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MONEY SUPPLY AND ASSETS VALUE

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Abstract. The aim of this paper is to clarify the role of money supply as the most important target of the classical monetary policy for the price stability, inflation and economic growth. The theory of monetary policy was developed by observing the money supply. The simple relationship of the monetary policy including all instruments, targets and goals contains a huge number of empirical models which express relationship between money supply and demand, interest rates and asset prices.

Accepting all determinations about regulation of money supply including the theory of quantity of money, money supply is described as supplementary function of inflation, interest rate, wealth, human capital, etc.

The problem is to determine how the arguments will have influence on the money supply growth, which argument will initiate higher inflation, when and how long monetary policy instruments should be used.

Using empirical models we examined relationship between money supply and assets value. Differentiation of the bond and money market was provided by the author using partial derivatives for estimating interaction between interest rates, prices, money supply, and assets value.

Keywords: monetary policy, money supply, assets value, monetary instruments, targets.

PINIGŲ PASIŪLA IR TURTO VERTĖ

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Santrauka. Pastaraisiais metais infliacijos augimas pasaulio ekonomikoje siejamas daugiausia su kylančiomis energinių išteklių kainomis. Tokio pobūdžio infliaciją, kurią lemia importuojamų žaliavų kainos, galima vertinti kaip išorinių veiksnių keliamą grėsmę tolesniam vis daugiau plintančiam kainų augimui, kurį sustabdyti gali tik racionaliai naudojamos pinigų politikos priemonės kartu su fiskalinės politikos priemonėmis.
Straipsnyje analizuojama pinigų pasiūlos ir turto vertės sąveika. Pinigų pasiūla (pinigų kiekis) yra svarbiausias pinigų politikos svertas, veikiantis infliaciją, o kartu ir turto vertę. Analizei naudojami metodai ir dėl empirinių tyrimų gautos lygtys, kurias diferencijuodama pagal pinigų ir vertybinių popierių rinkos rodiklius autorė gauna išvestines ir parodo sąveiką tarp palūkanų, kainų, pinigų pasiūlos ir turto vertės.

Reikšminiai žodžiai: pinigų politika, pinigų pasiūla, turto vertė, monetariniai instrumentai, svertai.

1. Introduction

Money supply being as a general target of the monetary policy together with another related targets always creates environment for the price stability, balance of payments and exchange rate stability.

Central banks through the monetary policy need to control the money supply as proximate target which affects directly the level of inflation (Goodfriend 2001; King 1996). So, monetary policy affects the economics by changing the quantity of money using different econometric models of the classical theory by way of interaction between the theoretical and empirical aspects of monetary policy. Also the level of the nation's money supply depends on the process characterised by the interaction between the various asset markets (Berg 1997; Chick 1973).

Investigation of money supply and relationship with macroeconomic goals such as economic growth, price stability, high income, exchange rate stability could be provided on the base of equations obtained from empirical investigations.

Having results of these equations we could determine what changes should be made by monetary policy seeking to keep less inflation.

Especially important is the target of money supply which should be under the control from the Central bank side.

2. Interaction between money supply and assets value

The interaction between money supply and assets value may be explained as the influence of processes taking place in the money and bond markets on the value of tangible assets.

Suppose that tangible assets consist of money, debts, securities and real capital. We make an assumption that there are neither banks nor financial intermediaries. Real capital K is productive, earns additional income, is used for the production of goods and services, sells at a price P, and its nominal value of the capital stock is PK. National consumption is financed by issuing money, their base B and bonds S. Debts are rated following the effective interest rate; VS presents the market value of a still-outstanding debt. By buying bonds, the public lends money to the bond issuer.

Where W is the value of the public assets market or the net liabilities.

The phenomenon, which is taking place inside these tangible resources, including how the money transforms into real capital, and other changes produce a macroeconomic effect or condition for economic growth.

Fig. 1 (Laidler 1985) shows the balance between the public and private sectors. The value of the public assets market is *W*. The public does not have any liabilities according to this simple model. The balance between the Central Bank and the Government shows the resources *An* including gold, foreign currencies and special drawing rights.

The Public		**Central Bank and the Government**	
a)		b)	
B *VS* *PK*	*W*	An	B VS

1 pav. Balansai

Fig. 1. Balances

One cannot deny that *An* is the principal source of money. Central banks in a number of countries operate as the so-called fiscal agents, which limit the public debt. The Central Bank makes efforts that the public debt would be recovered in the open market by exchanging money into state bonds. If we subtract *An* from the public debt and the money base, we receive a fiscal deficit or surplus (Choosing an... 1990; Dornbusch 1980)].

When in Fig. 1 a) the balance shows an increase in the base of money $B\uparrow$, the total assets are growing $W\uparrow$. When there is a surplus of money, it does not correspond to the increase in the real assets and the prices $P\uparrow$ and then $PK\uparrow$ stars to go up; the real capital *K*, however, does not undergo any changes.

Another case or a simultaneous situation when $PK\uparrow$, the debt value *VS* is changing; when there is a surplus of money and the prices are growing, it brings about the increase in interest rates of bonds issued later; therefore, the price of bonds issued in the market will exhibit a downward trend. Thus, in the event of *B* surplus and the resulting inflation, the public loses when buying bonds but it could win by investing into the real capital. Therefore, when shaping monetary policy and national economic policy, it is not hard to forecast the behaviour of the public when it notices the increase in the price of real capital *P* and in the interest rates of bonds. With the expectations of further increase in the interest rates of bonds, the public will try to sell old bonds until their sales will have not become loss-making in the market, and probably will not rush to buy new ones. Thus, the interest rates will have to decrease.

The first equation expresses the function of the need for money, equation (2) states the function of debts (of bought bonds), and equation (3) shows the market value of the resources available (Friedman 1990; Laidler 1985):

$$B = \lambda (i, P, ap, w, H, e), \quad (1)$$

$$- + - + + -$$

$$S = \beta (I - \pi, P, p, ap, W, H, e), \quad (2)$$

$$+ + - - + + -$$

$$W = PK + vS + B. \quad (3)$$

The variables marked by pluses and minuses at the bottom show the answers how an argument (variable) affects the assets functions λ and β, B and S respectively, or the reaction of functions to the arguments. The function of the money base B decreases due to the increase in interest rates I, *i.e.* the larger interest rates have to be paid, the more money the public has to have, and, for example, the rise in the price of capital P (the market value of the capital stock PK) adds to the money base; the larger is the market value of a share, the higher is its price, it also results in a larger income generated by a share owner measured in money and it increases its function of the need for money and the money base B; increasing prices (in general) also boost the function of the need for money; rising inflation, which reflects not only the deflationary increase, but also the currency devaluation in progress, decreases the money base as it devaluates the latter. The rise in the market value of the available resources W increases the money base and the growth in human (labour) capital or labour value as well as B; the anticipated growth in capital return e per capital unit will decrease the money base B because, in the hope for larger profit in future, the public will try to acquire as many assets as possible by using the money it already has.

When i-π is positive and the difference between i and π is growing, the function of debts S as the loan granted by the public in the form of the bonds acquired, will increase accordingly; the rise in the assets price P will also increase S because the interest rates i will rise correspondingly; the current and anticipated growth in prices P and ap will reduce the tendency towards having larger S; in such a case the public expects that the rise in prices as the outcome of inflation will also increase the interest rates of bonds issued in future and then it will appear that it is more advantageous to buy bonds in future than at the moment, as well as S may decrease with the hope of its increase in the forthcoming years. The growth in the market value of assets W may always potentially increase S_L too, and the growth in labour value M increases income; it means that the solvent demand will also be shaped for buying bonds, i.e. increase in S; the anticipated growth in the return per capital unit e will cut S as the need will rise for K.

As we see, the effect of these variables on the function was examined here by adhering only to the relationship between one variable and the function or to the relationship between two variables and the function. The explanation is based on the logic and on equations (1), (2) and (3) worked out by carrying out empirical research and mathematical analysis.

The expected rate of inflation π and expected return per unit of capital e are the principal channels of the impact on the asset market. The anticipated prices ap, anticipated rate of inflation π and nominal rate of interest I are the major funds, which affect the current price of the asset package and value W.

We will use equalities (1), (2) and (3) to find the equilibrium conditions in compliance with the values i, P, B, S and K. We shall define that β dependence on P is positive: rising P increases β function depending on the arguments (variables) in brackets. The reason is that increase of P constantly reduces return on real assets affecting the substitutes, i.e. securities. More specifically, if the price of assets goes up, while its return goes down, the value of shares is likely to decrease, so is the return on them.

MM curve in Fig. 2 (Krugman, Obstfeld 2006; Ladler 1985) shows the combination of the interest rates and asset prices, at which a constant amount of base money is willingly held (constant B). The curve is positively bowed out (upwards), which shows that higher interest rates compensate for the impact of the asset price increase on the need of a base of money.

How shall we understand such compensation as presented in Figure 2? Prices PI rise and the growth of PKI, WI and demand for money B will be compensated by higher interest earned on securities. If the interest on securities does not go up, there will be a shortage of money with B=*constant.* In this case, either the central bank will have to provide a higher amount of money in circulation or the rise of prices will stop. The increase of interest on securities will accompany P growth as long as it is effective, or the increase of investment income will enable higher dividends or interest earned. In case of increasing interest, the public willingly keeps money in hope to make investment in future or acquire securities (bonds, shares), when the interest will be even higher. *CM* curve suggests the combination of interest rates and asset prices at which the outstanding government debt is held (not bought out bonds). The curve goes down showing that interest rates must be decreased upon the growth of asset prices, i.e. the public is willing to retain bonds, since the interest on the newly issued bonds is reduced.

CM curve shows that interest should decrease with the increase of the asset price, which encourages the public to keep the securities of the government. Money and bond markets are in equilibrium, at the point i_0 and P_0. This holds a base of money, government debt and capital. Changes of the base of money and debts affect I and P changing the position of the curves *CM* and *MM*. Changes in ap, p, e, W, H and π affected by a monetary or fiscal policy change *CM* and *MM* at the same time. Solutions concerning I and P in the equations for the asset market are obtained from equations (1) and (2), with the price level and price forecast being constant.

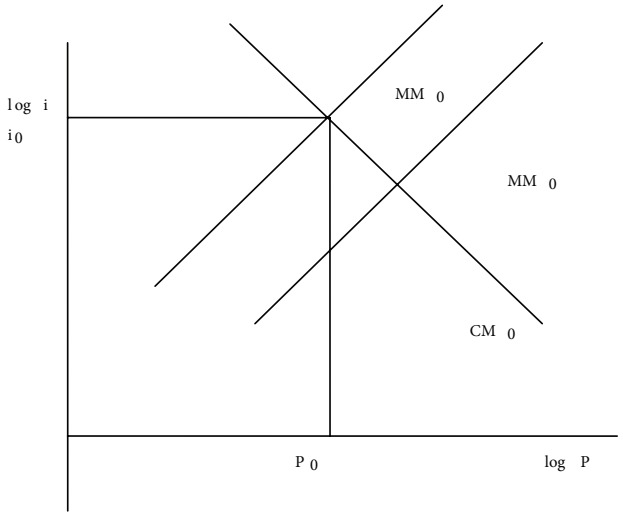

Fig. 2. Interest rate and asset price interaction

3. Differentiation of the bond and money market

Differentiation of the equalities for the bond market (*CM*) and money market (*MM*) and use of partial derivatives result in the following derivatives:

$$MM: \frac{\mathrm{di}}{\mathrm{dP}} = -\frac{\lambda \mathrm{p} + \lambda \mathrm{wK}}{\lambda \mathrm{i} + \lambda \mathrm{wViS}} > 0. \quad (4)$$

Derivative *MM* is obtained from equation (4): we look for the derivative when

$$B = \lambda(I, P, w); \quad (5)$$

$$dB = \lambda i di + \lambda p dP + \lambda w dw. \quad (6)$$

Derivative *CM* is obtained from equation (5):

$$dS = \beta i di + \beta p dP + \beta w dw, \quad (7)$$

$$dW = KdP + Sdv + vdS + dB. \quad (8)$$

K = constant.

Sdv + vdS is the differential of the product of *vS*.

This is an equilibrium model showing that *B* and *S* are in equilibrium, which means that they have a max or min value as functions, when their partial derivatives in respect of *P* equal zero (= 0).

B and *S* equilibrium in respect of *P,* minimum values of *B* and *S* ensure a stable condition:

$$\frac{dB}{dP} = \lambda i \frac{di}{dP} + \lambda p \frac{dP}{dP} + \lambda w \frac{dw}{dP} = 0, \quad (9)$$

$$\frac{dS}{dP} = \beta i \frac{di}{dP} + \beta p \frac{dP}{dP} + \beta w \frac{dw}{dP} = 0. \quad (10)$$

Equations of derivatives (9) and (10) include the equilibrium presumption that *B* and *S* reach the minimum.

$$\frac{dW}{dP} = K\frac{dP}{dP} + S\frac{dv}{dP} + \frac{dB}{dP}. \quad (11)$$

Equation (14) is an equation of a balance.

Whereas $\frac{dS}{dP} = 0; \frac{dB}{dP} = 0,$ equation (11) results in the following:

$$\frac{dW}{dP} = K + S\frac{dv}{dP}; \quad (12)$$

$$\frac{dv}{dP} = \frac{dv}{di} x \frac{di}{dP}; \quad (13)$$

Then $$\frac{dW}{dP} = K + S\frac{dv}{di} x \frac{di}{dP}. \quad (14)$$

Equation (17) is inserted into equation (12):

$$\frac{dB}{dP} = \lambda i \frac{di}{dP} + \lambda p + \lambda w\left(K + S\frac{dv}{di} x \frac{di}{dP}\right) = 0; \quad (15)$$

$$\frac{dS}{dP} = \beta i \frac{di}{dP} + \beta p + \beta w\left(K + S\frac{dv}{di} - \frac{di}{dP}\right) = 0; \quad (16)$$

$$\frac{dB}{dP} \%\lambda i \frac{di}{dP} + \lambda p + \lambda wK + \lambda wS\frac{dv}{di} x \frac{di}{dP} = 0; \quad (17)$$

$$\frac{di}{dP}\left(\lambda i + \lambda wS\frac{dv}{di}\right) + \lambda p + \lambda wK = 0; \quad (18)$$

$$\frac{di}{dP} = -\frac{\lambda p + \lambda wK}{\lambda i + \lambda wViS} > 0. \quad (19)$$

Similarly:

$$\beta i \frac{di}{dP} + \beta p + \beta w\left(K + S\frac{dv}{di} x \frac{di}{dP}\right) = 0; \quad (20)$$

$$\frac{di}{dP}\left(\beta i + \beta wS\frac{dv}{di}\right) + \beta p + \beta wK = 0; \quad (21)$$

$$\frac{di}{dP} = -\frac{\beta p + \beta wK}{\beta i + \beta wViS} < 0. \quad (22)$$

We may write the partial derivative of the functions of the money market as follows:

$$MM: \frac{di}{dP} = -\frac{\lambda p + \lambda wK}{\lambda i + \lambda wViS} > 0. \quad (23)$$

And the partial derivative of the function of the bond market as follows:

$$CM: \frac{di}{dP} = -\frac{\beta p + \beta wK}{\beta i + \beta wViS} < 0. \quad (24)$$

With λ and β specifically defined as functions of the money base B and bonds or debts S expressed in equations based on the arguments in equations (1) and (2), we may

find the *i* and *P* values in compliance with the equilibrium conditions and forecast them depending on the real data or, with the *i* and *P* values, we may forecast *B* and *S*.

The position of the curves *MM* and *CM* in Fig. 2 and *i* and *P* values depend on *B* and *S* and all variables, where *i* and *P* serve as the arguments for the functions λ and β. By increasing *B, MM* curve moves to the right, which means that interest rates on debt securities are likely to decrease, while the price of assets may rise (see equation (3). However, the public, in this case, may suffer losses, for the state pays less interest on bonds, while the price of the real capital goes up, though the real capital itself remains unchanged. This is the essential conclusion, which is the case when money supply increases where the national product is stable or decreasing.

4. Conclusions

In pursuit of the price and finance stability we analyse the interaction between the money supply and asset value by showing the changes that occur when the balance between the money supply and demand is upset in the market. However, the growth of the inflation level and prices serves as a signal that the money supply needs regulation, sometimes also employing strict measures of monetary regulation. Therefore, a regular analysis of the processes in the money market is essential.

The methods for the analysis of the money supply and asset value used in the article enable the assessment of the impact by each variable on the money supply or base of money, which helps to uncover both: the reasons for the price growth and factors affecting inflation.

Presently, the tendency for the growth of inflation is of two types in Lithuania. Inflation is affected by both external and internal factors. All factors affecting inflation can be divided into external (exogenous) and internal (endogenous). External factors, such as increasing prices of energy resources in the world, directly depend neither on the national economic policy, nor on any other factors of the economic growth.

Nevertheless, the prices of all goods and services related to the increasing prices of energy resources in the domestic market as derivative prices will always depend on the monetary and fiscal policies of the state. Consequently, the growth of both prices of energy resources and all other prices of related goods and services are attributable to external factors, independent of and dependant on the conditions in the domestic market, and may be called the external inflation, which is hard, though partly possible, to be affected by fiscal and monetary measures.

The second part of the inflation relates to the internal factors. The increased excess of liquidity of the gross national product is associated with excess quantity of money in circulation and its price belongs to the internal factors inducing inflation. Such type of inflation is „controllable", i.e. depending on the monetary policy of the national central bank and the fiscal policy of the government. To harness such type of inflation measures of the monetary and fiscal policies are employed.

The formulas of empirical studies provided in the ARTICLE show what influence of the changes in interest and the asset value could reduce the quantity of money in circulation and slow down the price growth.

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