THE ROLE OF ELECTRONIC PAYMENTS IN INFLATION DYNAMICS

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Abstract

The technological progress is transforming economy, trade and also their determinants and dynamics. Technological developments have serious effects on payment services, especially in the last 20 years. The world has been in a low inflation period compared with the previous periods. In this context, this study investigates the relationship between electronic payments and inflation dynamics in Turkey. A single equation model with the electronic payments variables is applied with quarterly data between 2005:3 – 2016:3. In the equation, the total number and total volume of transactions in the electronic fund transfer system are used as proxies for the real economy and monetary policy actions. The estimation results show that both the volume and number of transactions have effects on inflation dynamics.

Keywords: *Inflation Dynamics, Electronic Payments, Electronic Fund Transfer Systems*
JEL Classification: *C22, E31, E42*

ELEKTRONİK ÖDEMELERİN ENFLASYON DİNAMİKLERİ ÜZERİNDEKİ ROLÜ

Öz

Teknolojik ilerlemeler ekonomiyi, ticareti, aynı zamanda bunların belirleyicileri ve dinamiklerini dönüştürmektedir. Özellikle son 20 yılda, teknolojik gelişmeler ödeme sistemleri üzerinde ciddi etkilere yol açmıştır. Dünya daha önceki dönemlerle kıyaslandığında daha düşük enflasyonun yaşandığı bir dönemdedir. Bu bağlamda olmak üzere, çalışmamız Türkiye'de elektronik ödemeler ile enflasyon dinamikleri arasındaki ilişkiyi araştırmaktadır. 2005:3 -2016:3 dönemleri arasındaki 3'er aylık veriler kullanılarak elektronik ödemeler değişkenlerini içeren tek denklemli bir model uygulanmaktadır. Denklemde elektronik fon transfer sistemindeki toplam işlem sayısı ve toplam işlem hacmi reel ekonomi ve para politikası işlemleri için vekil olarak kullanılmaktadır. Tahmin sonuçları hem işlem sayısı hem de işlem hacminin enflasyon dinamikleri üzerinde etkili olduğunu göstermektedir.

Anahtar Kelimeler: *Enflasyon Dinamikleri, Elektronik Ödemeler, Elektronik Fon Transfer Sistemleri*
JEL Classification: *C22, E31, E42*

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1. Introduction

Related with the new millennium's technological climate, every aspect of life is in a transformation mode. Economy and trade are at the center of this transformation. In this transformation, payment systems are not exceptions. In every part of payments systems, there are huge transformations including the migration of paper based instruments to electronic based instruments. The transformations of electronic based instruments in payment systems have been still going on consistent with the technological changes. With these changes there occurs lots of changes, new products and new mechanisms in every aspect of electronic payment systems (From now on we will use payment systems instead of electronic payment systems.).

As a service, central banking has been developing along with the progress in money and monetary policy (Rumelili Koç, 2019). Since money is the primary actor of any kind payments, payment concept has always attracted the attention of central banks. Payment systems are the backbone mechanisms for the payment processes with the institutional and organizational framework and include high level technological components for providing efficient functioning of the financial system and economy. As financial integration increases between the countries, the number and the volume of financial transactions increase. The platforms, in which the global and local financial transactions occur (payment systems), become important elements of a good running economy. In other words, payment systems are the crucial elements of effective and good working financial markets. Money supply linked with the velocity of money and transaction costs, are the two main bridges of payment systems to financial markets (Listfield and Negret, 1994; Rumelili, 2006). So that payment systems have been the critical working areas for central banks, especially for the last 30 years.

Monetary authorities begin to deal with payment systems as a political instrument instead of an operational instrument since financial stability becomes one of the main issues of central banks. Payment system as a whole is a transfer and regulatory system for money. In order to implement monetary policy efficiently, the central banks need efficient payment systems for the transmission of monetary policy. A central bank is highly dependent on payments systems for controlling the price level with the interest rate and liquidity policies (Rumelili, 2006).

With the open market operations, monetary policy operations are transmitted implicitly to the financial and real sector. As the efficiency of open market operations is directly related with the timing of these operations, the infrastructure of payment and settlement operations play a critical role. Being in the core of this study, electronic fund transfer (EFT) systems, which are the main infrastructure of payment systems, have been evolving with the developments in information technology. As the diversity and range of products in payment systems increase, the non-cash transactions also increase year by year (World Payment Report, 2019).

Zandi *et al*. (2016) calculated the contribution of electronic payments to GDP in 70 countries between 2011 and 2015 as 296 billion USD. They also found that the contribution of electronic payments was equivalent to the creation of about 2,6 million jobs per year. In the Perryman Group Report (2015), it is mentioned that the payment systems make the payments faster and easier and as a whole increase the efficiency. Consequently, these systems facilitate and increase consumer spendings. Finally, production and GDP increase more than it would have otherwise and consequently, this will lead to inflationary pressure in the economy.

In several studies, it is argued that payment systems increase the velocity of money by increasing the number of transactions (Geanakoplos and Dubey, 2010; The Perryman Group Report, 2015; Schoellner, 2002). The increase in the velocity of money will also have an effect on the general price level and inflation. As price stability becomes one of the major policy of the central banks, implicit or direct inflation target oriented monetary policies become a de-facto framework for the central banks. The widespread use of technology-driven financial innovations reduces the liquidity preference in the economy while increasing the circulation rate of money. Increases in financial

innovations cause changes both in money supply and money demand and thus make the money supply an endogenous variable which is more difficult to control. This situation causes a more problematic environment for the central banks which are trying to hit the price stability target (Goldfeld and Sichel, 1990; Kogar, 1995; Oktayer, 2011)

In this study, we explore the relationship between electronic payments and inflation. We use EFT variables as proxies for electronic payment variables. With this introduction our paper has the following sections: In the next section, we give some information about EFT system and inflation dynamics in Turkey. In section 3, we set up the theoretical framework regarding the literature. In Section 4, the empirical model, data set and the empirical results are given and finally in Section 5, we provide some implications of our study.

2. Electronic Fund Transfer And Inflation Dynamics In Turkey

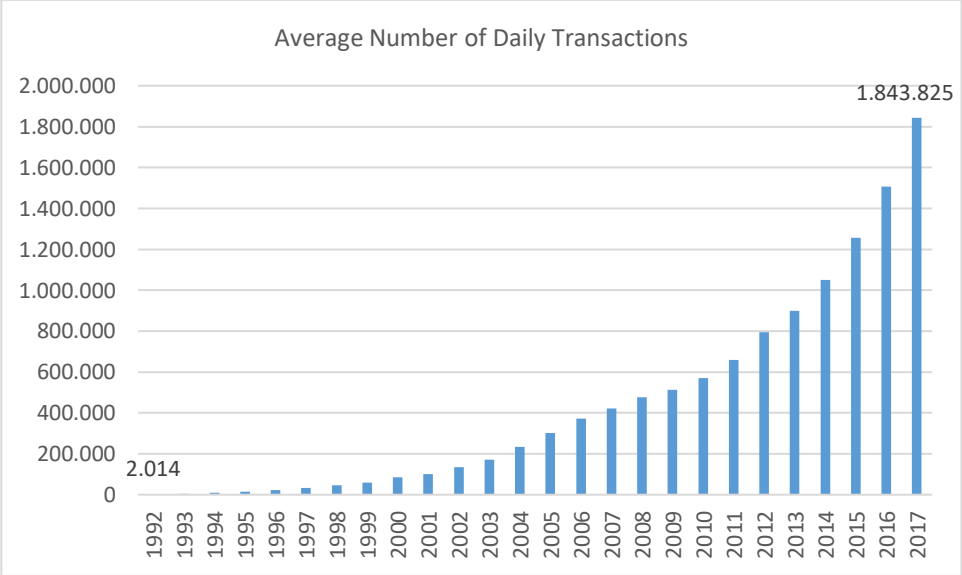
2.1. EFT in Turkey

In Turkey, the interbank transfer system (named as Electronic Fund Transfer (EFT) System) has been operating since 1992. The operation has been performed by The Central Bank of the Republic of Turkey (CBRT). In EFT System, it is possible to transfer Turkish Lira between the customers of different banks with an infrastructure in which operations are done in a real-time transfer and real-time gross settlement system. After the first generation of the EFT system, in 2000 the second generation and in 2013 the third generation was put into service (CBRT Web Site).

As indicated in (CBRT Web Site), the major features of the EFT system are; transferring the money among the banks in a faster and safer way at lower costs. By EFT, banks can manage their funds easily and more effectively.

As can be seen in Figure-1, beginning with only two thousands of transactions per day in 1992, the EFT system reached a number of 84505 average transactions in 2000. The system exceeded one million average daily transactions in 2014. And finally, in 2017 it reached 1843825 average transactions per day.

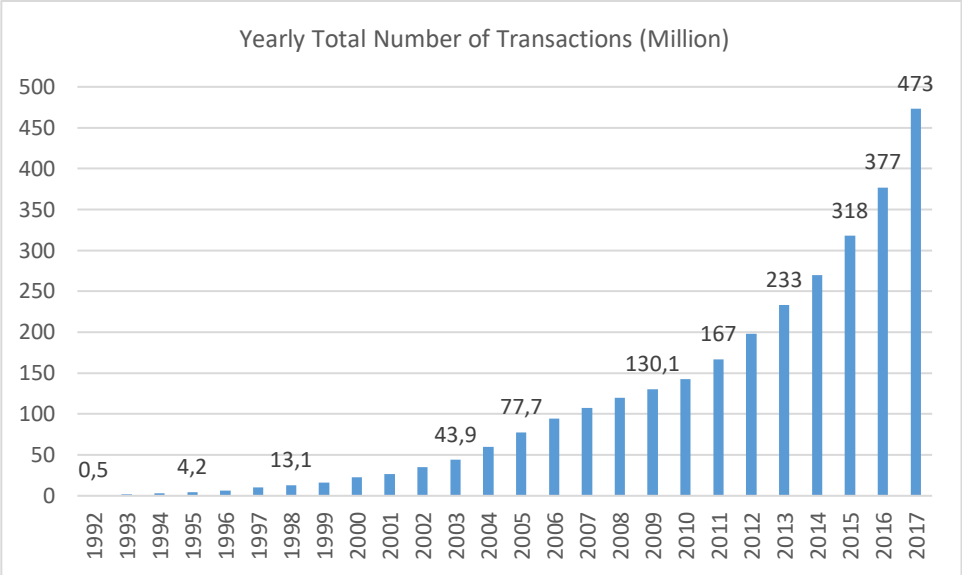
Figure-1: **Average Number of Daily Transactions.**



Source: CBRT

The yearly total number of transactions are given in Figure-2. In the first year (1992) of EFT system yearly total number of transactions was 500.000 and reached to 22,8 million in 2000, and it exceeded 100 million in 2007 and finally, it was 473 million in 2017.

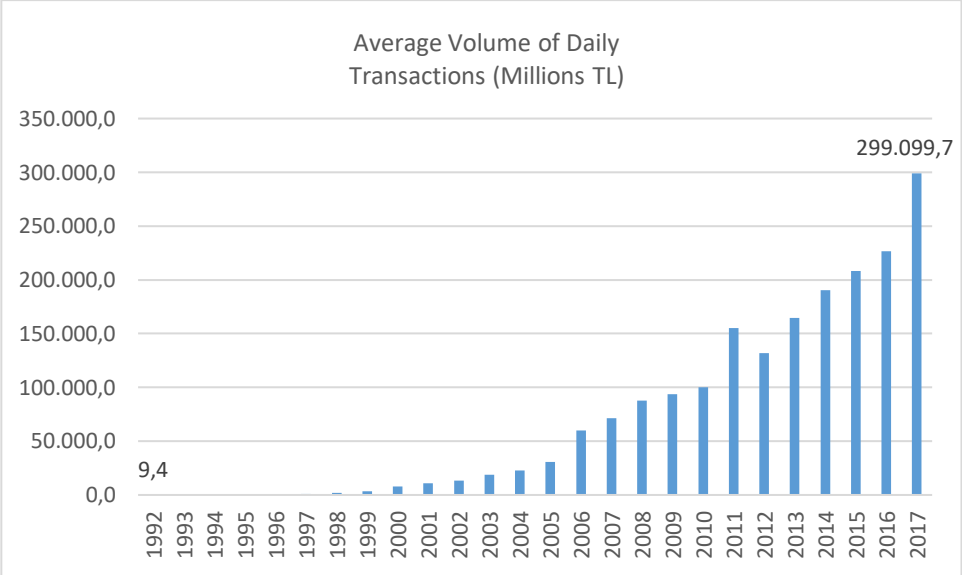
Figure-2: **Yearly Total Number of Transactions.**



Source CBRT

As can be seen in figure-3, on the volume side, there is a similar increasing pattern. In 1992, the system began with a 9,4 million TL of volume on a daily average basis. The average volume exceeded one billion in 1998 and reached to 1,8 billion TL. It was 100 billion in 2010 and 299,1 billion in 2017.

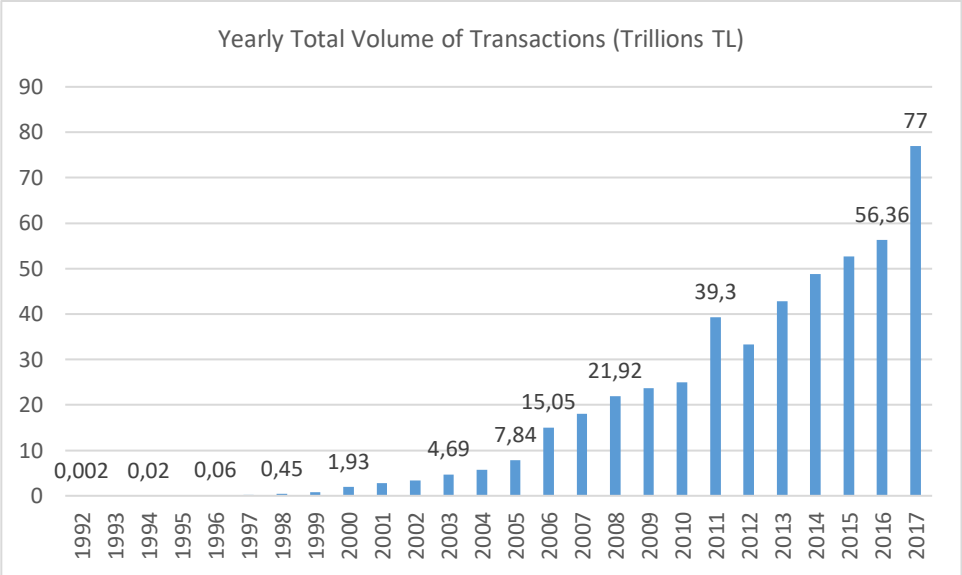
Figure-3: **Average Volume of Daily Transactions**



Source: CBRT

In Figure-4 the yearly total volume of transactions is given. The total volume was 2 billion TL in 1992. The total volume increased 965 times in the next 8 years and reached 1,93 trillion TL in 2000. In 2010 the total volume was 25 trillion TL and finally, in 2017 it was 77 trillion TL.

Figure-4: **Yearly Total Volume of Transactions.**



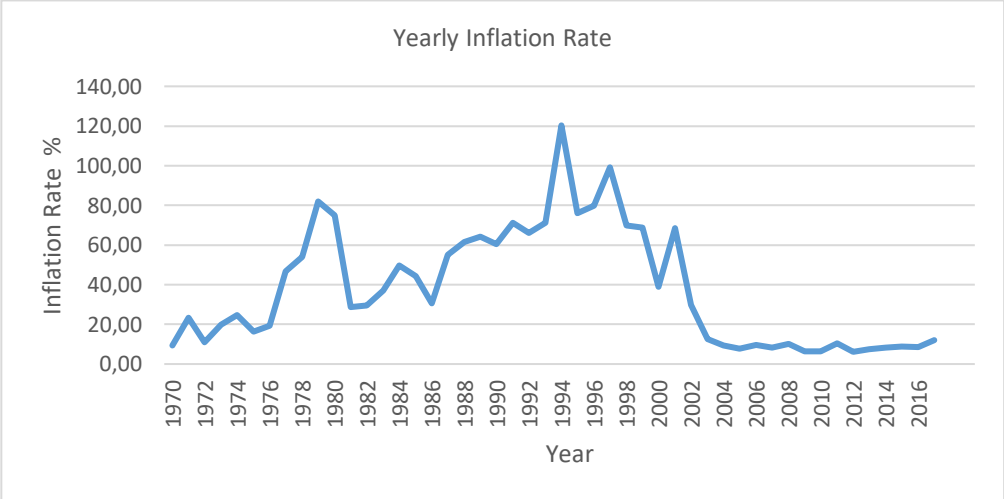
Source: CBRT

The figures 1-4 indicate an increasing pattern that is compatible with the technological development and increasing use of technological equipment in the banking sector. In 2017, there were 51.922.000 customers who were registered and logged in to internet banking at least once in one year period and the total number of transactions in July-September 2017 period is 126 million and the total volume of transactions in the same period is 1,1 trillion TL (The Banks Association of Turkey, 2017).

2.2. Inflation in Turkey

In 1980, the Turkish Government announced an economic stabilization program which was far away from the ongoing economic policy. The new program was targeting to liberalize the Turkish economy.

Figure-5: Yearly Inflation Rate of Turkey



Source: CBRT

The graphical presentation of inflation rates in Turkey between 1970-2017 is given in Figure-5. The 1980s was the period of the preliminary steps of liberalization. In that period privatizations

began and the exchange rate regime was liberalized for foreign portfolio and direct investments. The 1990s were still the period that privatizations were in progress and that inflation was out of control and high. In 1994, Turkey faced with an economic crisis and the measures taken after the crisis were neither enough to decrease inflation, nor to control public finance. This period ended with another crisis in 2001, which was a critical moment both economically and politically for Turkey. Since 2001 crisis was the most destructive one compared to the previous crises, taken actions were unprecedented and very strict (The details of these actions can be found in CBRT web site: www.tcmb.gov.tr). With the amendment of CBRT law, price stability has become the primary objective of the bank. Implicit inflation targeting regime was implemented between 2002 and 2005. After 2006 CBRT began to explicit inflation targeting and during this time inflation was reduced to less than 10%. Following the 2008-2009 global financial crisis, the CBRT added financial stability to its goals in addition to price stability. For achieving financial stability objective, an unorthodox policy with more than one policy rate was followed in a wide interest rate corridor. With the application of new interest rate corridor policy, CBRT developed an instrument which was mainly based on reserve requirements and named it as "Reserve Option Mechanism". This unorthodox and heterogeneous policy set was used until May 2018. As of this date, the CBRT has simplified its interest rate policy and returned to the single policy rate (Şahin and Koç, 2019).

3. Theoretical Framework

Inflation is generally defined as a persistent increase in the general level of prices. What are the sources of this continuous increase in prices? The causes of inflation are generally addressed under four categorization. These are monetary factors, demand-pull factors, cost-push factors and finally expectations.[1] We can also add the structural problems and factors arising from corporate weakness to these four categories.

Inflation in Keynesian models is explained by the situation when the total demand is greater than real output, and this is called the inflationary gap. Inflationary gap is due to expansionary policies in an economy that is in full employment or very close to full employment level. Since the increase in the demand for production factors, especially for labor causes an upward movement in wages/salaries which is also the basis of the Philips Curve. On the other side, according to the monetarist school, the growth of money supply is the major factor in economic activity and inflation (Friedman and Schwartz, 1963; Mishkin, 2010). Friedman concludes this idea in a single famous statement: *"Inflation is always and everywhere a monetary phenomenon"* (Friedman, 1963). If the increase of the money supply is more than the money demand, the general level of prices will increase. In other words, if the increase of money supply is more than the monetary increase required by economic growth, inflation will occur. On the other hand, beginning from the late 1970s, the inflation dynamics is being explored by the researchers via using the micro supply and demand analysis in the macroeconomics (Gordon, 2011).

In the last 20 years, inflation in all over the world has been very low and the Phillips Curve has reached to a flatter form (Blanchard, 2016; Mavroeidis *et al*., 2014). In 2019, inflation in the developed countries generally remained strictly below the inflation targets (BIS, 2019). Inflation in Turkey has almost the same path and trend similar to that of other countries. The high inflation period in Turkey has left its place to a relatively lower inflationary period starting from 2003. The comparison in Turkey is only within itself, of course, there is still a very high inflation rate compared to the other similar countries.

The flattening of the Phillips curve may occur because of the success of central banks in controlling inflation or there may be some structural changes in the economy such as globalization and technological advances (BIS, 2019). Technological developments affect macroeconomic indicators

[1] This information is held on the web site of The Central Bank of the Republic of Turkey "www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Core+Functions/Monetary+Policy/PRICE+STABILITY+AND+INFLATION/"

in several ways. One of them is the effect of labor-replacing technologies that have critical implications for wages and productivity. Another effect is the increased competition among firms which is caused by the customers who are making price comparisons very quickly. Firms also use big data for analyzing the customers' properties who are sensitive to price discounts. In this way, firms can increase their price efficiency. Also, electronic payments systems enable online transactions and by this way, firms are forced to synchronize the prices not only in local perspective but also in national (for some cases in international) perspective. With this technological progress, a downward trend in relative prices and also lower inflation becomes possible (BIS, 2019).

During the low-inflation period, the developments and transformations of the electronic payment systems were significant. In this context, the answer to the question of whether this development in electronic payment systems may have an impact on the decline of inflation is sought.

In the last forty years, many new payment instruments have joined to the payments system. With the development of new technologies and alternative money usages, consumers have increasingly shifted their payment preferences to the electronic payment systems. It is inevitable that the prevalence of electronic payments directly and strongly affects the money demand. These developments in payment systems increase the circulation of money on the one hand, and, reduce demand for cash and lead to increased supply of money with reserve currency multipliers on the other hand. Therefore, increases in financial innovations can cause significant changes in both money supply and money demand (Kogar, 1995; Oktayer, 2011).

For an effective monetary policy, financial stability is just as important as price stability. Rosengren (2011) defines financial stability as the continuation of supplying credit intermediation and payment services due to the requirements of the real economy. In a good working financial system, nobody deals with the infrastructure of this financial system. As Rosengren (2011) emphasizes that the occurrence of financial instability with the "problems (or concerns about potential problems) within institutions, markets, payments systems, or the financial system in general" has serious effects on the monetary implementation and the real economy. Banks are very critical in ensuring financial stability. Banks, by carrying out financial intermediation services, not only provide credits to the real economic agents that provide employment and growth but give payment systems services to all economic agents. Payment systems, being an important component of financial stability, are one of the mechanisms in which systemic risks are most likely to occur (Rosengren, 2011).

The rapid spread of the Internet and the impacts of technology have serious effects on finance and financial instruments. In other words, the use of information technology is changing the financial system as a whole. Technological developments and innovations in the financial sector cause a productivity increase in the banking sector and this affects the whole economy (Lee *et al.*, 2010). It is undoubtedly true that these changes in the financial system also affect the monetary policy and monetary transmission mechanism, and it has potential consequences. There are potential consequences in terms of the ability of the central bank to implement monetary policy, the link between the interest rates it controls and the basic market rates, how these rates affect the real economy. There are indications that these consequences can be seen with the magnitude and timing of the effect. It is generally considered that the most likely effect of internet technologies on the real economy is the acceleration of the transmission mechanism of the monetary policy. For example, using information technology in inventory systems ("just in time" procedures) and to monitor sales more closely means that a decline in sales will more quickly reflect changes in output and prices. The faster the information spreads through the internet, the faster the agents react. On the other hand, developments in information technologies and digitalization suggest an important potential to the banks for managing their interbank market operations more efficiently (Hawkins, 2001).

Payment and settlement systems are very important in a well operating financial system. Because of this reason central banks have close and direct impacts on payment systems due to their responsibility of constituting monetary and financial stability. In particular, from a monetary policy

perspective, it is important to have safe and efficient payment systems in place that will allow a reliable transfer of funds and securities between the central bank and other participants in the financial system. The effect of these transactions and thus the effect of the policy implemented by the central bank spreads to the whole economy (Rossi, 2007).

Haldane *et al.* (2008) define payment as the transfer of monetary value and payment systems as the organized arrangements for transferring the value to the economic agents. They use the metaphor of "lifeblood" for money, while the circulatory system is used for the payment system. They emphasize that the failures in the circulation system cause serious problems in real and financial transactions, consequently resulting in significant welfare costs.

The operational area of conducting monetary policy is the platform of payment systems which is also an important element in financial stability. In the concept of EFT, the operations between the banks and the central bank are done within the infrastructure of large value transfer system (LVTS) (or large value payment system (LVPS)). The central bank's monetary policy actions and related operations due to the targets of the central bank are all implemented in LVTS.

Monetary policy can be affected by the payment systems in several ways. Since reliable and predictable operations in payment systems is a prerequisite for effective liquidity management and monetary policy implementation, as a whole institutional structure in payment systems have a serious impact on money market. The liquidity of the banks during the day is an important determinant for the overnight market and the payment systems have an effect on the stability and predictability of the demand for liquidity supplied by the central bank. The central banks manipulate the overnight interest rates (short term interest rate) for the implementation of monetary policy (Schmitz and Wood, 2006).

As mentioned in Schmitz and Wood (2006) the influences of payment systems on monetary policy can be expressed in three categories. The first one is the effect of the payment systems on level of the demand for central bank money via *"its structure, predictability, velocity and sensitivity with respect to central banks' instruments"* (Schmitz and Wood, 2006: 18). The second dimension is the operational efficiency of the environment in which the monetary policy is implemented. And the final one the quick adaption of the different instruments which are needed for monetary policy.

It may be possible to see the effects of electronic payment systems on macroeconomic variables in two different areas. The first of these is the interventions made by the Central Bank through LVTS to ensure price stability. With these interventions, central banks want to align inflation with the target. In this framework, the value of the transactions (in USD) in electronic payment systems mostly indicates the interventions of the central bank. In this context, the relationship between the total value of transactions and inflation is expected to be negative. On the other hand with electronic payment systems, it becomes possible to supply more liquidity to the banks for the purpose of lending to the real sector. This process has a positive effect on inflation. But compared to the central bank interventions, this amount can be negligible.

The second major effect of electronic payment systems is the effect on the velocity of money. As mentioned before, electronic payments increase the velocity of money which in turn promotes economic growth. The number of transactions in electronic payment systems shows a close relationship with economic activity. As the transaction in an economy increase, the economic growth will then increase. From this perspective, the correlation between the number of transactions in electronic payments and inflation will be positive.

4. Empirical Model, Data Set and Estimation Results

4.1. Empirical Model

The use of information technologies can affect the monetary transmission mechanism in many ways, through the effects on financial institutions, easy trading in financial markets via new digitalized financial instruments, and changes in the behavior and quick reactions of the real economy.

It is very difficult to assess the timing and the magnitude (or even sign) of the net effect (Hawkins, 2001). Technological developments provide a serious variety of financial instruments and methodologies that can be used in every part of the economy (Guo *et al*., 2020).

The close relationship between monetary policy and payment systems is established due to the operational area of LVPS which is needed for the central banks to implement liquidity and short term interest rate policies for price stability. The efficiency of the monetary policy is also dependent on the cash holdings of all the economic agents including both households and banks.

An efficient monetary transmission can be provided by a well-functioning LVPS in which all the policies can be deployed in a short time (Deutsche Bundesbank Monthly Report, 1997; Johnson, 1998).

As a user in the payment systems, central banks make transactions for the implementation of monetary policy. These transactions may be related with the money, foreign exchange or government bond markets. In addition to their direct role in the operation of monetary transactions, payment systems have a more complex role in conducting monetary policy. Since central banks intervene in the money market via two channels. One is through the open market operations and the other one is by changing the level the mandatory reserves of commercial banks. In both channels, the success of the central bank is dependent on the ability of forecasting the daily influences on money market liquidity which can be carried out easily if a reliable large value payment system is operating. In the absence of such a mechanism, it is difficult to implement the desired monetary policy (Pringle and Robinson, 2002).

In the empirical model, we use a reduced form of inflation in the line with Kara *et al.* (2017). Related with the primary aim of our study we include the total amount and number of transactions in the EFT system[1]. For the inflation inertia effect, we use the lagged value of inflation (Kara *et al*., 2017; Fuhrer, 2012; Kamber *et al*., 2020; Mazumder, 2018; Stock and Watson, 2019; Zhang *et al*., 2008; Johnson, 1998; Rudd and Whelan, 2007). We include the local currency denominated import price for the effects of the exchange rate and the import price index (Guerrieri *et al*., 2010; Bianchi and Civelli, 2015; Kamber *et al*., 2020; Johnson, 1998; Busetti *et al*., 2019; Stock and Watson, 2008; Kara *et al*., 2017; Özmen and Topaloğlu, 2017; Dany-Knedlik and Garcia, 2018). Industrial production index is used as a proxy for real activity and output (Coibion and Gorodnichenko, 2013; Blanchard *et al*., 2015; Roberts, 1995; Stock and Watson, 2019; Özmen and Topaloğlu, 2017; Kara *et al*., 2017; Paloviita, 2008). We are aware that we employed a simple specification in our estimation. We believe that using relatively more complicated models such as time varying coefficient models or state space models would not add to our understanding of the subject. Therefore, we choose to use a simple one. Our reduced form of inflation equation is expressed as:

$$INF_t = c + \beta_1 * INF_{t-1} + \beta_2 * \Delta EFTVAL_t + \Delta IPI_{t-1} + \beta_3 * \Delta IMP_t$$
$$+\beta_4 * \Delta EFTNUM_t + \beta_5 * @Trend + u_t \quad \textbf{(1)}$$

where *c* is the constant term, β's are the coefficients to be estimated, INF_t is the inflation, $EFTVAL_t$ is the total amount (value) of electronic fund transfers, IPI_t is industrial production index, IMP_t is the local currency denominated import prices (import price index multiplied by the exchange rate), $EFTNUM_t$ is the total number of transactions in EFT system, $Trend$ is the trend variable and u_t is the error term. Industrial production index is used as a proxy variable for real activity, while lagged inflation is for the effect of inflation inertia. The effects of exchange rate pass through and import price index are given with the local currency denominated import prices.

[1] A similar approach is used in the study of (Reddy and Kumarasamy, 2015). They investigate the nexus between inflation and electronic payments. For the electronic payment variables, they use the total amount and number of electronic payment transactions.

4.2. Data Set

We collect all the data from Electronic Data Delivery System of CBRT. All the variables are in logarithmic forms and seasonally adjusted. We use the percentage change of the quarterly data for Turkey over the period 2005:3 – 2016:3. We use Augmented Dickey-Fuller Tests (ADF) for the lags from 0 to 6 by including a constant term and a linear trend. According to the test results, there is no evidence for unit roots.[1] The descriptive statistics of the variables are given in Table-1:

Table-1: **Descriptive Statistics of The Variables**

VARIABLES	Mean	Std. Dev.	Minimum	Maximum
Inflation	0,01833	0,00791	-0,00311	0,04228
Change in Industrial Production Index	0,00878	0,02786	-0,09213	0,05872
Change in Total Amount of EFT	0,05010	0,11153	-0,32008	0,36462
Change in Total Number of EFT	0,03742	0,02394	-0,01373	0,10779
Change in Import Prices	0,01807	0,05288	-0,08129	0,15927

4.3. Empirical Results

The estimation results of Equation (1) are given in Table 2. Except the trend, all the variables are statistically significant at % 10 significance level. As expected and validated by various empirical studies such as (Kara, Öğünç, and Sarıkaya, 2017; Fuhrer, 2012; Paloviita, 2008), lagged inflation is a major determinant of current inflation and our finding for lagged inflation is in the line with these studies. Our finding for lagged inflation implies that the effect of %1 increase in the current inflation will cause % 0,4 increase in the next quarter's inflation. The effect of lagged inflation in Turkey changes between % 0,27 and %0,34 in Kara *et al.* (2017), while this effect varies between % 0,074 and % 0,36 for the United States of America in Fuhrer (2012). In the study of Paloviita (2008) for OECD countries, this effect is between %0,379 and %0,411.

The empirical result for the industrial production index which is used as a proxy for real activity and output is consistent with the theoretical literature. As expected there is a positive relationship with the industrial production index and inflation. This is the traditional Philips curve relationship. Although the ongoing debate is focused on the flattening of the Phillips Curve, and the weakened correlation between unemployment and inflation, our empirical results support the real activity and inflation paradigm. Since the effect of real activity is not as high as lagged inflation, it is still quite noticeable. The effect of % 1 increase in industrial production index is %0,073 and that is the second highest effect in our variable set. In the study of Kara *et al.* (2017), the effect of output on inflation is between % 0,08 and % 0,1 for Turkey. In a panel data analysis for 47 countries, it is found out that the effect of output on inflation is varying between % 0,074 and % 0,138 (Kamber *et al*., 2020). Our findings for the effect of real activity on inflation is consistent with these empirical studies.

The effects of exchange rate and import price index are measured in the ΔIMP_t (import prices in Turkish Liras) variable. According to our empirical results, there is a positive relationship between import prices and inflation. Our finding is in line with the theoretical literature. The effect of % 1 increase in the import prices is approximately % 0,0721.[2]

1 These results are available upon request.

2 Our results are consistent with the findings of Kara *et al.* (2017) and Kara and Öğünç (2012).

Table-2**: Estimation Results**

Dependent Variable: Inflation (quarterly, seasonally adjusted)	
	OLS
Lagged inflation	0,404494***
	(0,100649)
Δ Import prices(t)	0,072143***
	(0,016086)
Δ Industrial Production Index(t-1)	0,073282**
	(0,030510)
Δ Total Amount of EFT(t)	-0,021444***
	(0,007477)
Δ Total Number of EFT (t)	0,060197*
	(0,033952)
Trend	-5,64E-05
	(6,20E-05)
Constant	0,009107***
	(0,002894)
Observations	45
R-squared	0,634358
Durbin-Watson stat,	1,947749

Notes: Standard errors are in parenthesis. ***, ** and * refer to statistical significance at 1, 5 and 10 % level.

As indicated in Reddy and Kumarasamy (2015) electronic based payments or EFT systems are categorized as financial innovations that have serious effects on the velocity of money. The effects on transaction costs and easing the liquidation of financial assets are the two main mechanisms that increase the velocity of money. The effects of an increase in the velocity of money will probably lead to an increase in inflation. In our model, the variables related with the electronic payment systems have statistically significant effects on inflation. The total number of transactions in the EFT system is an indicator of the total transactions in the economy. According to our findings, if the total number of transactions in the EFT system increase % 1, it has an upward effect on inflation by % 0,06. This increase is consistent with the empirical studies (Zandi *et al*., 2016; Geanakoplos and Dubey, 2010) that are addressing the relationship between inflation and velocity of money. Since an increase in the total number of transactions will lead to an increase in the velocity of money that consequently leads to an increase in inflation. The link between electronic payments and inflation may also occur due to the interaction between electronic payments and aggregate demand. In the study of Hasan *et al.* (2012) and Oyewole *et al.* (2013), it is found out that electronic payments positively affect economic growth, consumption and trade of which have direct positive effects on the aggregate demand.

In the study by Kirdaban (2005), it is stated that electronic payment systems are important in order to enable markets to react quickly to monetary policy actions. They also contribute to the efficient operation of interbank money markets and provide a better monitoring of the liquidity of the system that enables not only an effective fund management but also appropriate and on-time operations as well. In our model, the total amount of EFT is an indicator of the central bank interventions in the money market for meeting the inflation targets. The more, the central bank interventions, the more, the decrease in inflation. Our empirical results support this idea. If the total amount of EFT increases by % 1, the inflation decreases by % 0,021.

The long-term relationship between the variables in equation (1) is given in Table -3:

Table-3: **The Long-Term Effects of the Variables on Inflation**

	The Long Term Coefficients
Change in Import Prices	0,121146935
Change in Industrial Production Index	0,123059614
Change in Total Amount of EFT	-0,036010076
Change in Total Number of EFT	0,101086482

As can be seen in Table-3, the long-term effects of the variables are more evident. In case of a % 1 increase in import prices will lead to % 0,1211 increase in inflation, while with the same amount of increase in industrial production index and total number of EFT transactions, the effects will be % 0,123 and % 0,101 respectively. And finally, the effects of %1 increase in the total amount of EFT will decrease inflation by % 0,036.

As a result, we can say that the EFT system has both direct and indirect effects on inflation in Turkey. Direct effects of the total amount and number of EFT transactions are given in Table-2, while indirect effects of EFT include the operability of monetary policy and financial stability.

5. Conclusion

Nowadays, technology and technology-related innovations are the key elements in every part of our lives. Due to the huge developments and enhancements in the area of information technologies, a new way of doing business enforces a new way of payments and fund transfer methods. Being in the core of payment systems, EFT systems become a critical component for financial stabilization.

In our study, we try to investigate the role of EFT systems in inflation dynamics. According to our findings, the total number of payments in EFT system has a positive impact on inflation as expected. This effect occurs due to the lower transaction costs and easing the liquidation of financial assets and both these two will increase the velocity of money. Consequently, the increase in the velocity of money will probably cause an increase in inflation. The link between the total number of transactions in EFT systems and inflation can be provided by the interaction between electronic payments and aggregate demand via consumption and trade channels.

The second variable related with electronic payment systems, is the total volume of transactions in EFT. Since a considerable part of this volume is the transactions between the banks and the central bank in LVTS. This variable is a proxy for the central bank to apply monetary policy actions quickly and effectively. As the monetary operations can be executed in a just on time and effective way, this will help the central bank to reach the price stability target. According to our empirical results, this variable has a negative impact on inflation dynamics, as we expect.

The developments in electronic payments will continue to increase a variety of the instruments used for money. Of course, these developments in payment systems will have serious effects on the economy through economic growth, consumption and inflation. With the new tools like big data and deep learning, it becomes possible to analyze the preferences of the households in using electronic payment instruments and their effects on economic variables.

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