Do Credits Affect Money Supply and Deposits, or Vice Versa, or Interconnected?

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Abstract

There are different approaches regarding the effect of credits on deposits and money supply. In particular, the view that banks do not need deposits to create credit has become increasingly popular. In this paper we empirically investigate the relationship among money supply, credits and deposits based on the Turkish experience. Specifically, using quarterly observations on M1, M2, M3, deposits in Turkish Lira (TL-Lira) and Foreign Currency (FX) deposits as well as credits spanning the December 2005 - September 2021 period we find that credits have significant effects on money stock and deposits. However, our results also suggest that credits are not the most important determinant of money supply or deposits. While our results suggest that credits may generate money and deposits endogenously, this finding does not imply that money is purely an endogenous variable.

Öz - Krediler Para Arzını ve Mevduatları Etkiler mi veya Tersi, ya da Bunlar Birbirleriyle Bağlantılı mıdır?

Kredilerin mevduat ve para arzı üzerindeki etkisine ilişkin farklı yaklaşımlar bulunmaktadır. Özellikle, bankaların kredi oluşturmak için mevduata ihtiyaç duymaması giderek daha popüler bir görüş haline dönüşmektedir. Bu çalışmada, konuya ilişkin olarak ilgili literatürden hareketle para arzı, mevduat ve kredi arasındaki ilişki hakkında Türkiye tecrübesine dayalı bir sonuca ulaşılmaya çalışılmıştır. Bu kapsamda, M1, M2 ve M3 para stokları, Türk Lirası ve Yabancı Para Mevduatları ile toplam kredi arzı arasındaki karşılıklı etkileşim analiz edilmiştir. Aralık 2005-Eylül 2021 dönemini kapsayan üçer aylık verilerle yapılan analiz sonuçlarına göre, kredi stokunun mevduat ve para arzını etkilediği tespit edilmiştir. Ancak, mevduat veya para stokunun en önemli belirleyicisinin kredi stoku olduğunu gösteren bir kanıt bulunamamıştır. Çalışmadan elde edilen sonuçlar, para stokunun içsel olarak da belirlenebileceğini göstermekle birlikte Türkiye'de para arzının tamamıyla içsel olmadığına da işaret etmektedir.

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1. Introduction

Recently one of the hot topics of monetary economics is the relationship between credits and deposits. Particularly with the rising popularity of Modern Monetary Theory at least as an argument issue, more economists, academics and financial analysists began to discuss the interconnected sides of these monetary concepts and tools. Indeed, financial intermediaries and financial system are always very significant theoretical and practical topics in terms of both economic literature and the financial world. As an essential part of economic system, the banks are functionally very important institutions for the payment system or the settlement of economic activities, as they play a significant role in systemic liquidity, credit mechanism, risk management and money supply. In addition, after 2007-2008 global financial crisis, also called "the great recession", financial system, the banks and financial stability have been much more popular economic, research and discussion subjects.

In that context, popular arguments and questions are: "which one is the first and the cause of other one, credit or deposit?"; "Does deposit create credit or vice versa?"; "What is the essential and key role of commercial banks in terms of money supply?" In this study, we studied whether the loans of commercial banks is the main cause for deposits via the data of Türkiye's 2006 - 2021 period. In addition, the significance and role of foreign exchange deposits in Türkiye in terms of money supply are explored. For instance, we try to understand the implications of high dollarization in domestic financial system of a developing country for basic monetary indicators and tools. In this study, we will try to find answers to these questions based on Türkiye's recent monetary data. Particularly, the two questions we explore are as follows: What are the main determinants of money supply? Are these determinants, especially deposits and loans, an important monetary and political issue? The relationship between money supply, credit and deposit data, and the size and direction of this relationship are of great importance financially and politically. Recently, there have been debates as to whether deposits or credits have the greatest impact on the money supply. This discussion also refers to a more detailed and different situation than the discussion of the endogeneity of the money supply. Because it brings up the debate about whether credits or deposits, basic contents of the broad money supply definition, occur first. In this study, both the endogeneity of the money supply and the issue of whether the money supply is affected by deposits or credits are examined through the data of Türkiye. In this way, we aim to reach a conclusion about the endogeneity of the money supply and the main determinants of the money supply especially in terms of the policy implications and the future

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researches in this field. We also aim to give an idea about how much weight should be given to which monetary issue, especially deposits and credits, in the formation process of the money supply.

2. Evolution of Money and Finance: A Brief Literature Review

Credits, banks and deposits are always critical and substantial factors and indicators in terms of monetary issue during civilization of humankind (Tiryaki, 2016, 15-104). Historically, the evolution of money and finance can be summarized as followed:

"Commodity Exchange > Money Tools > Credit Facilities > Bank Institutions > Creating Deposits > Banking Money > Financialization (Dominance of Finance) > ?" (Tiryaki, 2015, 31-54).

The concept and practice of credit, bank and deposit have been changing through the time. In spite of their evolution in times, the importance of all these monetary concepts and institutions is always an apparent point in terms of the general economy and monetary policy.

Especially over the last two decades, some academics have elaborated a new monetary approach generally based on Keynesian tradition. This alternative monetary approach called Modern Monetary Theory (MMT), "integrates the insights of Knapp's state money approach (also called chartalist and adopted by Keynes), the credit money view of Innes, Lerner's functional finance approach, Minsky's views of banking, and Godley's sectoral balance approach" (Fullwiler et. al., 2012). In the literature, some accepted that there are historically two basic intellectual approaches to the origin of money. From a historical perspective on money, the Metallism and the Chartalism can be seen as a distinction point.

The Metallism assumed money that based on metals and that is mainly appreciated by the value of metals. Therefore, the value of money is attributed to its scarcity and its acceptance as an exogenous factor. On the other hand, today, rather than on precious metals such as gold, the value of money generally relies on activities of an independent central bank for stability of the general level of prices, which is seen as a fundamental priority, and on the idea of exogenous determination (limiting) of the money supply (Wray, 2014, 2-3). According to metallist point of view, money is seen as a result of the intermediary function in economic exchanges, this intermediation is characterized as a tool that minimizes transaction costs. In this view, money is seen as a neutral tool, an object that veils the process of exchange in economic

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life, facilitates the functioning of the market, and derives its value from the metal (or reserve) it contains or represents (Tcherneva, 2005, 2). Although the Chartalism approach is more ancient in origin, it finds its main and strong supporters in the Keynesian tradition. The Chartalism is based on the idea that money exists and is circulated with the nominal value assigned to it by a legal authority such as the state. Despite all its commercial and contractual aspects, money is a product of the legal order and a reflection of state authority. According to this approach, only the state or an authority with a legal force can designate any national currency or something else as a final means of payment in fulfilling legal and social obligations. In particular, the collection process of public obligations such as taxes has played a significant role in the existence, acceptance and validity of money. As the serious contributors to the Chartalism approach, which is also called Modern Monetary Theory in the literature; the names Knapp, Innes, Keynes, Lerner, Minsky, Goodhart and Ingham stand out (Wray, 2014, 2-14).

At this stage, the Credit Theory of Money also emerges as an important perspective. This approach, whose motto was depicted by Ingham as "Money is credit, but not all credit is money", draws attention to the distinction between bilateral or multilateral, personal or impersonal, private or public relations in society by highlighting the social dimension of money. In modern life, two relationships are lived together in monetary relations at the same time. First is the relationship between the parties to a transaction and second is between those parties and the issuer of the payment instrument participating in the transaction. This triangular relationship, as the provider of impersonal trust in society, allows transactions between third parties to take place. In the modern monetary system, various triangular monetary relations with hierarchical differences such as banks, credit card issuers, central banks and states coexist. According to the credit theory of money, money as a fixed intangible unit of account cannot exist without current and potential liabilities based on the exchange transaction. Money is nothing but a credit instrument, a receivable for the final payment of consumer goods. Money is a credit that is tied to a nominal value standard and serves to transfer this value in order to fulfill its obligations in the context of social relations in the society. Credit and deposit instruments in the banking system, which are the main source of private debt generation, are also very important forms of money (Ingham, 2005, 8-15).

According to Chartalist or Modern Money perspective, at the top of the monetary system and the debt hierarchy are emissions, banking reserves, public debt and bill of exchanges, especially for the payment of tax obligations. The state has

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an important role in producing and consuming banking reserves. The system allows banks and the central bank to be used as a mutual payment instrument in settling their existing loans and debts. The final payment instrument is determined by the state as a result of taxes and other public obligations. Therefore, money in the modern sense is state money. Public expenditures always generate new money through banking reserves. Another main money creation factor is the central bank's open market operations. In addition, new credit creation expands the money supply by triggering new deposits. The issue of the endogenous money also emerges to at this point (Tcherneva, 2005, 12-22).

As Holmes (1969, 73-96) said, "In the real world banks extend credit, creating deposits in the process, and look for the reserves later", key role of banks in creation of money is not a new concept. However Moore (1983, 537-556) said, "The quantity of money is always demand-determined, there can never be an "excess" supply of nominal money balances. Bank reserves cannot be quantity constrained. Central banks can determine the short-term interest rate at which they will be willing to supply liquidity. But the money stock itself is not a control variable." Therefore, banks' abilities to affect determination of money stock, reserve management, asset classification and systemic liquidity are argumentative issues. In addition, the banks can use these tools to increase their loan portfolios and banking money supply. Moreover, direct and net impact of the central bank over reserve (liquidity) managements of the banks is deemed as limited. Thus, "The quantity of loans is almost entirely demand-determined" (Moore, 1986, 443-452). In that context, especially The Credit Multiplier Theory criticizes traditional "Money Multiplier" idea and the Quantity Theory of Money in terms of particularly money supply and creation process. Because, "The supply of money is a dependent variable, not an independent one... A bank's main task is to monetize debts... Precisely as the dictum says, 'loans create deposits'... The bank is not an intermediary between the depositors and the borrowers: it is simply an institution specializing in the creation and cancellation of money... Money is not just a stock it is also flow... Private credit precedes bank credit."(Bourva, 1992, 447-466).

Werner (2014, 1-19), opposes the traditional financial intermediation approaches regarding the place of banks in an economy and money supply, and states that the most important feature of banks is that they can create new deposits (money) by opening new loans without even needing any resources. Werner (2014, 1-19) mentions three theories regarding the monetary dimension of banking. These are "Financial Intermediation Theory of Banking", "Fractional Reserve Theory of Bank-

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ing" and "The Credit Creation Theory of Banking". Among these theories, it is stated that the dominant view is those who claim that banks create banking money as very important financial intermediaries. However, it is argued that banks do not necessarily need deposits to open new loans; on the contrary, deposits are a result of newly opened credits. The most important feature of banks is their credit creation functions. Finally, Werner (2014) argues that banks can create money (deposit) without resorting to any source through credits, unlike the traditional financial intermediation approach.

The traditional financial intermediation perspective sees banks as institutions that accept deposits and provide loans with these deposits. However, that the banks finance themselves through the money creation process has become quite common view. Banks are not just considered as payment institutions, they are accepted as monetary institutions. The source of loans is not savings, but the result of the financing (money creation) process of banks, and savings are seen as a result of lending itself, not as an antecedent. The externally determined reserves or deposits do not determine the banks' tendency and possibility to lend, only the banks' concerns and regulations such as profitability and financial adequacy (bankruptcy risk) limit their tendency to lend. For this reason, there will be no technical limit for credit and deposit stocks. Therefore, the impact and importance of the banking and credit (increase) process for the real sector and the economy goes far beyond the traditional financial intermediation perspective (Jakab & Kumhof, 2015). That's why, it is stated that deposits are only records that show which customers the banks owe and how much they owe, and the main factor that creates new deposits is the opening of new credits. It is even claimed that the opening of new loans is not directly related to deposits or bank reserves. As soon as banks lend to someone or buy their assets, the broad definition of money supply increases, because the main source of new deposits is the extending new loans (Mcleay et. al., 2014, 2-14). Essentially, banks create purchasing power with the financing opportunities they provide through their own balance sheets. The most important constraint banks face while creating this purchasing power is their profit targets. Policy rates and other legal obligations are more effective in determining credit volume, rather than central banks' reserve and other policies. In particular, capital and liquidity regulations for banks can be seen as the most important factors limiting credit growth. Therefore, today, banks produce new deposits as a result of the financing process itself, far beyond a simple financial intermediation activity. Banks give credits with loan agreements made in terms that differ according to the customer and risk perception. Banks have to operate subject

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to minimum capital and other requirements, in accordance with the regulations framed by the Basel rules (Jakab & Kumhof, 2015).

Historically, when we look at the development process of money and finance, credit or debt, can be considered as an even older concepts and institutions than money. The emergence of banks is closely related to loans, due to the effectiveness of making loans available through more organized and systematic institutional structures. It is clear that deposit is a concept and institution that emerged after the credit and banking. Although deposit is not the only reason for existence or starting point, it is essentially a result of banks' new resource needs. Its historical development also confirms that deposit is, in a way, a product of credit. Sure, the banks' only function is not to create deposits through new loans. It would not be a very reasonable point of view to describe banks as only "credit (money) factories". Just as banks are a significant money supply institution, they are financial intermediaries that provide information and confidence, primarily for loan customers and depositors, as well as risk and liquidity management. The capacity and ingenuity of banks on their own, especially in terms of credit and deposit creation, is very clear. It is possible for banks to provide loans by their own means without the need for deposits in the first place, and then create new deposits. However, it is not immediately possible for a bank to gain confidence in the market as a reputable institution and reach a certain volume in its activities. In particular, it is essential for a bank to reach a certain weight in the market and to expand its customer profile, to continue its more effective and efficient operations. For this reason, funds of depositors who have no direct or indirect relationship with the loan are extremely important for banks, especially in the early periods. As a result, although the criticisms against the traditional deposit-based banking money multiplier concept and the approach that banks are only financial intermediaries are quite valid, it should not be underestimated that the role of households in the deposit creation process without credits and that deposits are always an important source of funds for the banks (Tiryaki, 2016, 58-60, 71-72).

In Turkish Academia, especially Post-Keynesian views, endogenous money supply and impacts of credits over money supply are quite popular monetary research areas (Togay, 1994, 47-66), (Yozgatlı, 2007). Many of these studies find positive links between money supply and credits. There are three type of findings and causalities in these researches. The most of these studies point out that money supply is endogenous in Türkiye, but the direction of causalities between money supply and credit is questionable. (Karaduman, 2003), (Özgür, 2011, 67-90), (Nesanır, 2014, 115-133),

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(Köksel, 2016), (Aktakaş et al., 2015, 277-287), (Güney & Çepni, 2016) and (Kamacı et al., 2017, 400-409) imply that there is causality from credit to money supply direction. In addition, (Tokucu, 2008), (Aktop, 2010), (Yurtkur, 2019, 131-150), (Demirgil, 2020, 144-152) and (Baştav, 2021, 595-610) find bidirectional casualties between credit and money supply. On the other hand, Kofoğlu (2018) and Yurtkur & Öztunç) (2020, 36-44) present results that suggest that money supply is exogenous in Türkiye. Interestingly (Yurtkur & Öztunç, 2020) claim that credits are created by deposits. Deposits are not directly analyzed in many of these studies and generally, credits are modelled with money supply. In our opinion, the Post Keynesian thought that deposit is a product of credit, is the main hypothesis of these researches. Only (Güney & Çepni, 2016) explicitly mention, "We observe a bidirectional relation between bank loans and deposits. Endogenous nature of money supply still exists and the deposits are found to be significant in our framework."

In addition, Kofoğlu (2018) summarized in detail both the Turkish and international literature on the endogeneity of money supply. Although Kofoğlu (2018) found the opposite in his work, he stated that in more than 30 quantitative studies based on data from both Türkiye and other countries, it was determined that the money supply was largely endogenous. Therefore, in addition to these dominant findings in the literature on the endogeneity of the money supply, it is important to elaborate more on the role of deposits and credits in the money supply. This is the main motivation and purpose of our study.

3. Dynamics of Monetary Variables in Türkiye

Since 2005, the Central Bank of the Republic of Türkiye (TCMB) have calculated special M1, M2 and M3 money defined as follows:

M1: emissions and demand deposits (Turkish Lira (TL-Lira) and Foreign Exchanges (FX)),

M2: M1+time deposits (Turkish Lira (TL-Lira) and Foreign Exchanges (FX)) and

M3: M2+Repo+Money Market Funds + Issued Securities by the Banks (TCMB, 2021).

In Graph 1, quarterly volumes of M1, M2 and M3 in Türkiye can be seen since December 2005.

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Graph 1: Money Supplies of The Central Bank of the Republic of Türkiye (000, Turkish Lira)
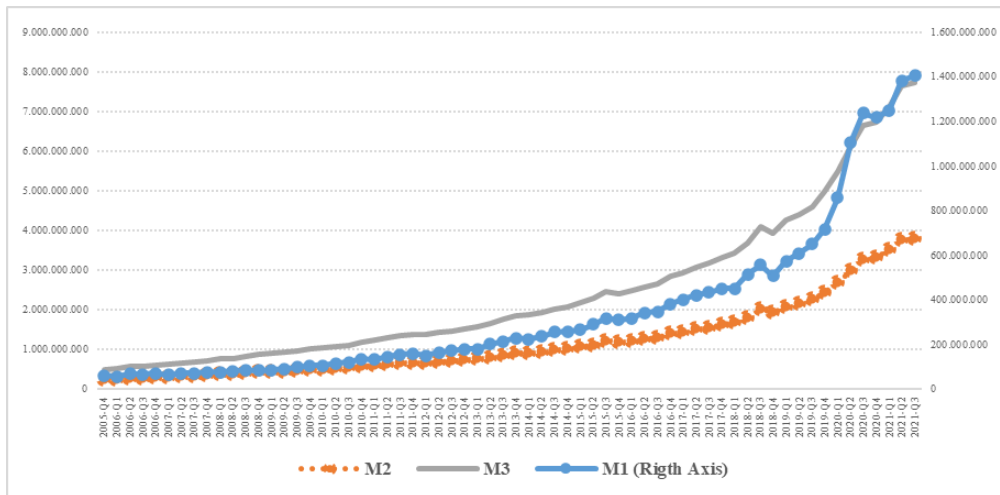
Until the end of 2016, there is a stable trend for volumes of three money definitions as seen in Graph 1. Particularly since 2018, money supplies in Türkiye have risen dramatically. Devaluation of Turkish Lira and domestic price inflation in this period also have significantly increased. As an official and economical part of money supplies, deposits in the Banking System also are very important in the same period.

In Graph 2, credit and deposit volumes of the Turkish banks are exhibited since December 2005. Also since it is an important financial and banking reality, foreign exchange deposits of the Turkish Banking System can be seen in the same period.

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Graph 2: Credits, Deposits and Foreign Exchange Deposits of the Turkish Banks (000, Turkish Lira)
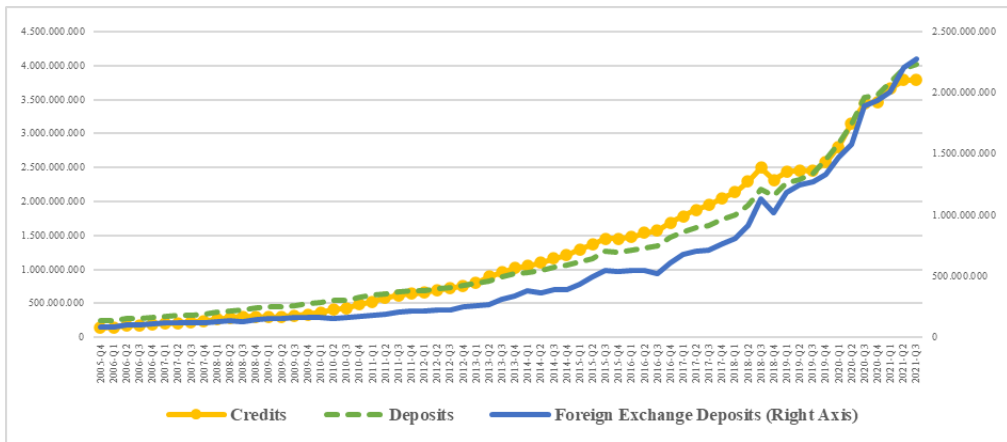
Resource: The Central Bank of the Republic of Türkiye (TCMB), EVDS

After 2016, parallel with money supplies volume in Türkiye, credits and deposits nominally increased drastically. In addition, as an important dollarization indicator in the economy, foreign exchange deposits surged severely in the same period. In that context, two significant banking ratios of Türkiye are shown for the same period in Graph 3.

Graph 3: Two Banking Ratios in Türkiye

Resource: The Central Bank of the Republic of Türkiye (TCMB), EVDS

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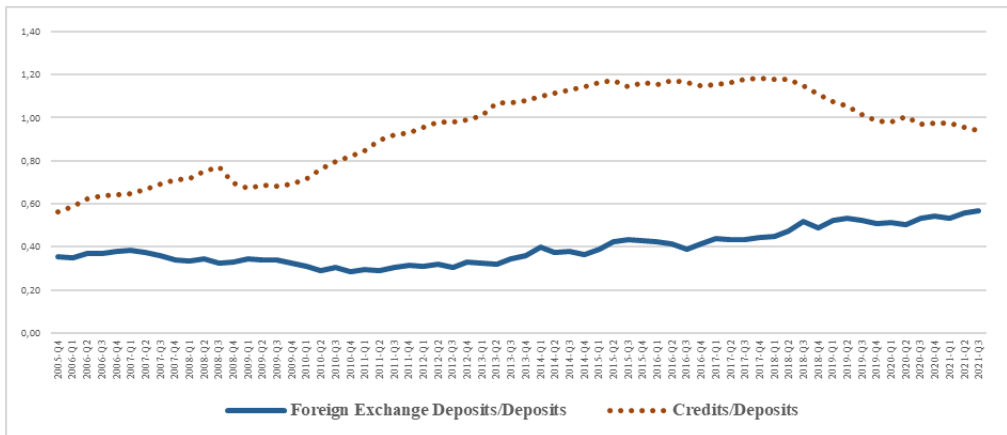
Currently, approximately 100% credits/deposits ratio and over 50% dollarization of deposits are observed in the Turkish banks. In terms of money supply and monetary policy, level of these ratios are also remarkable figures and indicators.

In order to present better view of relationships among M1, M2, M3, credits, deposits and foreign exchange deposits in Türkiye, we also present quarterly changes of these variables between December 2005 and September 2021. These six variables are presented as time series in pairs for allowing better visual patterns in Graphs below.

Graph 4: Quarterly Changes of M1 and Deposits (%)
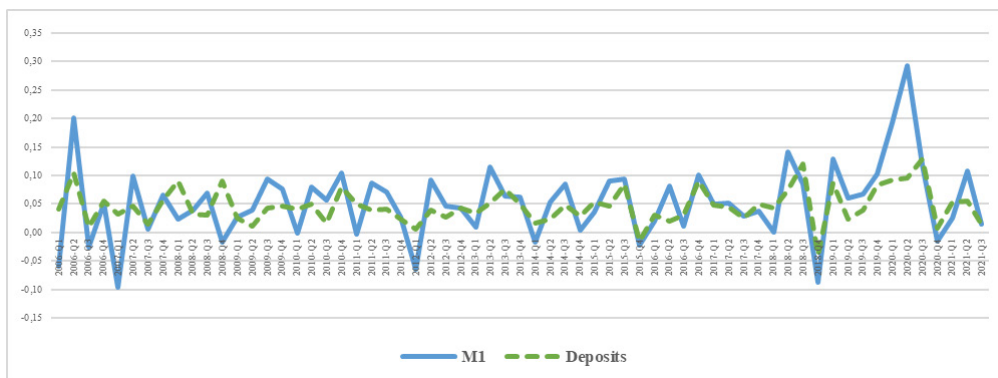
Resource: The Central Bank of the Republic of Türkiye (TCMB), EVDS

Graph 5: Quarterly Changes of M2 and Foreign Exchange Deposits (%)

Resource: The Central Bank of the Republic of Türkiye (TCMB), EVDS

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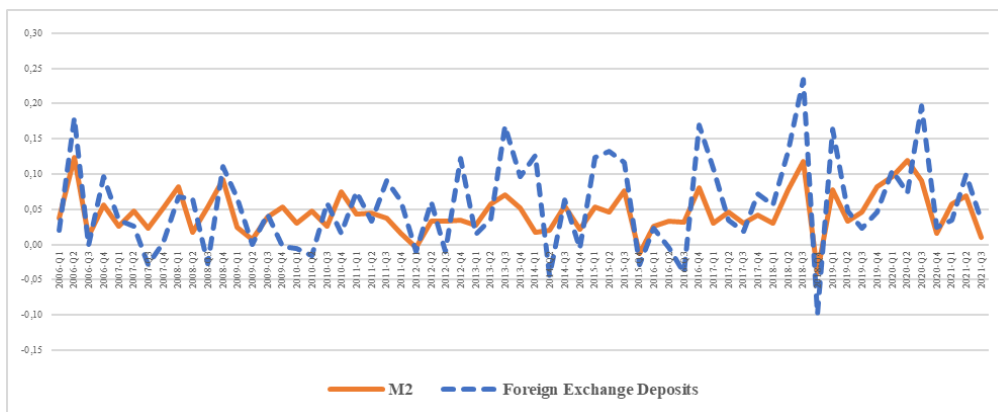
Graph 6: Quarterly Changes of M3 and Credits (%)

Resource: The Central Bank of the Republic of Türkiye(TCMB), EVDS

in Graph 4, 5 and 6, we exhibited changes of six variables time series as example. In Turkish Academia, generally credit numbers, the volume of gross national products, private investments, public and private funding needs and inflation ratios are modelled with the parameters of money supply (M1, M2, M3) in order to analyze the endogeneity of money supply; (Baştav, 2021, 595-610) and (Kofoğlu, 2018) present good summaries in this subject.

4. Econometric Method and Estimation Results

In this section we analyze empirical relationship among money supply, deposits and credits. For this purpose, we first estimate an appropriate econometric model among these var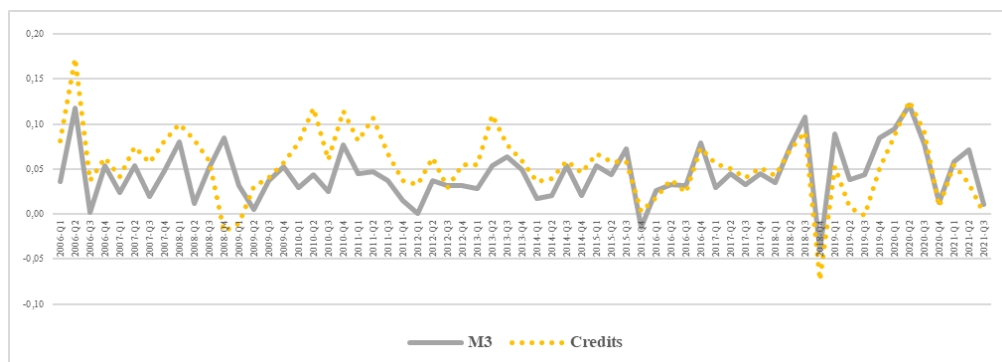iables and then using the estimated models we analyze how a shock in variables propagate in the monetary system. In order to see whether the estimated relationships are dependent on the definition of the money supply, we use all three aggregates, namely M1, M2 and M3 in our analysis. Specifically, we estimate three different models, one for each monetary aggregate, and analyze the relationships among the variables using these models. Also to see whether deposits in foreign currencies have different effects when compared to deposits in Turkish Lira, we use disaggregate data on deposits. The data are taken from the electronic data delivery system of the Central Bank of Republic of Türkiye and cover 2005.Q4 – 2021.Q3 period. We use natural logarithm of all variables in statistical analysis.

Building an appropriate econometric model for the time series requires the knowledge of stochastic properties of the series under consideration. Therefore, the first step in empirical analysis is to test for stationarity of the series. If all the series are stationary, one may estimate a vector autoregressive (VAR) model in level of the

series. On the other hand, if the series contain a unit root, one may test for co-integration of the variables. If the series are co-integrated, the appropriate model will be a vector error correction (VEC) model. If the series are not co-integrated, then one must estimate a VAR for the differenced series provided that the difference series are stationary.

As our aim is to analyze dynamic interactions among all the variables considered, instead of single equation tests for co-integration, which assume that only one of the variables is endogenous whereas remaining variables are exogenous, we use a system approach to test for co-integration. Specifically, we use the Johansen-Juselius co-integration test that is based on vector autoregressive models (Johansen, 1991).

To select the most appropriate model for the variables under consideration we apply preliminary specification tests. First we test for stationarity of the variables. The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are presented below in Table 1. Both tests suggest that all the variables are I(1) processes.

Table 1: Unit Root Test Results

Time Series	ADF		PP	
	Level	Difference	Level	Difference
M1	-1.512	-8.741*	-1.394	-8.709*
M2	-1.007	-8.369*	-0.952	-8.364*
M3	-0.876	-8.757*	-0.711	-8.745*
Credits	-1.996	-5.914*	-1.967	-5.914*
TL Deposits	-2.137	-7.091*	-2.230	-7.098*
FX Deposits	-1.441	-9.270*	-1.100	-9.247*

* Denotes rejection of the null hypothesis of unit root at the 0.01 significance level.
Notes: Test equation for the level of the series includes a constant and trend, but only a constant for the differenced series.

As all the series are integrated of order one, we proceed to test for co-integration among the variables. Below we present the results of analyses for all three models in turn.

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4.1. Relationship among M1, deposits and credits

Table 2 presents results of the co-integration test among (natural logs of) M1 monetary aggregate (LM1), deposits in Turkish Liras (LTLDEP, deposits in foreign currency (LFXDEP) and credits (LCRD)[1]. Both the trace and maximum eigenvalue test statistics suggest a single co-integration among the variables. Therefore, we estimated a vector error correction model for LM1, LTLDEP, LFXDEP, and LCRD.

Table 2: Co-integration tests among M1, deposits, and credits

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability**
None *	0.479450	58.01760	47.85613	0.0042
At most 1	0.170199	18.84544	29.79707	0.5041
At most 2	0.116617	7.651272	15.49471	0.5034
At most 3	0.003518	0.211454	3.841466	0.6456

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Probability**
None *	0.479450	39.17216	27.58434	0.0011
At most 1	0.170199	11.19417	21.13162	0.6279
At most 2	0.116617	7.439818	14.26460	0.4385
At most 3	0.003518	0.211454	3.841466	0.6456

* Denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The coefficients of the estimated level relationship among the variables are reported below in Table 3. As can readily be seen from the table, only the TL deposits have positive and significant effect on money supply whereas both FX deposits and credits have negative but statistically insignificant effect on money supply in the long run. This implies that the observed long-run co-integration relationship among the variables actually stem from the positive relationship between the TL deposits and money supply whereas credits and FX deposits do not belong to the co-integration space.

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[1] All the statistical analyses were carried out using E-views software. Lag structure of the VAR model was chosen using the AIC which has relatively better small-sample properties.

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Table 3: Long run level relationship among M1, deposits and Credits

	Intercept	Credits	TL Deposits	FX Deposits
Variables and Coefficients Estimated Equation: $M1 = \beta_0 + \beta_1 Credits + \beta_2 TLDeposits + \beta_3 FXDeposits$				
Coefficients	44.652	-0.814	4.930*	-0.950
Standard Error		(1.06651)	(1.47620)	(0.58368)
T-Statistics		(0.76284)	(3.33969)	(1.62807)

* Denotes statistical significance at the 0.01 level

The dynamic propagation of shocks in the variables are analyzed using impulse-response analysis. Graph 7 below presents calculated responses to one standard deviation shocks in the variables. As can be seen from the graphs below the innovations in the money supply leads to an increase in TL and FX deposits as well as credits. A shock in the FX deposits causes to a fall in TL deposits. Money stock and credits responds positively to the FX shocks only in the first period after the shock. On the other hand, shocks to TL deposits increases money stock and credits. FX deposits initially fall then rise in a response to a shock in Lira deposits. Credit shock leads to a rise in all the variables. However, it is remarkable to note that credit shocks increase FX deposits for a longer period when compared to TL deposits. The interaction of deposits in TL and FX implies a strong currency substitution.

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Graph 7: The impulse response functions of the first model

Response to Generalized One S.D. Innovations
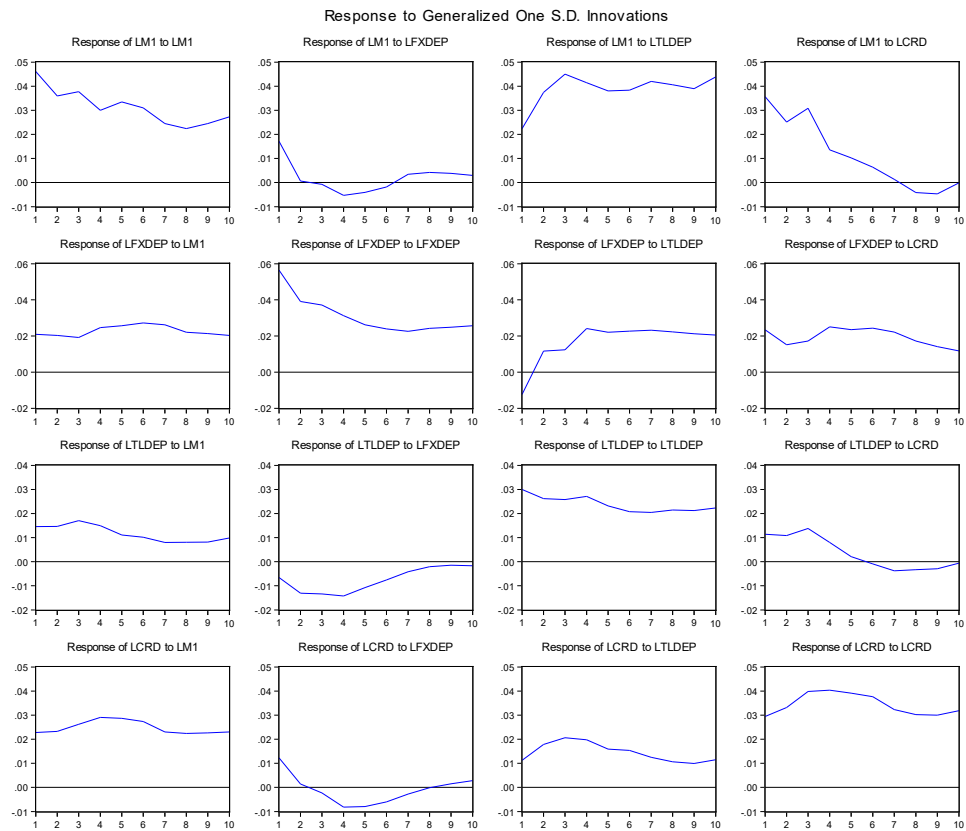
In order to analyze relative contribution of each variable in fluctuations of other variables we use variance decomposition. Table 4 below reports variance decompositions from the estimated VEC model.

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Table 4. Variance Decomposition of M1, Deposits and Credits

Variance decomposition of LM1					
Period	S.E.	LM1	LFXDEP	LTLDEP	LCRD
4	0.091708	68.23832	8.962571	19.76124	3.037869
8	0.140135	45.43594	6.785206	26.22152	21.55733
12	0.183960	34.15274	4.644811	31.60582	29.59663
Variance decomposition of LFXDEP					
Period	S.E.	LM1	LFXDEP	LTLDEP	LCRD
4	0.096564	19.55384	59.13785	19.47075	1.837567
8	0.122591	29.25974	43.57267	25.61497	1.552615
12	0.147840	27.80261	36.91209	30.85614	4.429161
Variance decomposition of LTLDEP					
Period	S.E.	LM1	LFXDEP	LTLDEP	LCRD
4	0.058922	27.07317	42.35942	29.71417	0.853237
8	0.079099	20.67346	31.39107	34.06600	13.86947
12	0.095541	18.62145	23.26458	39.88911	18.22487
Variance decomposition of LCRD					
Period	S.E.	LM1	LFXDEP	LTLDEP	LCRD
4	0.081639	38.86653	9.942090	0.740839	50.45054
8	0.117484	37.62746	11.57652	1.677058	49.11896
12	0.136998	39.24297	9.485508	1.570780	49.70074
Cholesky Ordering: LM1 LFXDEP LTLDEP LCRD					

The Cholesky ordering in variance decomposition is sensitive to ordering of variables. In Cholesky decomposition, the variables that are positioned after a variable are assumed to have lesser effect while variables positioned before a variable are assumed to have greater effect, and the variable positioned last is assumed to have the least effect on the other variables. Therefore, in order to check robustness of specific ordering of variables we have tried all possible combinations. But the results were qualitatively similar to those reported in this paper. In order to save space, we do not report results with other orderings, which are available upon request.

It is interesting to observe that the Lira deposits have the largest contribution to fluctuations in the M1 monetary aggregate although Lira deposits were positioned after FX deposits in Cholesky decomposition. Notice also that Lira deposits also explain the largest part of fluctuations in FX deposits. On the other hand FX deposits have relatively bigger contribution to fluctuations in credits when compared to Lira

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deposits. Largest part of fluctuations in credits is attributable to money innovations. Fluctuations in Lira deposits are mostly explained by FX deposits. M1 and credits contribute equally to fluctuations in Lira deposits in the longer run.

4.2. Relationship among M2, deposits and credits

Table 5 presents results of the co-integration test among (natural logs of) M2 monetary aggregate (LM2), deposits in Turkish Liras (LTLDEP, deposits in foreign currency (LFXDEP) and credits (LCRD). Both the trace (although at 10% significance level) and maximum eigenvalue test statistics suggest a single co-integration among the variables. Therefore we estimated a vector error correction model for LM2, LT-LDEP, LFXDEP, and LCRD.

Table 5: Co-integration tests among M2, deposits, and credits

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability**
None	0.367055	47.27603	47.85613	0.0566
At most 1	0.154669	18.91901	29.79707	0.4988
At most 2	0.127978	8.501318	15.49471	0.4135
At most 3	0.000177	0.010988	3.841466	0.9163

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Probability**
None *	0.367055	28.35701	27.58434	0.0398
At most 1	0.154669	10.41770	21.13162	0.7048
At most 2	0.127978	8.490329	14.26460	0.3310
At most 3	0.000177	0.010988	3.841466	0.9163

* Denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The coefficients of the estimated level relationship among the variables are reported below in Table 6. As can readily be seen from the table, both the Lira and FX deposits have positive and significant effect on money supply whereas credits have negative and statistically significant effect on money supply in the long run. Notice that although both Lira and FX deposits have positive effects on M2 as expected, Lira deposits have stronger effect than the FX deposits.

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Table 6: Long run level relationship among M2, deposits and Credits

	Intercept	Credits	TL Deposits	FX Deposits
Variables and Coefficients Estimated Equation: $M2 = \beta_0 + \beta_1 Credits + \beta_2 TLDeposits + \beta_3 FXDeposits$				
Coefficients	-0.182296	-0.189823*	0.808187*	0.427807*
Standard Error		(0.02090)	(0.02919)	(0.01150)
T-Statistics		[-9.08252]	[27.6893]	[37.1972]

* Denotes statistical significance at the 0.01 level

The dynamic propagation of shocks in the variables are analyzed using impulse-response analysis. Graph 8 below presents calculated responses to one standard deviation shocks in the variables. As can be seen from the graphs the innovations in M2 monetary aggregate leads to an increase in all the variables although monetary shocks have greater effects on the FX deposits when compared to Lira deposits or credits. A shock in the FX deposits causes to a fall in Lira deposits. Credits respond positively to the FX deposit shocks only in the first period after the shock whereas the effect of the shock turns to negative starting from the second period. Only M2 responds positively to the FX deposit shocks. On the other hand, shocks to Lira deposits increases money stock and credits. FX deposits falls with a shock in Lira deposits although the effect of shock vanishes after the first period. Credit shock leads to a rise in all the variables. Notice also that the interaction of deposits in Lira and FX in this model also implies a strong currency substitution.

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Graph 8: The impulse response functions of the second model

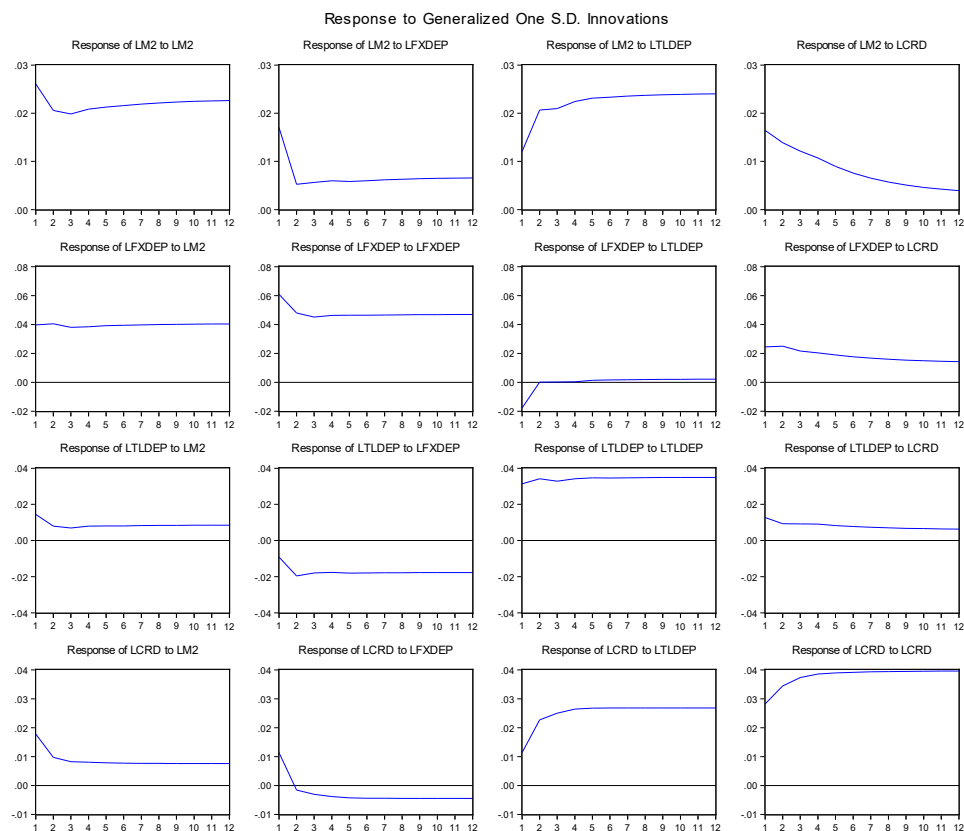Response to Generalized One S.D. Innovations

Table 7 below reports variance decompositions from the estimated VEC model. Notice that relatively greater part of fluctuations in M2 monetary aggregate can be explained by shocks to Lira deposits and credits although FX deposits were placed before these variables in Cholesky decomposition. Although the ordering of the variables imply that credits have the least effect on all the variables, credits contribute the most to fluctuations in M2 after 8 quarters. However, combined contribution of FX and Lira deposits far exceed the contribution of credits to fluctuations in money supply. Also notice that contribution of credits to fluctuations in FX deposits are greater than the contribution of the Lira deposits. Another interesting result is that FX deposits have greater effect on Lira deposits when compared to effects of the M2 aggregate although the ordering of the variables impose greater importance on M2. Finally notice that Lira deposits have the largest effect on credits. Also note that FX deposits have greater effect than the M2 aggregate.

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Table 7: Variance Decomposition of M2, Deposits and Credits

Variance decomposition of LM2					
Period	S.E.	LM2	LFXDEP	LTLDEP	LCRD
4	0.051013	74.22824	11.90763	11.04026	2.823870
8	0.078919	61.31994	12.28890	14.03389	12.35727
12	0.102645	55.45558	11.68708	13.95567	18.90166
Variance decomposition of LFXDEP					
Period	S.E.	LM2	LFXDEP	LTLDEP	LCRD
4	0.104670	55.94313	40.48940	2.531019	1.036443
8	0.146547	57.67423	34.53633	3.702876	4.086562
12	0.180806	57.70548	31.71421	4.033637	6.546671
Variance decomposition of LTLDEP					
Period	S.E.	LM2	LFXDEP	LTLDEP	LCRD
4	0.068344	8.216137	74.04283	17.67941	0.061619
8	0.099174	6.605386	73.36446	19.66678	0.363368
12	0.122816	6.201560	72.79027	20.22779	0.780382
Variance decomposition of LCRD					
Period	S.E.	LM2	LFXDEP	LTLDEP	LCRD
4	0.084419	7.624431	5.313519	35.67649	51.38556
8	0.131392	4.522375	5.771735	39.16418	50.54171
12	0.166049	3.667641	5.858630	39.91056	50.56317
Cholesky Ordering: LM2 LFXDEP LTLDEP LCRD					

4.3. Relationship among M3, deposits and credits

Table 8 presents results of the co-integration test among (natural logs of) M3 monetary aggregate (LM2), deposits in Turkish Liras (LTLDEP, deposits in foreign currency (LFXDEP) and credits (LCRD). Both the trace and maximum eigenvalue test statistics suggest that the variables are not co-integrated at conventional significance level. This implies that there was no stable long-run relationship among the level of variables during the analyzed period.

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Table 8: Co-integration tests among M2, deposits, and credits

Unrestricted Cointegration Rank Test (Trace)

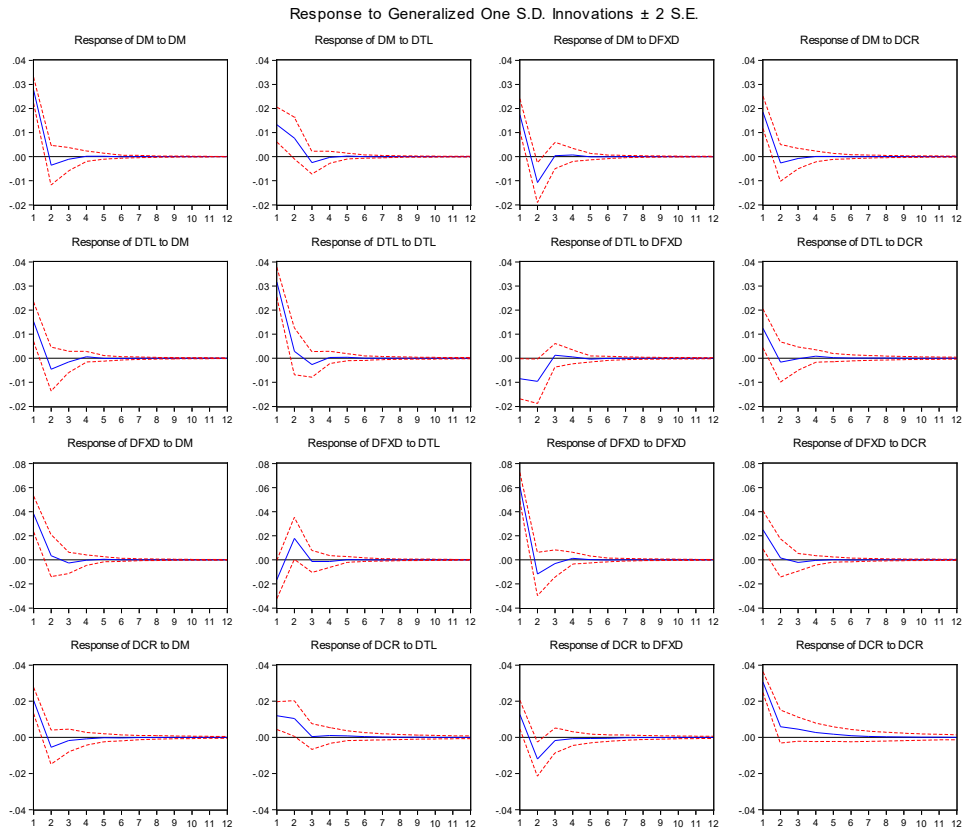| Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.263464	35.71052	47.85613	0.4111
At most 1	0.158834	16.75112	29.79707	0.6584
At most 2	0.088281	6.027224	15.49471	0.6923
At most 3	0.004778	0.296955	3.841466	0.5858

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.263464	18.95940	27.58434	0.4176
At most 1	0.158834	10.72390	21.13162	0.6748
At most 2	0.088281	5.730268	14.26460	0.6481
At most 3	0.004778	0.296955	3.841466	0.5858

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Since there variables are not-cointegrated we estimated a VAR model for the difference of the series. Short-run dynamic interaction among variables are analyzed via impulse-response functions and variance decomposition.

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Graph 9: The impulse response functions of the third model

Response to Generalized One S.D. Innovations ± 2 S.E.

Calculated impulse-response functions imply that a shock in Lira deposits and Credits have positive and statistically significant effect on M3 although these effects are limited to only one period following the shock. On the other hand, M3 first rises then falls as a response to a shock in FX deposits. Lira deposits responds positively to shocks in M3 and credits. FX deposits have negative and statistically significant, albeit marginally, effects on Lira deposits. On the other hand, Lira deposits have no statistically significant effect on FX deposits while shocks to M3 and credits have positive and statistically significant effects on FX deposits. Finally, shocks to M3 and Lira deposits have positive effect on credits although their effects vanish after second period following the shock. On the other hand, M3 first rises then falls as a response to a shock in FX deposits.

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Table 9: Variance Decomposition of M3, Deposits and Credits

Variance decomposition of DM					
Period	S.E.	DM	DFXD	DTL	DCR
4	0.030168	85.08661	13.61518	1.174572	0.123646
8	0.030169	85.08176	13.61921	1.175245	0.123781
12	0.030169	85.08176	13.61921	1.175247	0.123783
Variance decomposition of DFXD					
Period	S.E.	DM	DFXD	DTL	DCR
4	0.033454	36.11452	62.52382	1.204872	0.156790
8	0.033460	36.11700	62.52031	1.205030	0.157662
12	0.033460	36.11699	62.52030	1.205033	0.157674
Variance decomposition of DTL					
Period	S.E.	DM	DFXD	DTL	DCR
4	0.063917	22.76064	55.72402	20.89672	0.618614
8	0.063919	22.75328	55.71707	20.89534	0.634305
12	0.063919	22.75322	55.71691	20.89533	0.634533
Variance decomposition of DCR					
Period	S.E.	DM	DFXD	DTL	DCR
4	0.037373	32.20799	8.751316	9.386526	49.65417
8	0.037525	31.96071	8.721983	9.442376	49.87493
12	0.037527	31.95749	8.721422	9.443298	49.87779
Cholesky Ordering: DM DFXD DTL DCR					

FX deposits have the largest contribution to fluctuations in the M3 monetary aggregate and Lira deposits. M3 monetary aggregate has the largest contribution to fluctuations in credits and FX deposits. It is also worthwhile to note that Lira deposits have greater effect on credits when compared to FX deposits.

5. Conclusion

In the economics literature, the endogenous or exogenous nature of the money supply is an argumentative topic. Especially recently, the effect of financial intermediation and banks on money supply is a serious matter of discussion. There are different approaches to the effect of credits on deposits and money supply. In particular, it has become an increasingly popular argument that banks do not need deposits to create loans. In this study, we analyzed dynamic interaction among deposits, credits and money supply. In order to check robustness of our analysis for

different definitions of money, we performed the same analysis for M1, M2, and M3 monetary aggregates. Specifically, we analyzed long-run level relationship as well as short-run dynamic interactions among monetary aggregates, Lira deposits, FX deposits and credits.

We found co-integration among deposits, credits and money stock only for M1 and M2 but not for M3 monetary aggregate. As M3 includes money market instruments such as repo, money market funds and securities issued by banks in addition to deposits, this result implies that level of these instruments do not move with deposits and credits. These instruments might share common dynamics with government securities which may explain why we fail to find co-integration when we proxy money stock with M3. Our results also suggest that the co-integration relationship among M1, deposits and credits stem from the relationship between Lira deposits and M1. When we used M2 money aggregate, FX deposits and credits, we found that all the variables belong to co-integration space whereas both deposits have a positive and significant effect on money supply but credits have a negative effect on it. This finding implies that credits cannot be seen as one of the crucial determinants of the money supply in the long run.

Dynamic interaction among variables were analyzed using impulse-response functions. We also used variance decomposition to assess relative importance of each variable in explaining dynamics of other variables. Our results suggest that variations in M1 are mainly explained by fluctuations in Lira deposits followed by credits. Also, shocks to Lira deposits have relatively larger effects on M1 when compared to credits. On the other hand, we find that variations in M2 are mainly explained by credits followed by Lira deposits. M3, on the other hand, is mainly explained by both FX and Lira deposits. The effect of credits on deposits are found to be limited. In particular, we find that fluctuations in either FX or Lira deposits are mainly explained by money supply or Lira and FX deposits. We also find strong currency substitution effect. In particular we find that FX deposits rise with money supply and credits but fall with Lira deposits. Similarly, Lira deposits fall with FX deposits.

All in all, we find a strong relationship among money supply, deposits and credits both in the short and long run. While our results imply that money supply rise with credits and variations in credits contribute significantly fluctuations in money supply, credits are not the most important determinant of the money supply. Combined effects of Lira and FX deposits far exceed the effect of credits on money supply. Also, our results suggest that deposits are the main factor explaining credits. Thus,

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although we find that credit expansion may lead to a rise in money supply, credits are not the main determinant of money stock in the case of Türkiye.

Despite the dominant view of money supply endogeneity in the literature, we could not reach a strong finding about the endogeneity of money supply in our study. It can be said that modern money and money supply are complex and highly variable concepts and parameters. For this reason, it is necessary to approach to definite and forceful views about the source and direction of the money supply with caution. The same can be said about the relationship among deposits, credits and the money supply. In conclusion, it can be mentioned that there is an interconnected and complicated relationship between money supply, deposit and credit. Therefore, it would be beneficial for further research on this subject to focus on elucidating the intricate network of relations among money supply, deposits and credits.

* The views expressed in this paper are solely of the author, and do not necessarily reflect the views of the Banking Regulation and Supervision Agency.

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