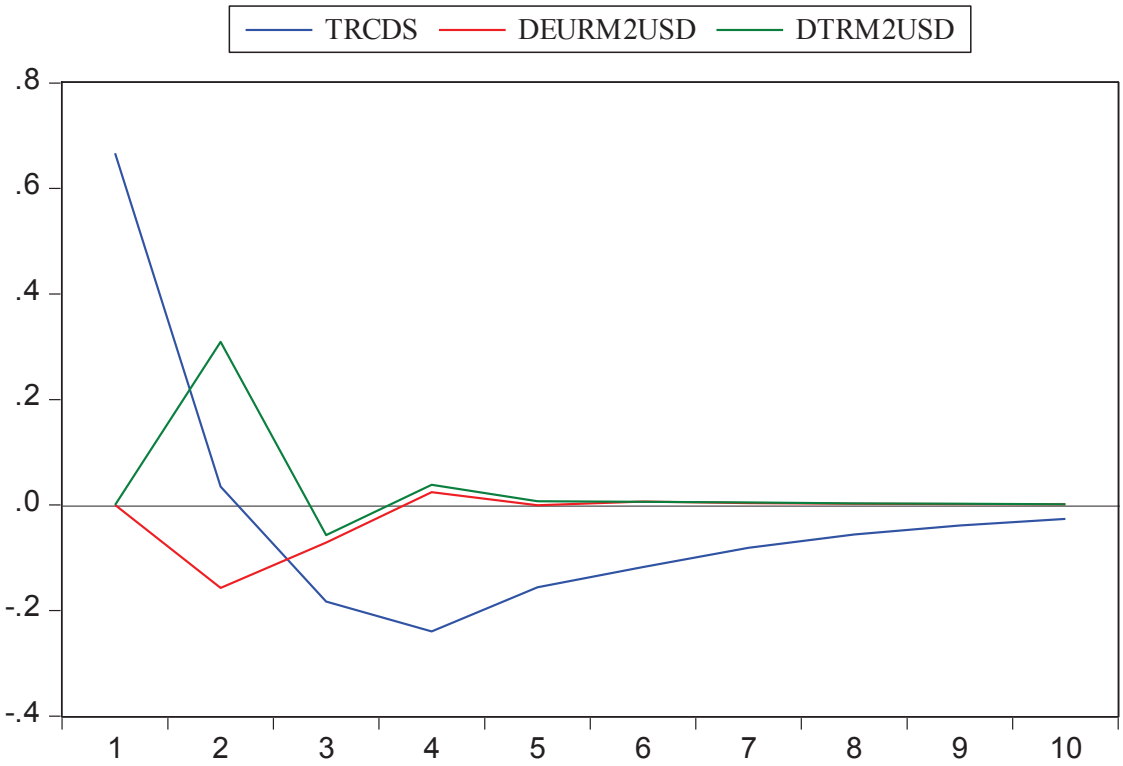
FIGURE 5: Response of DEURTRY to One S.D. Innovations to DEURM2USD and DTRM2USD



According to Figure 6, total effect of a shock to *TRCDS* data on *DEURTRY* is negative which seems to be controversial because an increase in riskiness especially in case of Turkey, should lead to depreciation of the local currency. Although the impact of a shock to *TRCDS* on *DEURTRY* is positive at the beginning, it turns out to be reversed after the second month. Moreover, including *TRCDS* data to the VAR analysis changes the Cholesky ordering of the variables as the adjusted R-squared value is maximized in an order which starts with *TRCDS*.

As a result Figure 6 on the one hand contradicts the economic theory by displaying the negative impact of TRCDS data on *DEURTRY*, on the other hand, supports it by presenting the impact of the monetary aggregates on *EURTRY* exchange rate in consonance with Figure 5. The underlying reason behind the negative effect of *TRCDS* on *DEURTRY* data is due to the fact that *TRCDS* data is stationary without being expressed in terms of percentage changes.

FIGURE 6: Response of DEURTRY to One S.D. Innovations to DEURM2USD, TRCDS and DTRM2USD



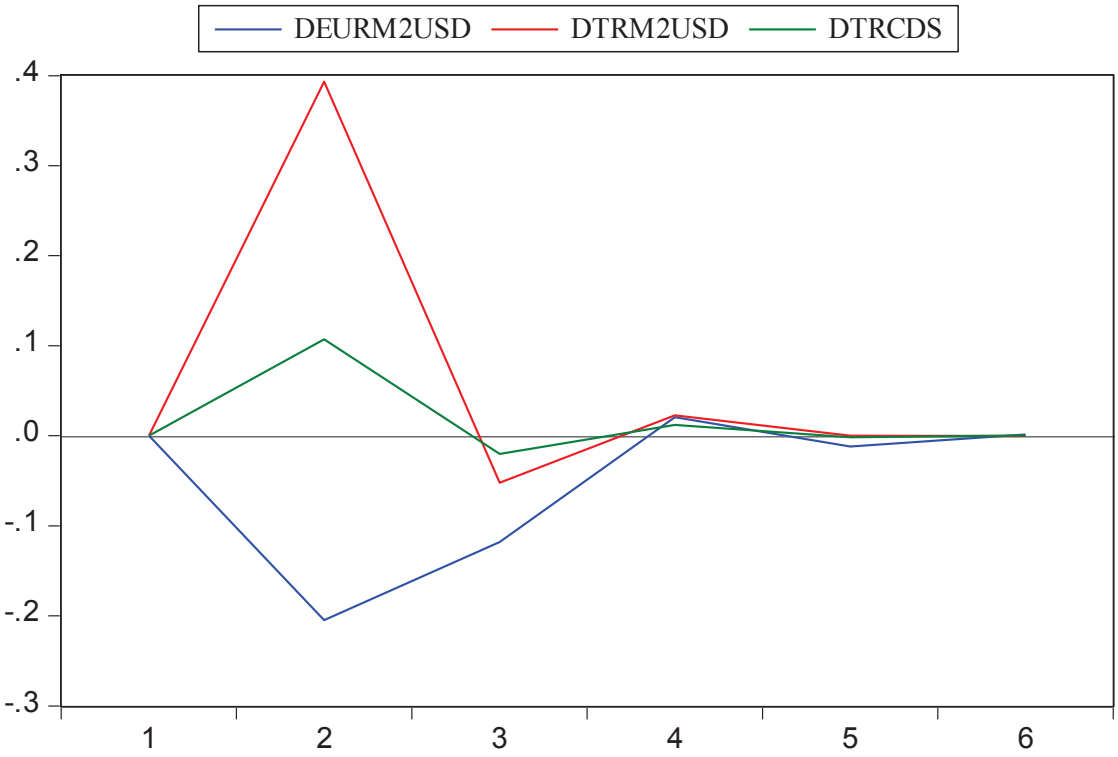
Correlation matrix presented in Table 6 exhibits how the correlation coefficient between *DEURTRY* and *TRCDS* changes (from 0.004 to 0.338) in case of expressing *TRCDS* data in terms of percentage changes.

TABLE 6: Correlation Matrix

	DEURTRY	*TRCDS*	*DEURM2USD*	*DTRM2USD*	*DTRCDS*
DEURTRY	1.000	**0.004**	0.386	**-0.300**	**0.338**
TRCDS	0.004	1.000	-0.100	-0.148	0.131
DEURM2USD	0.386	-0.100	1.000	0.695	-0.505
DTRM2USD	-0.300	-0.148	0.695	1.000	-0.678
DTRCDS	0.338	0.131	-0.505	-0.678	1.000

Likewise, expressing *TRCDS* in terms of percentage change leads to significant changes in impulse responses. For instance, total effect of one standard deviation shock to *TRCDS* data on *DEURTRY* is negative while total effect of a shock to *DTRCDS* is positive as can be seen in Figure 7 (Appendix A, Table A2. and Table A3.).

FIGURE 7: Response of DEURTRY to One S.D. Innovations to DEURM2USD, DTRCDS and DTRM2USD



It is beneficial to remind the fact that impulse responses exhibit how dependent series respond to the shocks to the variables while variance decompositions display the relative importance of each shock to variables on the movement in the dependent variable (Brooks, 2008). Movement of the dependent variable depends on both its own shock and shocks to the other variables that are presented in Table 7. Only two percent of forecast error variance of *DEURTRY* data can be attributed to *DTRM2USD* data and ninety seven percent of forecast error variance stems from its own shocks.

In regard to variance decomposition analysis seen in Table 7, at least ninety percent of the change in *DEURTRY* data originates from its own shocks even if *TRCDS* and *DTRCDS* data is included into VAR analysis (Appendix B). As mentioned earlier, Cholesky ordering is important for both impulse responses and variance decompositions. However, even if the order of the variables except for the first variable[7] is changed, forecast error variance of *DEURTRY* is mostly due to the change in its own series.

[7] The reason behind keeping *DEURTRY* as the first variable is because of the fact that it is the most endogenous variable since the highest adjusted R-squared value is obtained in an order where DEURTRY takes the lead.

TABLE 7: Variance Decomposition of DEURTRY

Period	S.E.	DEURTRY	DEURM2USD	DTRM2USD
1	2.638541	100	0	0
2	2.719291	97.33983	0.5518	2.108371
3	2.725186	97.15471	0.703803	2.141486
4	2.725469	97.1427	0.708429	2.148867
5	2.725496	97.14125	0.709907	2.148838
6	2.725497	97.14123	0.709929	2.148837

One can question the difference between the results of variance decomposition analyses and correlation matrix. The difference emerges because of the fact that correlation coefficient presents the magnitude of the relationship between two variables whereas variance decomposition investigates the relationship among more than two variables. Therefore, it is not unexpected to observe such a difference between correlation matrix and variance decompositions.

In accordance with what the economic theory suggests, Figure 7 exhibits the fact that an increase in risk level leads to exchange rate depreciation. Moreover, variance decomposition analysis where *TRCDS* data is included, illustrates that a change in *TRCDS* data has the second biggest impact on *EURTRY* exchange rate (Appendix B).

Conclusion

Monetary expansions have been one of the prior policy tools for the monetary authorities throughout the history. Many economies especially USA, conducted expansionary monetary policies to neutralize the unfavorable effects of the recent global financial crisis of 2008 on the economy. During the period between 2009:01 and 2014:09, three consecutive quantitative easing programs were announced by FED. Moreover, several countries applied expansionary monetary policies in accordance with USA, which in return, had significant effects on the global liquidity and gave rise to the concerns regarding the issue of currency wars.

This paper analyzes how effective monetary aggregates can be on exchange rate determination in a world of increased liquidity and financial integration using a framework that combines two prominent approaches in the literature: Keynesian Liquidity Preference and Purchasing Power Parity. First of all, several bivariate and multivariate regressions have been employed to investigate the statistically significant relationship among monetary aggregates, interest rate

and exchange rate in agreement with the derived formula that based on Liquidity Preference and PPP models. After constructing the statistically significant structure that explains the exchange rate formation in the light of monetary aggregates, VAR analysis is performed to test relative importance of each factor and explore whether the impacts of the variables on the percentage change of *EURTRY* exchange rate are consistent with the economic theory or not.

Regression analysis that illustrates the validity of monetary aggregates on exchange rate formation, in a way, proves the fact that PPP condition holds for Turkey. Even though there have been abundant number of articles that contradict this finding, this paper stands for the empirical findings of Findreng (2014) which states that lifespan of PPP is much shorter than expected. Denominating the monetary aggregates in USD is, indeed, necessary to offset the effects of quantitative easing programs conducted by FED due to the reserve currency role of USD and to make a more realistic comparison of the percentage changes in monetary aggregates of Turkey and Eurozone.

Regarding the results shown in Table 2, prior effect of monetary policies is on the exchange rate rather than the interest rate while country risk level, CDS, influences both variables in agreement with the assumptions of UIRP condition. Despite the fact that a change in CDS data is responsible for a small portion of the percentage change in *EURTRY* exchange rate according to Table 3, *TRCDS* data is the most influential variable as far as the Granger causality test statistics shown in Table 5 is concerned. Nevertheless, percentage change in *EURTRY* exchange rate is primarily attributed to the monetary aggregates expressed in terms of USD rather than the risk level according to the regressions in Table 3.

In accordance with Table 2, change in monetary aggregates in Table 3 does not have any statistically significant impacts on the interest rate as long as the regression assumptions are fully satisfied. Thus, one can reach a conclusion that increasing money supply results in depreciation of local currency instead of a decrease in interest rates contrary to general belief of many politicians. Moreover, even if an increase in monetary aggregate M2 causes the interest rates to fall significantly because of the sticky prices in the short run, a monetary expansion may lead to bilateral exchange rates to overshoot due to the inflation expectations.

In similar vein, UIRP condition also leads to the same conclusion in two ways. First of all, a decrease in domestic interest rates regarding the increase in money supply will cause the expected exchange rate (S_{t+1}^{e}) to increase which in return raises the spot exchange rate even more to neutralize the fall in interest rates. Secondly, even if there isn't any change in expected

exchange rate, spot exchange rate should increase to compensate the decrease in interest rates and to prevent the capital outflows.

Impulse responses, however, need to be investigated to verify whether the responses of EURTRY exchange rate are consistent with the economic theory or not, albeit, multivariate regressions in Table 3 approve the relationship among the monetary aggregates and exchange rate. In parallel to the economic theory, impulse responses exhibit the fact that monetary aggregates denominated in USD have counter effects on *EURTRY* exchange rate: An increase in monetary aggregate M2 of Turkey leads to depreciation of Turkish Lira against Euro whereas the monetary expansion of Eurozone results in an appreciation of Turkish Lira.

Yet, including *TRCDS* data to VAR analysis leads to controversial results according to impulse responses. Total impact of a shock to *TRCDS* on *DEURTRY* shown in Figure 6 is negative notwithstanding an increase in country risk initiates depreciation in local currency and leads to an increase in interest rates due to the capital outflows. In case of expressing *TRCDS* in terms of percentage change, however, the total impact on *DEURTRY* seen in Figure 7 reverses significantly in consistence with Table 1.

It is useful to keep in mind that impulse responses reveal how dependent variables correspond to shocks to other variables whilst the variance decompositions investigate the relative importance of these shocks simultaneously. In this regard, at least ninety percent of the forecast errors of *DEURTRY* are attributed to its own shocks (Appendix B, Table 7). The impulse responses also lead to the similar results if displayed in table format rather than graph which give opportunity to illustrate and compare the magnitude of the shocks to each variable (Appendix A).

As a result, monetary policies undoubtedly influence exchange rates. Even if the interest rates are affected by these policies in the short run due to the sticky prices, impact of monetary policies on the interest rates cannot last long enough. Regression analyses support this fact in consistence with the economic approaches of literature such as UIRP condition, long run neutrality of money, exchange rate overshooting and PPP. As far as Friedman's approach is concerned, an increase in money supply can lead to two different results depending on whether it is unexpected or not: an unexpected increase in money supply leads to a decrease in interest rates whereas an expected increase causes overall price levels to rise. Nonetheless, conducted monetary expansion programs cannot be regarded as unexpected in the period of 2009-2014. Hence, there remains to be only one possible result which is an increase in overall price level.

In regard to UIRP condition and exchange rate overshooting model, local currency will depreciate even though an unexpected monetary expansion takes place. Accordingly, PPP and long run neutrality of money approaches cause the exchange rate to increase if there is an expected rise in monetary aggregates. Hence, increase in money supply is whether expected or not, expansionary monetary policies result in depreciation of local currency; in the short run according to UIRP and exchange rate overshooting models whilst in the long run regarding the PPP and long run neutrality of money approaches.

Moreover, Central Bank of Turkey aims to apply monetary policies in accordance with the QTM model ($MV=PY$) and the level of the real exchange rate. Therefore, QTM condition shown in Appendix C holds for Turkey more often than the other developing countries from 2009 to 2014. Furthermore, majority of Turkey's trade volume is with the European countries. Thus, it is not an unexpected result to have an adjusted R-squared value of seventy seven percent in the regression where the dependent variable is DEURTRY.

In addition, monetary expansion in developing countries such as Turkey that runs consistent current account deficits seen in Table 8 will certainly induce depreciation since trade deficit causes foreign exchange reserves to shrink. It is beneficial to keep in mind that there are three channels in an economy: trade, finance and more importantly expectations. Thus, an increase in monetary aggregate will definitely lead expected exchange rate to increase due to the rise in inflation expectations which mainly depends on the previous inflation rates presented in Table 8.

TABLE 8: Current Account Balance, Inflation Rate and Short-term Debt Statistics of Turkey

Period	Current Account Balance (Million USD)	Inflation Rate (%)	Short-term Debt (% of Total Reserves)
2004	- 14.198,00	10,58	82,7
2005	- 21.449,00	10,14	74,1
2006	- 31.836,00	9,60	67,7
2007	- 37.781,00	8,76	56,4
2008	- 40.372,00	10,44	71,3
2009	- 12.124,00	6,25	65,4
2010	- 45.420,00	8,57	89,9
2011	- 75.082,00	6,47	98,8
2012	- 48.497,00	8,89	84,1
2013	- 65.110,00	7,49	99,5
2014	- 45.846,00	8,85	104,3

Source: Federal Reserve Economic Data-FRED, Central Bank of Turkey, The World Bank-IBRD

Last but not least, one of the most important leading indicators of exchange rate expectations is the short-term debt to total reserves ratio as far as the international investors are concerned. As can be seen in Table 8, this ratio rises up significantly in Turkey after 2009 compared to previous years.

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APPENDIX A: Impulse Response Analysis

TABLE A1: Response of DEURTRY:			
Period	**DEURTRY**	**DEURM2USD**	**DTRM2USD**
1	2.638541	0	0
2	0.485731	-0.201998	0.394847
3	0.132277	-0.107079	-0.056001
4	0.02463	0.018828	0.02411
5	0.005692	-0.010525	-9.73E-04
6	0.001459	0.001283	3.69E-05

TABLE A2: Response of DEURTRY:				
Period	**TRCDS**	**DEURTRY**	**DEURM2USD**	**DTRM2USD**
1	0.666393	2.513685	0	0
2	0.034658	0.388333	-0.156845	0.309449
3	-0.183119	0.079619	-0.071000	-0.056798
4	-0.239816	-0.005322	0.024487	0.038187
5	-0.156151	-0.023522	-0.000783	0.007242
6	-0.117437	-0.017638	0.006341	0.006199
7	-0.080871	-0.013695	0.003792	0.004943
8	-0.055934	-0.009558	0.002609	0.002925
9	-0.038735	-0.006645	0.001919	0.002167
10	-0.026685	-0.004606	0.001286	0.00146

TABLE A3: Response of DEURTRY:				
Period	**DEURTRY**	**DEURM2USD**	**DTRM2USD**	**DTRCDS**
1	2.657515	0	0	0
2	0.487146	-0.204736	0.393263	0.107235
3	0.144002	-0.118077	-0.052076	-0.020272
4	0.025237	0.020589	0.022692	0.012033
5	0.006902	-0.011764	7.67E-05	-0.001748
6	0.001631	0.001287	-0.00026	0.000419

APPENDIX B: Variance Decomposition of DEURTRY

TABLE B1: Variance Decomposition of DEURTRY (TRCDS included)

Period	S.E.	TRCDS	DEURTRY	DEURM2USD	DTRM2USD
1	2.600518	6.566617	93.43338	0	0
2	2.652368	6.329464	91.95969	0.349682	1.361167
3	2.661427	6.759857	91.42421	0.418475	1.397462
4	2.672601	7.508628	90.66178	0.423378	1.406217
5	2.677272	7.822626	90.35342	0.42191	1.402046
6	2.679919	7.999207	90.17934	0.421637	1.399812
7	2.681181	8.082655	90.09707	0.42144	1.398835
8	2.681784	8.12252	90.05781	0.421345	1.398324
9	2.682074	8.141624	90.03898	0.421305	1.398088
10	2.682211	8.150688	90.03005	0.421285	1.397974

TABLE B2: Variance Decomposition of DEURTRY (DTRCDS included)

Period	S.E.	DEURTRY	DEURM2USD	DTRM2USD	DTRCDS
1	2.657515	100	0	0	0
2	2.74003	97.22858	0.558311	2.059939	0.153167
3	2.74692	97.01631	0.740287	2.08556	0.157846
4	2.747233	97.00263	0.745735	2.091907	0.159728
5	2.747267	97.00083	0.74755	2.091855	0.159764
6	2.747268	97.00081	0.747571	2.091855	0.159767

APPENDIX C: Quantity Theory of Money and Sample Countries

Period	Inflation (%)	Change in M2 (%)	GDP Growth	Change in M2 denominated in USD (%)	(1+ΔP)*(1+ΔY)	Change in Value of Local Currency Against USD (%)
Turkey						
2004	0,1058	0,0000	0,0936	0,0000	0,0000	0,0000
2005	0,1014	0,4100	0,0840	0,5000	0,1939	-0,0600
2006	0,0960	0,2500	0,0689	0,1700	0,1715	0,0700
2007	0,0876	0,1600	0,0467	0,2700	0,1384	-0,0900
2008	0,1044	0,2700	0,0066	0,0900	0,1117	0,1700
2009	0,0625	0,1300	-0,0483	0,1100	0,0112	0,0200
2010	0,0857	**0,1900**	0,0916	0,1900	**0,1852**	0,0000
2011	0,0647	**0,1500**	0,0877	0,0700	**0,1581**	0,0800
2012	0,0889	**0,1000**	0,0213	0,0300	**0,1121**	0,0700
2013	0,0749	0,2200	0,0419	0,1500	0,1199	0,0600
2014	0,0885	**0,1200**	0,0287	-0,0400	**0,1197**	0,1700
Russia						
2004	0,1086	0,0000	0,0718	0,0000	0,0000	0,0000
2005	0,1268	0,3900	0,0638	0,4100	0,1987	-0,0200
2006	0,0968	0,4900	0,0815	0,5500	0,1862	-0,0400
2007	0,0901	0,4300	0,0854	0,5200	0,1832	-0,0600
2008	0,1411	0,0100	0,0525	0,0400	0,2010	-0,0300
2009	0,1165	0,1800	-0,0782	-0,0800	0,0292	0,2800
2010	0,0686	0,3100	0,0450	0,3700	0,1167	-0,0400
2011	0,0844	0,2200	0,0426	0,2600	0,1306	-0,0300
2012	0,0507	0,1200	0,0341	0,0700	0,0865	0,0500
2013	0,0676	0,1500	0,0134	0,1100	0,0819	0,0300
2014	0,0783	0,0200	0,0064	-0,1500	0,0852	0,2100
Poland						
2004	0,0358	0,0000	0,0514	0,0000	0,0000	0,0000
2005	0,0211	0,1300	0,0355	0,2700	0,0573	-0,1100
2006	0,0111	0,1600	0,0619	0,2100	0,0737	-0,0400
2007	0,0239	0,1400	0,0720	0,2800	0,0976	-0,1100
2008	0,0435	0,2000	0,0392	0,3800	0,0844	-0,1300
2009	0,0383	**0,0800**	0,0263	-0,1600	**0,0656**	0,2900
2010	0,0271	**0,0800**	0,0370	0,1200	**0,0651**	-0,0300
2011	0,0426	0,1200	0,0476	0,1300	0,0922	-0,0200
2012	0,0356	**0,0400**	0,0176	-0,0500	**0,0538**	0,1000
2013	0,0103	0,0700	0,0167	0,1000	0,0272	-0,0300
2014	0,0011	0,0900	0,0330	0,0900	0,0341	0,0000
Hungary						
2004	0,0678	0,0000	0,0479	0,0000	0,0000	0,0000
2005	0,0355	0,1500	0,0426	0,1700	0,0796	-0,0200
2006	0,0388	0,1400	0,0396	0,0800	0,0799	0,0500
2007	0,0794	0,1100	0,0051	0,2700	0,0849	-0,1300
2008	0,0607	**0,0800**	0,0088	0,1500	**0,0700**	-0,0600
2009	0,0421	0,0400	-0,0655	-0,1100	-0,0262	0,1700
2010	0,0488	0,0300	0,0079	0,0000	0,0571	0,0300
2011	0,0396	**0,0600**	0,0181	0,0900	**0,0584**	-0,0300
2012	0,0571	-0,0300	-0,0148	-0,1400	0,0415	0,1200
2013	0,0173	0,0500	0,0153	0,0600	0,0329	-0,0100
2014	-0,0024	0,0600	0,0364	0,0200	0,0339	0,0400

Source: Bloomberg, Federal Reserve Economic Data-FRED, Central Bank of Turkey, Central Bank of Hungary, Central Bank of Russia, Central Bank of Poland