Money Policy Modelling in View of the Macroeconomics Stabilization

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Abstract: - The stabilization of an economy can be achieved in two ways: (a) in case the behavior relationships that are specific for the endogenous variables depend on the long term variables, not on the current values of the variables; and (b) by using the automate stabilizers’ properties. The latter ones stand for mechanisms that automatically trigger compensation modifications to the current changes that occur to the income; however, at the same time, they represent a bottleneck to obtaining the targeted level of the income or of the output, and they are commonly made use of within the counter-cyclic tax policy.

The macro-stabilization policies applied to Central and Eastern Europe countries are issued based on a model according to which the trade liberalization, the real wages cutting-down and the cutting down of government subsidies shall lead to the development of private businesses both as concerns the investment domain, and also that of the production, as well.

Key-Words: - macroeconomics modelling, cybernetic systems, money policy, multiplier process, interest rate, inflation targeting, macroeconomic stabilization.

1. Basic correlations of the money policy

Should the government / the decision making party frequently adopt a decision, the same phenomenon shall be expected to happen in the future, too. A method to solve this situation relates to underlying a temporal lack of consistency with other optimal policies. The government’s credibility shall be affected if several recession shocks occur, and if they are answered to, each time, by means of expansionist money policies (or tax policies). An example of the credibility decrease occurs when an inflation decrease is looked for. We can illustrate this with the help of the Phillips curve as in figure 1. People are assumed to expect that the inflation be x%, supposing that, in economics, there is no increase of the labor productivity, therefore, the Phillips curve applies for the short term. Under such circumstances, the economy shall remain at point A (where the inflation is x% and the unemployment is equal to the U natural rate) if the expending currency rate is x%. Should the government make public his intention to lower down the inflation, and in view of that, the government would adopt a cutting-down policy of the expanding currency rate under x%, there shall occur a sudden decrease of the inflation rate, but, however, the unemployment rate shall not increase. The economy shall move on from point A to point B. This situation occurs under the conditions in which people believe that the government’s policy shall result in the predicted and looked-for result. In case people do not believe that the government shall mark a success with this, the government’s credibility shall decrease, and inflation
shall not be expected to decrease. The higher the government’s credibility, the faster the people shall modify their expectation related to the inflation; therefore, the Phillips curve shall get closer to point B. Nevertheless, should the government achieve the costs of their anti-inflation policy, and should the government come back to this one, it is not only that the government shall not fulfill the targeted objective, but the government shall also trigger an increase of the costs of their anti-inflation future policies. These shall be less credible, and, consequently, the people shall be less willing to accept that a decrease of the money stock could be maintained, and, as a conclusion, they shall be more cautious with reference to their inflation-related expectations; people shall no longer be moderate as concerns the (price / wage) report, and they shall put pressure to obtain a salary increase to comply with the inflation increase.

Due to the consequences they have on the future credibility, the adopted policies shall have in view not only the short term costs, but also the long term ones, while also including the costs triggered by the credibility decrease. The more the elections come closer, the more the government’s credibility decreases, and people consider that the announced policies are rather oriented to the election campaigns, and less to the economic situation improvement.

Henceforth, when the basic correlations of the money policy are talked about, it is the output – the money stock correlation, the interest rate – the inflation rate, and the money stock – the inflation rate that we really talking about.

1.1. Output – money stock
Given the following function of the output (Y):
\[ Y = \alpha_0 + \alpha_1 + \beta M + \varepsilon \tag{1} \]
where M represents the currency offer, X represents the explicative variable on which Y depends, \( \varepsilon \) represents the stochastic error, \( \alpha_0, \alpha_1 \) and \( \beta \) are the coefficients of this regression equation with \( \mu_\varepsilon = \mu_\xi = 0 \) and \( \sigma_\varepsilon = 0 \).

The central bank adjusts M to compensate for the consequences of X on the output (PIB), and, thus, we shall obtain the optimum M:
\[ M^* = \frac{(Y_f - \alpha_0 - \alpha_1 X)}{\beta} \tag{2} \]
Where \( Y_f \) stands for the desired level of PIB.

Given \( M = \lambda M^* \) with \( \lambda \) being either \( <1, =1 \) or \( >1 \). We shall calculate \( \sigma_{YM} \):
\[ \sigma_{YM} = [\alpha_1 X (1-\lambda) + \varepsilon] [-\lambda (\alpha_1 X)/\beta] \sigma_X^2 \tag{3} \]
If \( \lambda = 1 \), then \( \sigma_{YM} = 0 \)
If \( \lambda < 1 \), then \( \sigma_{YM} < 0 \)
If \( \lambda > 1 \), then \( \sigma_{YM} > 0 \).

For he money policy to become optimum, that is to say \( M = M^* \), therefore \( \lambda = 1 \), there shall result that M and Y are not correlated.

Then, when the inflation exceeds the money stock increase rate, the real currency offer shall decrease, and, reciprocally, when the inflation is no longer supported by the money stock increase, the production shall decrease. Therefore, it is imperative that a money stock increase rate be determined to be correlated with the PIB in order to assure an adequate monetization of the economy.

1.2. Interest rate – inflation rate
We shall take into consideration an economic system in which the interest rates are free to adjust (competitive equilibrium), and the present and estimated inflation shall be exogenously determined. This way, we shall be able to analyze the interest rate adjustment within the commercial bank system to be in a partial equilibrium.

It can be proven that the report between the real interest rate for credits and the inflation nominal rate is strong and positive, and that the report between the inflation and the real interest rate for deposits is negative.

The real rates of the interest are:
- for deposits: \( r_d = i_d - \pi \) \tag{4}
- for credits: \( r_c = i_c - \pi \) \tag{5}
where \( i_d, i_c \) respectively, represents the average nominal interest rate for deposits, and, respectively, credits offered by the bank system for all the types of deposits, for all the levels of maturity.
Given \( k \) as the average percentage of the statutory reserves in deposits (\( D \)), and, assuming that the statutory reserves are not interest-bearing, the credits (\( L \)) shall represent:

\[
L = (1 - k) D \tag{6}
\]

Even if there is no official interest rate cap, or any other restrictions for the credit, the statutory reserves force the commercial banks to substantially cut down the interest rate for deposits and to increase the interest rate for loans, and the result would consist in contracting flow of funds in view of loans. Surprisingly enough, the increase of this cutting-down largely depends on the inflation rate, even when the nominal interest rate adjusts freely depending on the inflation.

Further on, we shall assume that the banks that attract deposits operate at a zero profit, meaning that the current receipts from loans are entirely paid by the depositors, that is to say:

\[
i_{i}L = i_{d}D \tag{7}
\]

where \( i_{i} = i_{d} / (1 - k) \)

We can obtain \( \pi \) from the equations (4) and we shall replace it in (7):

\[
r_{l} + \pi = (r_{d} + \pi) / (1 - k)
\]

There results: \( r_{l} = r_{d} / (1 - k) + \pi k / (1 - k) \tag{8} \)

The equation (8) indicates the fact that the extent to which the real rate for credits exceeds the real rate for deposits is and increasing function of \( k \). Therefore, at a given real rate for deposits \( (r_{d}) \) and having a given \( k \), the real rate for credits shall increase simultaneously with the inflation rate. The bigger the inflation, the more the banks shall be forced to pay a bigger nominal interest for deposits to be able to maintain the real base of the deposits. The conclusion is that when the nominal interest rates are free to adjust, the inflation shall trigger the increase of the difference between the interest rates for deposits and the loans \( (r_{l} - r_{d} = i_{i} - i_{d} = \pi) \).

### 1.3. Money stock – inflation rate

To support the use, by the money policy as operational target, of the offered money stock, we shall analyze the equilibrium condition of the Cagan model. Here, the money request function is a function that is exponential from the minus of the estimated rate of the inflation.

From the equilibrium of the demand for money real offer there results:

\[
M_{t} / P_{t} = \exp \left[ -\alpha \left( E\left( P_{t+1} | \Omega_{t}\right) - P_{t}\right) / P_{t} \right] \tag{9}
\]

By applying the logarithms to both members, and further to taking into account the fact that we can make the approximation

\[
E(P_{t+1} | \Omega_{t}) - P_{t} = ( E(P_{t+1} | \Omega_{t} - P_{t}) / P_{t}
\]

we shall obtain:

\[
m_{t}p_{t} = - \alpha \left( E(P_{t+1} | \Omega_{t}) - P_{t}\right)
\]

And therefore:

\[
p_{t} = a \left( E(P_{t+1} | \Omega_{t}) + (1-a) m_{t}\right)
\]

Where \( a = \alpha / (1 + \alpha) \).

Therefore, the price level depends on the level estimated for the next period and on the current nominal money stock. Since in this model the demand for money is a function that decreases in relationship with the inflation estimated rate, \( \alpha > 0 \), and, therefore, \( a \) (0.1). The flexibility of today’s price level compared to the level estimated for the future is less than 1.

The announcement of a future increase of the money stock shall result in the increase of the price present level. The real money stock \( (M / P) \) shall decrease, and the prices shall increase little by little, in time. Henceforth, the inflation shall happen previously to the money offered quantity, which is due to the fact that individuals look forward into the future. They know that during the period before the money stock increase, inflation is estimated, and, thus, they try to reduce the quantity of money. This way, the prices shall become bigger previously to the money stock increase.

### 2. Inflation reduction

The reduction of the inflation gives birth to two problems that are related to the drawing up of the money policy, namely (a) what is the speed at which inflation should be reduced to the desired level, and (b) whether the money policy should react to the output shocks in the same way as the inflation.

Mervyn King introduces the concept of optimum speed to obtain deflation as being that speed at which the inflation target (the proposed objective level) converges to the price stability. It shall also be possible to approach the issue of the speed at which policy compensates a temporary shock on inflation – the money policy flexibility, but this is valid only for those countries that have a credible commitment regarding the stability of prices (or a low and stable rate of the inflation), situation that shall not be approached here.

Therefore, as concerns the countries that try to pass from a moderate or high inflation regime to a regime of the price stability, it is possible to speak about the
There is an optimum des-inflation speed that depends on how quickly the expectations adapt, with reference to the inflation within the private sector, to the regime modification.

### 2.1. Inflation targeting

A money policy program shall be defined by an assembly of objectives (intermediary, operational, final) that share different interdependency and instrument relationships by means of which the first targets shall be reached; however, all of them are conditioned by a set of restrictions of a macro-economical nature in order to obtain the economic system stability at the money level.

The money strategies that are targeted as of the present moment by the central banks can be classified into three categories: inflation targeting, money aggregate targeting, and exchange rate targeting, respectively. The supporters of the first two classes are the Bank of England and Bundesbank, respectively, while the common objective, even for the Bank of Austria – who aims at the exchange rate targeting (so that this one acquire stability in relationship with the German mark), consists in assuring the price stability.

The proposed solution for the potential problems that are related to the implementation and monitoring of the inflationist target refers to setting the forecasted inflation as a target (inflation forecast targeting). Since the inflation targeting implies the inflation forecasting, this one becomes the central bank’s intermediary target. By definition, this one is the current variable that is the best correlated with the final target, it is better controllable than this one, and it can be more visible and obvious than the final target. At the same time, it can be extremely transparent, and, thus, it facilitates the communication with the public; consequently, the last one shall be able to understand the money policy.

### 3. Inflation model for the macro-economics stabilization

The main hypothesis of the hereinafter proposed model, hypothesis to be applied to Romania’s situation, as well, refers to the fact that the money policy is set and managed by the central bank, and, therefore, this one acquires the full independency of the used tools – this way becoming free to select the policy type in the absence of the government’s interference (Art. 2 from the National Bank of Romania’s statute). This is the case of setting a target level that is optimum, and therefore, entering into a contract with the central bank (Svensson, 1997) who has operational independency, rather than an independency of the targets (liberty to set the money policy targets). This delegation of the money policy can be interpreted as a main commitment (society) – agent (central bank).

The central bank approaches the money policy based on a loss function; it is only afterwards that this one shall reach the decisions while this function looks like below:

\[
L_{BC} = \frac{1}{2} \left[ w \pi^2 + (Y_t - sY_t^*)^2 \right]
\]

Where \( \pi \) is the inflation rate during the period (month) \( t \); \( Y_t \) is the output level; and \( sY_t^* \) represents the desired output level (at the equilibrium); \( w \) is a stochastic parameter with the average equal to 0 and with a constant dispersion (heteroskedastic); \( w > 0 \). \( w \) represents the relative aversion of the output deviation to the inflation. The smaller \( w \) is, the bigger the tolerance to the inflation. At the limits, a central bank who does not care for the output level (\( s = 1 \)), shall produce a 0 inflation. The \( 1/w \) relationship stands for the aversion to inflation, and, therefore, it shall be as big as possible. “s” stands for a parameter that indicates the output variation permissiveness from the equilibrium level, \( s > 0 \).

The condition is that the central bank minimize this loss \( (L_{BC}) \) in relationship with the inflation.

The study carried out by Bruno M. and Easterly W. (1998) comes to the conclusion that a yearly inflation rate of more than 40% (inflation crises) shall result in the dramatic decreases of the output increase, that shall, however, be quickly recovered, after the stabilization. There is more to it as the econometric results developed by the two economists point to, and support the fact that a high inflation stabilization does not involve output losses. The regressions estimated for 12 Latin American counties (known for the inflation high rates) for a period of 30 years (between 1950 and 1985) have demonstrated that a reduction to the half of the inflation rate has resulted in the slowing down of the PIB increase by 0.4%.

The money policy has an impact on the output and on the labor employment on the short term, NOT on the long term, as here the real economy contribution is necessary. This way, the money policy becomes a combination of an ex-ante set targeted inflation and a discretionary answer to certain shocks. These shocks are the ones the central bank is in a position to answer before the private sector has managed to adjust their activity. Subsequently to numerous transformations of the Phillips equation described in 1958 that refers to the existing negative correlation between inflation and unemployment, there has been reached the finding of an inverse correlation between output and inflation, but...
The equilibrium on the goods and services market (IS):

\[ Y_t = k' \left[ a + b E_t + d M_t \right] \]  

(22)

Where

- \( Y_t \) stands for the output level;
- \( a \) stands for the own income effect;
- \( b \) stands for the import sensitivity to the currency rate; and
- \( d \) stands for the export sensitivity.

And \( k' = 1/[(1-c)(1-t) + m + g11/12] \)  

(21)

The central bank can chose, in view of running his money policy program to control the inflation, between using a money aggregate (M2 or the money base M0) as operational target, or using the currency rate. It is, therefore, possible to set, as an anchor, the money stock or the currency rate; in the first case, the currency rate shall either be maintained as stable, or it shall be allowed to fluctuate within limits; and, in the second case, the procedure shall be similar to the money stock dynamics.

The inflation control by means of the M2 aggregate control is based on the hypothesis of the stability of the velocity of money. The estimations have proven that the output dynamics is significantly correlated with the money stock elements. But, since between the modification of the money stock level and the modification of the inflation level there exists a certain lag, within this time interval a modification is likely to occur, namely a modification of the determinant elements of the money rotation speed, and particularly of the trust in capabilities of the money authorities to practice an anti-inflationist policy.

The money stock control implies the control of its component parts, and the difficulty consists in the fact that, as far as a transition economy is concerned, the evolution of the variables cannot be known beforehand, the described operational relationships are not stable, and the disturbances that affect the financial market do not abide by a normal distribution law.

The loss function of the central bank can now be written in a more displayed way:

\[ L^{BC} = \frac{1}{2} \left\{ w \pi_t^4 + \left[ Y_t^* + h(1-\gamma)\pi_t - h(\pi_{t-1} - \pi_{t-2}) + e_t - s(a + bE_t + dM_t) \right]^2 \right\} \]  

(26)

By minimizing during the current period, we shall obtain:

\[ \partial L^{BC} / \partial \pi_t = 0 \]  

(27)

\[ \omega \pi_t + h(1-\gamma) \left[ (1-s)(a + bE_t + dM_t) + h(1-\gamma)\pi_t - h(\pi_{t-1} - \pi_{t-2}) + e_t \right] = 0 \]  

(28)
The inflation objective level shall become:

\[ z_t = \frac{\beta (1-\gamma) (x_{t-1} - x_{\omega, t})}{[w+h^2 (1-\gamma)^2]} + \frac{\beta (1-\gamma) (a + bE_t + dM_t)}{[w+h^2 (1-\gamma)^2]} + \frac{h (1-\gamma) \epsilon_t}{[w+h^2 (1-\gamma)^2]} \]  

(29)

\[ \pi_t = \rho_0 (\pi_{t-1} - \pi_{t-2}) + \rho_1 E_t + \rho_3 M_t + \rho_4 \]  

(30)

Where

\[ \rho_0 = h(1-\gamma)/[w+h^2 (1-\gamma)^2] \]

\[ \rho_1 = \nu \rho_0 \]

\[ \rho_2 = (1-s) \beta \rho_0 \]

\[ \rho_3 = (1-s) d \rho_0 \]

\[ \rho_4 = [(1-s) a - \epsilon_t] \rho_0. \]

If there exists an objective level of the inflation, and it is known ex-ante by the economic subjects (and they also take into account a certain verisimilarity coefficient related to the fulfillment of the target that the political decision making factor has declared), then, the money policy credibility shall be maximum when the deviation of the inflation effective level registered during the period from its objective level is minimum.

4. Conclusions

Under the specific conditions of the transition period, the impact of the money policy on certain factors shall be reduced, and, this way, the capacity of the money authority to control a certain inflation level is limited to operating only for a short term.

The money policy is subject to the influence of a multitude of exogenous factors, and, consequently, any forecasting of this one has a high degree of uncertainty. However, the money authority can undertake certain targets (to reduce inflation, to get a stable national currency rate) and can shape its policies so as to be able to fulfill them. Since prices answer with a certain lag to any economic shock, the price stability target implies the increase of the interest rate immediately after a shock, and shall not wait for the prices to increase.

A round the clock attention shall be granted particularly to three elements that are likely to become the money policy tools: (1) the interest rate – to be positive in real terms. It can influence, on the short term, the currency rate (the bigger the interest rate in relationship with the inflation, the more demanded the respective country’s currency shall be, that is to say, the more appreciated it shall be). (2) the money stock – this one should grow more rapidly than the inflation rate, resulting in “ceteris paribus” – to reduce the money rotation speed till the level considered as “normal”: 3-4 rotations per year. (3) the currency rate. The central bank’s decisions should be related to two aspects:

- how to control the money stock and the interest rates
- whether to have a steady currency rate, or to allow it to fluctuate.

Therefore, a money policy rule should be set based on:

- the identified operational tool – the interest rate or the money base
- the final target
- the loss function to which a cost can be added in case of more ample deviations from the target. For example, it can be important for the central bank to have the reputation to be able to assure a slow modification of the bank rate without large movements and sudden returns, thus to avoid the appearance of uncertainty on the financial markets.

The decision making factors shall, at the same time, be aware of the lags, be able to estimate the future values of the variables in the absence of money policy actions, be familiar with the external shocks that might “hit” the economy, and be aware of the impact of such shocks.

References: