

## DO THE ADVANCES IN INFORMATION TECHNOLOGIES COMPLICATE THE CONDUCT OF MONETARY POLICY?

Erdal DEMİRHAN<sup>(\*)</sup>  
Gökhan DEMİRTAŞ<sup>(\*\*)</sup>

**Özet:** Bilgi teknolojileri para politikası üzerindeki etkilerine bağlı olarak para politikasının yönetimi zorlaşmaktadır. Bu çalışmada bilgi teknolojilerindeki ilerlemelerin para politikası yönetimini nasıl zorlaştırdığı incelenmiş ve para politikası yapıcılar tarafından para politikasının yönetiminde bazı temel faktörlerin göz önüne alınması gerektiği sonucuna varılmıştır. Bu faktörler verimlilik büyümesinde geçici ve sürekli değişimlerin ayırt edilmesinin zorlaşması, fiziksel olmayan mal ve hizmetlerin ekonomideki ağırlığının artması ve elektronik para ve zorunlu karşılık kullanımlarındaki değişimlerdir.

**Anahtar Kelimeler:** Bilgi Teknolojileri, Para Politikası

**Abstract:** The conduct of monetary policy is getting complicated due to the impacts of IT on monetary policy. In this study, it is examined how the advances in the IT complicate the conduct of monetary policy and concluded that some main factors are to be taken into consideration by monetary policy makers in conducting monetary policy. These factors include the difficulty in distinguishing permanent changes from transitory ones, the increased role of intangible goods and services in economy, and the changes in the usage of electronic money and reserve requirements.

**Keywords:** Information Technologies, Monetary Policy

### I. Introduction

Developments in macroeconomic area owing to advances in information technology (IT) have changed the perspective of monetary policy applications. Today, macroeconomic policies have to be performed rapidly and flexibly for adjusting to advances in IT. Therefore, application of fiscal policy, used as a stabilization instrument, has become less important and monetary policy has stood in the forefront. The reflections of IT advances on monetary policy can be seen in several ways. To begin with, central banks have started to give information to the public directly as a result of the decreasing secrecy on monetary policy actions in knowledge economies. Moreover, IT advances have facilitated the transfer of information on monetary policy actions to the public. By assuming that transparency improves monetary policy credibility Geraats, 2001:10), and reliability (Faust and Svensson, 1998:389), it can be foreseen that advances in IT may have positive impacts on the efficiency of monetary policy.

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<sup>(\*)</sup> Doç.Dr. Afyonkocatepe Üniversitesi İİBF, İktisat Bölümü

<sup>(\*\*)</sup> Arş.Gör. Afyonkocatepe Üniversitesi İİBF, İktisat Bölümü

While rapid developments in computer and telecommunication technologies are increasing transparency, they also impose new obligations on monetary policymakers. Initially, economies today exhibit more flexible structures than the previous ones did. Therefore, policymakers should react more flexibly and rapidly to adjust the economy to external shocks. Similarly, central bankers have to specify risks and act more rapidly. Monetary policy implications of advances in IT are not only related to its contribution to transparency and responsibility of policymakers to act rapidly and flexibly. In developing countries, policy makers have already taken necessary measures in order to provide transparency and have sufficient flexibility and speed. However, monetary policy makers confront with more complex problems related to the complication of monetary policy as a result of advances in IT. This study is focused on this problem of monetary policy, faced extensively after 1990s.

Section II explains macroeconomic impacts of IT and how these effects complicate monetary policy management. Section III concerns with uncertainty of potential production level and its effect on the complication of monetary policy management. Section IV gives a general conclusion.

## **II. Complication of the Monetary Policy Management as a Result of the Macroeconomic Impacts of the Advances in Information Technologies**

Advances in IT may complicate monetary policy because of their impacts on macro economy. In this section, firstly, basic macro economic effects of IT are explained, and then some information about how these effects complicate monetary policy management is given.

### *A. Basic Macroeconomic Impacts of the Information Technologies*

IT advances have more microeconomic effects than macroeconomic ones. (DeLong and Summers, 2001:32), But, it does not mean that they do not have any macroeconomic reflection. One impact of IT on macro economy can be given as the raising economic growth. A potential production increase attributed to IT not only stems from some IT related sectors but also from all sectors in the economy. First of all, improvements in IT increase the growth rate of capital stock by encouraging investments concerning IT. More importantly, the extent of knowledge spread and shared quickly in business and out of business influences the factor composition. By this way, efficiency in business management increases, restructured of businesses become easy and thus a synergy effect can be obtained. Consequently, IT causes productivity growth. (MOFA, 2000) Investments in new IT also improve the efficiency of production process. This triggers the increases in the technical and problem-solving skills of employees and new human resource practices. (Bartel et. al., 2007:1721)

Such effects of IT on economy can be called as supply-side effects arising from high potential production and productivity growth. (Hamalainen, 2001)

IT also has demand-side effects. Demand-side effects take place as a result of investment growth related to IT, increases in demand for services linked to IT, and development of new services such as electronic financial transactions and electronic trade. The facilitation of knowledge transfer between consumers and firms via internet creates new facilities and new demand types for firms. Acceleration of investments on account of this increasing demand contributes to economic growth. On the other hand, while technology innovations may cause job losses, it is also possible that new job opportunities are created in the sectors linked IT. (MOFA, 2000)

Another important impact of IT may be observed effect on general price level. Supply-side effect of new technologies generates the expectation that price level decreases in later years. On the other hand, consumers' expectation of having an increased life-cycle income may result in an increased consumption in the short-run. (Srejber, 2000) As a result, it should not be expected that advances in IT reduce inflation rate in the short run.

The most popular example of macroeconomic effects of IT advances is positive developments in economic indicators in USA, especially seen after the second half of 1990s. Most economists stress that technological changes increase productivity and thus contribute to rapid economic growth without generating inflationary pressure in US. (Bullard and Schaling, 2001:57) After 1995, GDP growth rate increased in US economy seriously. According to Baily (2001:216,210) the reason of that increase is productivity growth<sup>1</sup> which stems from IT advances in two ways: (1) Increase in investment on IT sectors because of improved quality and of price of PCs and other IT products. (2) Increasing productivity in traditional sectors owing to advances in IT. In addition, some favorable developments concerning inflation and unemployment were observed at the given period. However, the rate of current account deficit to GDP increased in 1995-2000, mainly due to rising in US dollar as a result of strong economic performance.

Finally, IT advances have a positive effect on economic growth by lowering the cost of financial services, which allows greater access to this services and enables credit possibilities for a wider range of consumers, including small and medium-size firms. Increasing access to the credits is an important objective in industrial and developing countries. (Claessens et. al., 2002:44,104)

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<sup>1</sup> See Oliner and Sichel (2000), Gordon (2000), Jorgenson andv Stiroh (2000) for the measurement of productivity growth rate in US.

*B. Complication of Monetary Policy Management Because of the Uncertainty of Potential Production Level*

Ascertaining the potential product level in an economy requires the prediction of annual economic growth. Growth rate equals the multiplication of rate of labor productivity increases and the rate of labor amount increases. (Blinder, 2000) At this point, since IT advances cause for productivity changes, it may make difficult to estimate potential production level which is used to specify production target from the stand point of monetary policy. The aim of central bank is to stabilize inflation rate in low level where economic growth sustainability is achieved. The aim of central banks is to stabilize the inflation rate. For this reason, monetary policy helps to minimize the variability between inflation and output, generally measured by deviations from the target level. Accordingly, determining the target levels is immensely considerable in terms of monetary policy. It needs to be stated that central banks have a consensus on an ideal inflation target ranging from 0 to 2 percent.

However, there are problems on specifying the output target stemming from two main channels: productivity changes arising from IT improvements (Antonelli, 1995:2) and effect of financial openness on output volatility depending on IT developments. It should be noted that the developments with monetary shocks have a strong positive effect on output volatility, too. (Ko, 2008:42).

The problem monetary policy-makers encounter in monetary policy applications is the necessity of reacting differently depending on whether productivity changes are permanent or temporary. The policy makers try to maintain output in fixed ratio in the event that the productivity shock is temporary. This means that it is allowed to deviate from long-run target level. On the other hand, if productivity changes are permanent, appropriate policy reaction is to allow production to move parallel with its long-term trend and to stabilize inflation rate. (Cecchetti, 2002:16)

The problem in estimating the potential output level due to IT advances does not only result from the difficulty in making distinction between the permanent shocks and temporary ones hardly but also from uncertainty about magnitude, timing, and the effects of tendency of IT. The precise effect of IT may occur following complementary innovations. In addition, the actual impact of an innovation may aggravate appear by means of its expansion towards various sectors and society. (Hamalainen, 2001) Uncertainty about these effects results in some delays in taking policy measures, undermining the expected achievements from monetary policy actions. Actually, the excess of demand-side effects over supply-side ones may hinder central banks to attain price stability defined as the primary goal of monetary policy.

Another problem concerning price stability goal is the difficulty in collecting statistical data and deficiency in inflation measurements. IT advances bring about an increase in the proportion of intangible goods such as

“knowledge” in economic activities, which makes data collection difficult. So, it is not easy for central banks to choose the various economic indicators in monetary policy applications and to interpret these indicators. Also, intangible goods and services complicate to define price stability goal when it is specified as ultimate goal of monetary policy. The overestimation of IT goods and service prices causes some measurement errors in Consumer Prices Index, harming monetary policy credibility. (Inoue, 1998:31) The reason is that nominal increases in sales value of IT goods and services are considered to reflect increases in prices. As known, it is too difficult to clarify a qualitative change from a quantitative one. (Ishida, 2001:5-6)

### **III. The Increase of the Demand on Central Bank Money because of Information Technologies**

In case of decreasing demand on central bank money (CBM), central bank cannot use overnight interest rates to provide the price stability and to influence economic activities. At this point, decreasing of demand on central bank money as a result of increase in electronic money usage and from a decline in usage of required reserves due to improving IT has been serious problem for monetary policy actions.

#### *A. Monetary Policy Results of Broad Usage of Electronic Money*

The primary reason of decreasing demand on central bank money based on IT improvements is the substitution of electronic money<sup>2</sup> for banknotes and coins. The survey of Gormez and Capie (2000a) among electronic money operators and providers reveals that the demand on electronic money increases substantially.<sup>3</sup> Nevertheless, there are some opinions stressing the importance of using money in spite of IT advances. For instance, the considerable increase in Automated Teller Machine in US resulted in a growth of vault cash holdings of banks. (Bennett and Peristiani, 2002:2) Thus, banks hold more cash than preceding periods in which no IT appears.

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<sup>2</sup> Transactions done by electronic money should not be confused with debiting and other electronic means of payment as credit cards. Credit cards usually require debiting the customer account after online transaction and provision. Electronic money, also, reveals a monetary value charging an electronic vehicle. The value is purchased by customer and reduces when purchasing is finished. (BIS, 1996:13)

<sup>3</sup> According to results of this study, the majority of participants in questionnaire think that electronic money will be able to replace with paper money. Also, 18% of participants think that electronic money can not replace with CBM. On the other hand, this transmission can be possible for the rest of participants, 82%. It is to be stated that 35% of this rate include “yes” response, the others, %47, include “partly”. 55% of saying “yes” expects that electronic money will replace with CBM until 2010, whereas only 17% of them (saying “yes”) expect this development will take place after 2020.

Complication of monetary policy because of the rise in the usage of electronic money can be especially valid in the event that emission is the large part of central bank money. The proportion of emission to central bank money is high in some countries. For example this ratio is 86.7 percent for Canada, 84.5 for Japan, and 84.1 for US. Today, central banks have monopoly power in issuing central bank money. Restricting the power of central bank by substituting electronic money for central bank money may diminish the effects of central banks on economy in later years. (King, 1999:411) Also, substituting electronic money for banknotes lessens the total liabilities and assets of central bank balance sheet. This means that it is difficult for central bank to undertake comprehensive policy actions. Central bank may want to sell its assets in order to meet banks' liquidity requirements and to sterilize its large-scale purchases of foreign exchanges, which requires that central bank must hold sufficiently assets. (Hawkins, 2001:100) On the other hand, as long as central bank accepts monetary targeting as a policy rule, the stability and level of the demand on monetary base does not link with monetary policy applications. (Woodford, 2001:320)

In respect of the e-money issuance, the conductor of monetary policy and maintaining of price stability as its primary objective are the main concerns of the central bank. However, a potential unrestrained issuance of e-money could constitute some main risks to price stability. The marginal cost of producing e-money may be very low when there is no necessity for interest payments. In addition, the function of money as being the unit of account needs to be preserved. In order to accelerate the spread of the use of certain e-money products rapidly, the perspectives by the market regarding the creditworthiness of issuer could play a role in determining the value of outstanding economy. In such case, e-money products issued by different bodies could be purchased at varying exchange rates. This would undermine the money's role of productivity a common financial denominate for the whole economy. Furthermore, since the developments in e-money may have the power to change the behavior of monetary aggregates related to developments in the economy, they may also have implications for monetary policy. Therefore, it is essential to have related statistics on the use of e-money. Finally, if the issuance of e-money by private bodies is widespread, there may emerge some implications at this situation on both the central bank's balance sheet and its control on interest rates in the short run. (BIS, 2000:23) Consequently, it is needed to have some regulations restricting the issuance of e-money products depending on the structure of credit institutions. Being liable to appropriate regulations, especially liquidity requirements, and supervised, not-fully-fledged credit institutions provide only domestic payments systems. (Gormez and Capie, 2000b:9)

At this point, due to the usage of electronic money, three problems could be mentioned related to monetary targeting. (ECB, 1998:17,18) Even if central bank specifies a monetary target, the rapid improvements in electronic

money and electronic access products can affect the stability of money demand. Thus, the stable relationship between prices and expenditures can be rebuilt after electronic money market is established completely. With the increase in the usage of electronic money, it can be difficult to distinguish between money assets and non-money assets, complicating to establish a framework for the definition of monetary aggregates. In addition, since interest bearing assets has important part in monetary aggregates, monetary aggregates targeted are not easily controlled.

It is to be specified that these effects are also valid for inflation targeting strategy. On the other hand, for the appearance of these effects, monetary aggregates are to be taken as indicator in inflation targeting regime and the process of monetary transmission mechanism must be affected by any change in the interest rate elasticity of money demand. However, the effect on inflation targeting strategy is smaller than the effect on monetary targeting regime. (ECB, 1998:17)

#### *B. Interest Elasticity of Money Demand Due to Broad Usage of Electronic Money*

Control of central bank on money supply is necessary to provide the effectiveness of monetary policy. If the central bank is to have control power on money supply, close substitute of money stock must not exist, which shows low interest elasticity of money demand. Also, developing new products due to advances in IT may have crucial effects on interest elasticity of money demand. Degree of substitutability is to be taken into consideration on this topic. The lower the degree of substitutability of new products, the lower the interest rate elasticity of money demand. Thus, the activities applied by central bank so as to change money supply have less affect on money demand, which causes a strong influence of interest rate on expenditures and national income. Also, in the event that the degree of substitutability of new products for money is high, the effects of interest rate on expenditures and national income are weak.<sup>4</sup> (White, 2001:12)

If it is examined with IS-LM model, interest rate elasticity of money demand is low, money balances held in cash by individuals and firms are not sensitive to changes in interest rates. In this case, the operation of central bank towards its adjustment in issued money changes interest rates enormously. It is explained that an alternative situation where interest rate elasticity of demand on money is high and thus the money balances held in cash by individuals and firms are powerfully affected by changes in interest rate, which indicates that

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<sup>4</sup> The change in interest rate as a result of shifting of money supply (MS) curve affects the nominal income, thus money demand (MD) curve shifts. This movement is not shown for simplicity.

changes in money supply have small impact on interest rate. As understood from the explanations, as long as the interest rate elasticity of money demand is high, increasing interest rates as a consequence of the tight monetary policy actions have small effect on expenditures and national income. In other words, the change in interest rate executed to stabilize nominal income requires large scale adjustments in money supply.

### *C. Monetary Policy Results of Decrease in Using Required Reserve*

Since the required reserve determines the magnitude of money multiplier and the tendency of increasing of bank credits, it is evaluated as an important instrument of monetary policy. However, the usage of required reserve has decreased nowadays, as seen in industrialized countries, especially in US. Decrease in required reserve stems from the following developments. (Sellon and Weiner, 1996:5)

Firstly, most central banks tend to control short-run interest rate rather than short-run reserve. The examples of Canada, New Zealand and England illustrate that strong monetary policy actions can be applied without using required reserve as a monetary policy instrument.

The second development decreasing the usage of required reserve instrument is the evaluation of required reserve as a tax for commercial banks, reducing the competitiveness with other financial institutions. Therefore, it has been widely accepted that abolishing required reserves increases both profitability and competitiveness of banks with other financial institutions as a result of being removed an unfair tax.

Third, although not reduced as formally, required reserves' efficiency is decreased via financial innovations, especially in US. Commercial banks in US have tried to avoid from required reserves by creating new types of liabilities which required no holding of reserves and are similar to deposits. So, the composition of liabilities alters depending on whether deposits involving required reserves or not. Consequently, although not decreased formally, required reserves are reduced by commercial banks.

Decline in the usage of required reserves has crucial effects on monetary policy implications. First of all, these effects are important in terms of the relationship between monetary policy and means of payment. In traditional banking system, in which banks must allocate required reserves, short-run interest rates are determined by reserve supply and reserve demand. In this framework, the structure of means of payment has little impact on reserve supply and reserve demand, thus has no matter for conducting monetary policy. On the other hand, the demand on central bank balances no longer depends on reserve demand but on balance by which commercial banks make payments. In these circumstances, there is a direct relationship between monetary policy and payment systems since perpetual changes in payment systems require the changes in monetary policy methods in order to achieve efficiency in monetary

policy. Moreover, reducing the use of required reserves causes increase in short-run interest rates.

Complication of monetary policy management owing to the increase in interest rate changes forces central banks to take precautions in order to limit these changes. Otherwise, central banks confront with difficulties in performing monetary policy by controlling short-run interest rates. In short, it is probable that central banks do not attain interest rate target, making difficult for financial markets to assess monetary policy. Besides, if the short-term interest rate reflects the long-term interest rate, some real economic effects may appear.

#### **IV. Conclusion**

Today, it is generally accepted that advances in IT have positive macroeconomic influences. Particularly, productivity growth occurring due to IT improvements and thus increasing production can be seen as a crucial instrument for the enhancement of welfare. However, advances in IT also cause for the complication of monetary policy conduction from the aspect of the determinants of monetary policy.

The first problem related to the complication of monetary policy due to advances in IT is that estimation of potential production level is getting harder. When a policy model in which monetary policy decisions are made based on potential production levels is taken into consideration, monetary policy actions either have no effect or less effect on economy. Monetary policy makers specify target magnitude with difficulty, especially in monetary policy strategies including monetary targeting and inflation targeting.

The complication of monetary policy management linked with IT advances also occurs owing to decreasing tendency in the demand of central bank money, which arises from the increase of electronic money usage and the decrease of required reserves. If the demand on central bank money decreases, regardless of any causing factors, central bank cannot use overnight interest rates to achieve price stability and to affect economic activities.

However, availability of an obligatory redeemability requirement on all e-money issuers may limit the risk unrestrained issuance of e-money and maintain the unit of account function. This would also contribute to the preservation of central bank's control power on short term interest rates, ensuring a clear link between e-money and central bank money. Furthermore, there are some similar features between e-money and sight deposits. Therefore, imposition of minimum reserve requirements on e-money issuers may be needed to ensure an equal treatment between issuers of e-money and issuers of other forms of money.

Advances in IT, result in efficiency of monetary policy by increasing transparency. On the other hand, this favorable result in terms of monetary policy may lessen on account of the fact that IT complicates the management of monetary policy. Therefore, monetary policy makers are to develop policy

reaction models and to specify target magnitudes by considering advances in IT. Since IT advances reduce demand on central bank money, central banks should benefit from their diminishing balance-sheets efficiently. Thus, the magnitudes in balance-sheet are to be changed optimally.

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