The Transmission Mechanism of Monetary Policy in Romania

S.A. Ionescu, A.R. Voicu, A.Ionescu

Abstract— As concerns the process to traverse the macroeconomics analysis reasoning of the budgetary earnings and expenses, there shall be crossed the phases whose target consists in defining and understanding the „*the balanced production*" term. The issue of the consequences generated by the increase of the real quantity of money on the interest rate from the transmission mechanism point of view is by means of the monetary policy management mechanism that the National Bank shall control the money stock as an independent variable, and, consequently, shall also control the interest rate and the available income as associate variables. The multiplier modelling process can make it possible to render evident a possible interaction between the central bank and the other banks as concerns the money offer. This interaction implies an adjustment mechanism that consists in re-defining the monetary base, in re-formulating the multiplier, and in studying the money – credit relationship.

Keywords— macroeconomics modeling, cybernetic systems, money supply, multiplier process, interest rate, monetary base

I. THE MAIN CHARACTERISTICS OF THE MONETARY POLICIES

The Romanian banking system has experienced a continuous development from the point of view of financial operators, offered products and services as well as from the point of view of geographic spreading in the country.

Identifying the correlations and the degree of structural similarity between the national reality and the international one in the fiscal-financial system is essential in our analysis.

Monetary policies represents the action, with a global character, for economics variables: price, level of activity, using of work power, external balance. This action shall be carried out by means of money aggregates, in spite of the fact that these are not controllable. These variables are called intermediary objectives, and they represent the money policy target. The intermediary targets are the money aggregates and the credit aggregates, the interest rate and the currency rate.

A. Money policy targets

The moment, tactical targets of the economic policy are also the money policy targets, and they are subordinated to certain permanent, strategic targets.

The purposes of the economic policy have in view, mainly, labor employment, price stability, economic increase, and balance of payments stability.

The list with other purposes of the economic policy can continue as follows:
- state budget stability
- achievement of a more equitable assignment of the earnings to the society
- national resource conservation
- external debt reduction, etc.

At a certain moment, the priorities depend, as far as each country is taken apart, on the existing economic conjuncture context. The economic policy targets shall be achieved by applying alternative economic strategies, within which there are used diverse combinations of the economic tools, depending on the conjuncture of the economy evolution and structure.

The money policy depends, to a great extent, on the mixture of economic policies, on the proportion in which they enter into this combination, while even demonstrating that the money policy targets cannot exist by themselves, in the absence of the other targets of the economic policy.

The targets that the money policy can pursue are: inflation control; the control of the volume of money offer from the economy; assurance of an incentive level of the effectively practiced interest rates and of an adequate level of the currency rate of the national currency, but, the main target refers to the avoidance of not-anticipated fluctuations of the prices, therefore, it refers to getting the prices at a steady level for the long term. The basis of an analysis given by the equation of the exchanges that Irving Fisher formulated in 1911:

$$M*V = P*Q \qquad (1)$$

Where M stands for the money stock, V stands for the money rotation speed in economy, P stands for the price level, and Q stands for the quantity of goods and services.

There is more to it, namely, since the prices are a variable that is determined by this equation:

$$P=(M*V)/ Q \qquad (1')$$

The money circulation speed, V, represents an exogenous variable that depends on psychological factors.

The increase of V means the decrease of the trust in the national currency. The money policy natural target refers to the general level control of the prices (of inflation) that can be achieved by means of the aggregate demand control, and particularly by means of the money stock control, the latest one being the only one from the variables of the modification equations that the state can control in a direct way, based on the sovereign right for money issue, and this, however, within certain limits.

The previous years' experience has outlined that the targets that have in view the external equilibrium and the prices cannot be reached without registering negative consequences on the output increase and on the use of the production factors, while further to favoring the increase and the employment, it shall be the external equilibrium and the inflation that shall be affected.

This sequence, that starts from the tools and goes till the final targets of the money policy, contributes not only to a better understanding of the policy transmission, but also to a higher transparency of this one, fact that is very important as concerns that economy in which the public formulates and acts in accordance with certain expectations (anticipations) of the economic variables.

B) Money policy tools

According to the coherence principle that was issued in 1952 by the Dutch economist called Jan Tinbergen, the economic policy shall make use of at least as many independent tools as the independent targeted objectives. At the same time, according to R. Mundell (1963), it is advisable that each tool be assigned to the target for which the respective tool has the strongest relative efficiency (efficiency principle).

Based on the submitted theory, there results that indirect tools correspond to the actions taken on the market, while the direct tools represent measures taken by the money authorities.

The category of indirect tools contains: the bank rate, the open-market policy, and the system of statutory minimum reserves.

C) Statutory minimum reserves

The statutory minimum reserves - presented to the world for the first time in the USA, back in 1993 – were developed with a purpose to assure a minimum solvency at the central bank; the reserves have been designed as percentage from the sum of the deposits to be found at the banks belonging to the system.

Depending on the conjuncture interests, they can be used as a tool of the money policy in order to increase the volume of the credit that has been granted to the economy (crediting conditions relaxation), thus intensifying the economic activity (by means of reducing the statutory reserve) or in order to immediately narrow down the credits and to attenuate the development of the economic activity (by increasing the reserve). The idea to build such reserves is based on the fact that, between the unemployed crediting resources and the long-term availabilities, on the one hand, and the credits granted for different subject matters, on the other hand, there should exist a tight correlation. The overdrawing, beyond certain limits, of the granted credits in relationship with the available resources, leads to a question with reference to the bank solvency, and, obviously, to its reliability.

The fluctuation of the quota of statutory minimum reserves is extremely efficient as it directly affects the credit multiplier, it can be practiced under the form of the differentiating quotas depending on the money stock structure, and it results in a successful output both in case of the economy where there are

bank notes to a big extent, and also in case of the economy where the bank money prevails.

Period	Interest rate (%)
01 August 2008 – 31 December 2008	10,25
27 June 2008 – 31 July 2008	10,00
07 May – 26 June 2008	9,75
27 March – 6 May 2008	9,50
4 February – 26 March 2008	9,00
8 January – 4 February 2008	8,00
01 November 2007 – 07 January 2008	7,50
26 June – 31 October 2007	7,00
03 May – 25 June 2007	7,25
27 March – 02 May 2007	7,50

Table 1. Evolution of the rate of statutory minimum reserves. Source: *the National Bank of Romania** It fluctuates depending on the currency solvency degree.

The money stock fluctuation is:

$$\Delta M = \Delta E \times \frac{1}{r + b - r * b}, \qquad (2)$$

Where:

ΔM = the newly created currency quantity

ΔE = the volume of liquid reserves in excess (that can be granted as credits)

R = the rate or the quota, or the coefficient of the statutory reserves

B = the preference for the bank money (the extent to which the funds remain in the bank system).

$$K = \frac{1}{r + b - r * b} \text{ is the credit multiplier.} \qquad (3)$$

The advantages of using the statutory minimum reserve mechanism (RMO) are as follows:

• it affects all the banks to the same extent;

• it contributes to a considerable decrease of the money multiplier volatility, to the increased stability of this one which results in the fact that the money offer is easier to manage;

• it increases the degree to which the depositing institutions depend on the money authority, on their regulations, which facilitates the control, by the central bank, of the money expansion;

• it is recommended in view of the (long-term) sterilization of the solvency excess, under the conditions in which this tend to acquire a chronic side.

D) Re-financing tools

In a series of developed countries, as well as in those under the transition process, the central banks apply two types of re-financing tools:

- permanent facilities,

- tools of the money market.

By *re-financing operations* there shall be modified the bank rate operations. Generally speaking, by bank rate, the property right on the collateral (guaranty) shall be transferred to the central bank until it grows to maturity. Consequently, the re-financing process shall be guaranteed for a period of time that corresponds to the maturity of the collateral involved in the transaction.

E) Open – market operations

As concerns the developed countries, the open – market operations have become the main money control tool. This is due to the advantages it implies, advantages that consist in:

- it offers increased flexibility, from the point of view of the volume of money policy operations initiated by the central bank;

- it allows the setting of impersonal relationships between the market participants;

- it allows the avoidance of the market inefficiency and of the economy, further to direct control.

If the open – market operations represent the main instrument to implement the money policy, it results that the other instruments should be adjusted so as to the target fulfillment be assured.

There is no program to strictly use certain money instruments to the purpose of assuring the economic stability, but, on the contrary, it can be talked about the existence of some action patters to achieve the targeted objectives, patters that do not take into account the historical and social realities of a country, as well as the cultural ones, too.

The money that exists at the level of the society at a certain moment is detained by the population as cash and as deposits at financial institutions. This means that the money stock (M) represents the total sum of the money that is deposited at institutions (D) and the money in cash that the population owns (N):

$$M = D + N \qquad (4)$$

If we consider that a first used money variable is the population's behavior (m1), seen as a ratio between the detained cash and the deposits at the bank, then, a second variable represents the banks' behavior (m2) that indicates the ratio between their reserves ® and the money deposits (D), and that since the deposits at the banks represent the debts that these institutions have to their clients, according to the same principle, the deposits at the Central Bank represent the debts that the Central Bank has to the depositing banks; and then, the third variable stands for the Central Bank's behavior; therefore, the below equations can be written down:

$$m1 = N/D \qquad (5)$$
$$m2 = R/D \qquad (6)$$
$$m3 = H/D \qquad (7)$$
$$M = m1*D + D = (m1+1) * D \qquad (8)$$

where H represents stands for the money base (money reserve with great purchase power).

This reserve is necessary to be able to meet the requested payments. The banks' preferences for the m2 ratio depend on three main factors:

- the cash flow lack of certainty (q),
- the bank rate (r_S), and
- the commercial interest rate (i_c).

The m2 ratio is a function of the following sequence: $f(q, r_S, i_c, i)$.

The main sources of the money base are: gold, foreign currency, credits and other sources.

The equilibrium between the high purchase power money offer and request is given by the amount between the cash (N) and the reserve (R):

$$H^1 = N + R \qquad (9)$$
$$H^1 = (m1+m2) * D \qquad (10)$$

The equation expresses the request for money under the conditions in which the population's preferred ratio between the currency and the deposit has been adjusted, as well as the bank's preferred ratio between reserves and deposits.

Under the circumstances, the money multiplier, K_m, is:
$$K_m = M/H^1 = (1+m1)/(m1+m2) \qquad (11)$$
$$K_m = f(i, r_S, r_R, m1, q), \qquad (12)$$
where:
1 = interest rate
r_S = bank rate
r_R = requested reserve rate
q = deposit flow fluctuation.

Considering that there exists equilibrium on the money market, that is to say when the real request for money L(I, Y) is equal to the real offer of money (P – the price is indicated, so is the income – Y), then, it results that the below equation exists:

$$L(I,Y) = M/P \qquad (13)$$

and:
$$L(i,Y) = K_m(i, r_S, r_R, m_1, q) * H^1/P \qquad (14)$$

This represents the equilibrium equation of the money market depending on all the elements, equilibrium that can be graphically drawn as follows:

LL – function of the real request for money;

MS – function of the real offer of money

It can be deduced that the Central Bank has as available, three main instruments for the money control: *the money base, H^1*, that can be controlled particularly by means of the free market operations; *the statutory reserve rate, r_R*, and *the bank rate, r_S*. Obviously, when the Central Bank controls the interest rate that has been paid for deposits, further to modifying these ones, the Central bank shall be in a position to influence the currency – deposit ratio, m1, and, therefore, the Central Bank shall be in the position to influence the money multiplier, K_m. In a free market economy, this control shall be eliminated step by step so that the interest be able to play its part as equilibrium instrument between the request for money and the money offer. At the same time, there can be no strict control of the money stock as m1 is not constant, and, on
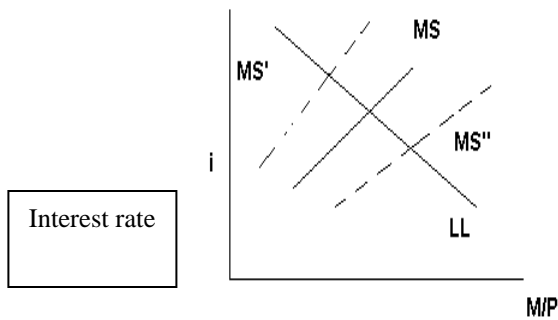
Fig. 1 Money market equilibrium

the contrary, it fluctuates from a period to another due to objective d subjective reasons that are more or less of a conjuncture nature. The level of ratio m2 is not constant, either, which is triggered by the fact that the deposits circulate between banks at different rates of the statutory reserve, and by the fact that banks modify the excess of the reserves they intend to detain.

F) Money policy pattern

To be able to submit an example of money policy, we shall use:

- y_t to mark the percentage deviation of the production from its natural state,

- πt_t to mark the inflation rate during the period t-1 and t (modification at the price level).

The production shall be determined by the aggregated request ratio:

$$yt = \psi_y E_t y_{t+1} + (1 - \psi_y)y_{t-1} - \square(i_t - E_t \pi_{t+1}) + \varepsilon^y_t, \qquad (15)$$

Where:

- i_t stands for the nominal interest rate that is related to a period that is set by the Central Bank.

The parameter $\varphi > 0$ is the reverse of the in-temporal elasticity of the substitution function of the consumption, and $0 = < \Psi_y = < 1$ determines the degree to which the agents shall forecast the consumption decisions.

When $\Psi_y = 1$, the previous equation becomes a linear approximation of the I-st degree Euler from the point of view of the consumption choice made by the agent.

The aggregated request perturbance ε^y_t is perceived as a white noise that comes from the natural interest rate fluctuation that represents the real interest rate that would result in maintaining the production at the same potential, and the production equation is as below:

$$yt = \psi_y E_t y_{t+1} + (1 - \psi_y)y_{t-1} - \square(i_t - E_t \pi_{t+1}) + \varepsilon^y_t \qquad (16)$$

where r^n represents the natural interest rate.

Under the circumstances, the inflation generated by the Philips curve is:

$$\pi_t = \psi_\pi \beta E_t \pi_{t+1} + (1 - \psi_\pi)\pi_{t-1} + \kappa y_t + \varepsilon^\pi_t, \qquad (17)$$

Where:

- $0 < \beta < 1$ is the discount factor of the representative agent
- $0 \leq \psi_\pi \leq 1$ determines the degree to which the competitive companies forecast the prices based on the expectations
- $k > 0$ is related to the evolution of the production prices.

The inclusion of the inertia $(1 - \psi_\pi) > 0$ shall be interpreted by from the point of fact that the workers are concerned with

the real wages when salary contracts are being negotiated. Up to this point, the pattern does not include any reference to the money aggregates.

Under the situation in which the exchange rate becomes the policy instrument, and the Central Bank wishes to have a stabilized inflation and production, the previous relations involve the necessity to postulate, either a loss function, or a policy rule for the Central Bank. This does not make it necessary to condition the money market equilibrium as the money stock does not play any independent part in the money transmission mechanism.

To be able to analyze the part paid by the money as concerns this pattern, it is necessary to indicate the relationship with the request for money that would postulate the quantity of money that needs to be provided by the Central Bank for this one to support a certain level of the interests. To have a simplified theory, there shall be considered a specific standard in which the request for money in view of the real detainings of money is positively correlated with the production modification, and negatively correlated with nominal interest rate. Further to achieving a first difference of the information sets, there shall be obtained the equation for the increase rate of the nominal money stock:

$$\Delta m_t = \pi_t + \alpha \Delta y_t - \gamma \Delta i_t + \varepsilon^m_t \qquad (18)$$

where:

- the α and γ parameters depends on the elasticity to replace the request for money by generation of reports related to the costs implies by the money ownership[2].

The money request perturbance, ε^m_t, stands for the shock, and it is considered as the *"white noise"*.

If the inflation is taken into account as depending on the consumption price index (ipc), on the deposits (d) that the National Bank of Romania has attracted, and on the credits © that have been granted, at the internal level, to the non-government sector, the previous equation shall be written as follows:

$$\Delta m_t = \square \Delta ipc - \square\square \Delta d + \square \Delta c + \alpha \Delta y_t - \gamma \Delta i_t + \varepsilon^m_t, \qquad (19)$$

Where $\Delta M2_t = \Delta M2_{lei} + \Delta M2_{val}$

II. EARNING AND EXPENSES. GOODS MARKET AND MONETARY MARKET.

As concerns the process to traverse the macroeconomics analysis reasoning of the budgetary earnings and expenses, there shall be crossed the phases whose target consists in defining and understanding the „*the balanced production*" term.

For the beginning, we take into account the following work variables:

Y – the real value of the production /of the earnings
C – public expenses
S – savings
X – exports
I – imports
TA – taxes
TR – transfers

NX – net exports

G – government expenses

An economy that implies neither the states's involvement (zero taxes, zero duties), nor exchanges with foreign countries shall be taken into account. Under such circumstances, there shall be obtained:

$$C+I=Y=C+S \qquad (20)$$

The left side of the identity indicates the component parts of the request, while the right side of it indicates the way in which the earnings are assigned. Given the situation, the savings are equal to the investments that have been calculated as a difference between earnings and consumption.

Should government expenses and net exchanges be included in the calculation, the below identity shall be obtained:

$$Y=C+I+G+NX \qquad (21)$$

However, in this situation, there shall appear the available income that is referred to as YD:

$$YD=C+S=Y+TR-TA \qquad (22)$$

thus obtaining

$$C=Y+TR-TA-S \qquad (23)$$

Nevertheless, if we replace in the equation (21), then:

$$S-I=G+TR-TA+NX \qquad (24)$$

It shall be easily noticed that the difference (G+TR-TA) represents the government deficit / excess.

Since $C=cY$, as consumption is a proportional function to the earnings, we shall obtain:

$$S=Y-C=Y-cY=Y(1-c) \qquad \text{and } 0<c<1 \qquad (25)$$

In case c stands for the marginal inclination to consumption, there shall be obtained the marginal inclination to savings:

$$s = 1-c \qquad (26)$$

I dare assert here that the IS-LM model can be placed at the basis of the macroeconomics policies to adjust and stimulate. This includes real and monetary factors, which leads to the identification of the market for goods and services (IS), and also to the identification of a monetary market (LM).

On the market for goods and services, the balance shall be reached when the global request and offer have become equal. Under the circumstances, the investments depend on the interest rate and on the initial moment, as well,

$$I=I_o+I_r*r \qquad (27)$$

where: I_o stands for the autonomous investment, I_r stands for the investment sensitivity to the interest rate evolution on which it negatively depends.

This way, it shall become possible to define the IS curve, namely as being the geometrical position of the combinations between the interest rate and the income, under the conditions in which the balance on the market for goods and services has been granted. Should all the factors remain constant, except for the interest rate, the lesser this one gets, the bigger the investment gets, and, the higher the interest rate gets, the lesser the investment gets, respectively. We should draw your attention here to the fact that, given an expansion fiscal policy (be it either an increase of the expenses, or a decrease of the duties) the IS curve shall shift to the right, while the restrictive fiscal policy shall move the curve to the left.

It is noticed that at a r_0 interest rate, the balance point on the market for goods is at E_1 according to the D_0 aggregated request straight line, and according to a Y_0 income. A decrease of the interest rate to r_1 implies an increase of the D_1 aggregated request, and, implicitly, of a level of the increased income to Y_1.

The IS curve is the more inclined so as the expenses with investments are less sensitive to the interest rate modification, and, respectively, it is the more flat so as these expenses become more elastic while related to the interest rate.
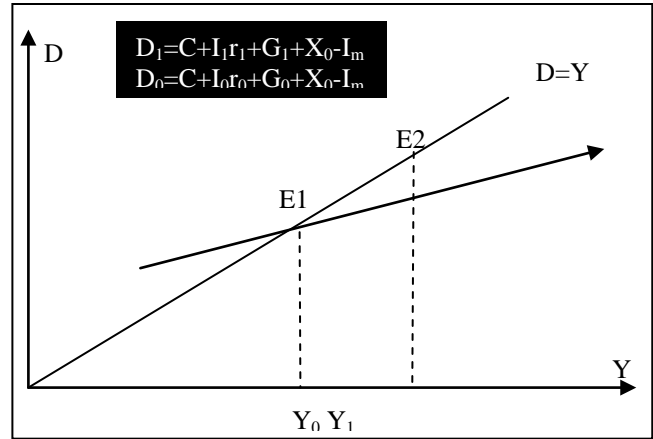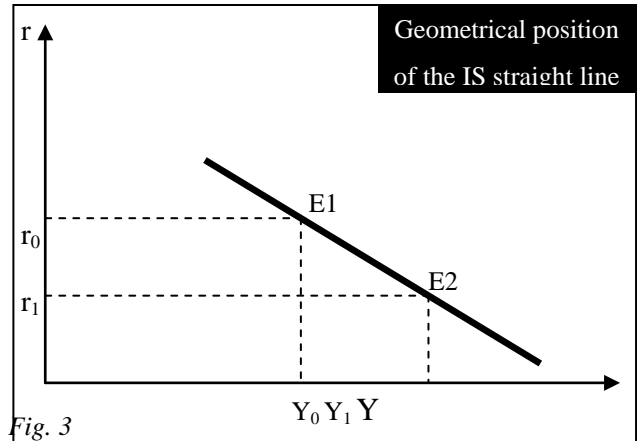

Fig. 2

Fig. 3

It can be noticed that, given an interest rate r_o, the equilibrium point on the market for goods is at E_1 according to the aggregated request, D_0, and acceding to an income, Y_0. A deduction of the interest rate to r_1 means an increase of the D_1 aggregated request, and, implicitly, of a level of the income increased to Y_1.

The IS curve has more propensity since the expenses caused by investments are less sensitive to the interest rate modification, respectively it is more flat since these expenses are more elastic in relationship with the interest rate.

As concerns the monetary market that generates the LM curve, the balance shall be agreed to exist when the request has become equal to the money offer. The money request is directly proportional with the volume of the earnings, with the number of transactions from the economy, respectively, and inverse proportional with the interest rate. Subsequently, it can be defined as being the balance geometrical position that

occurs on the monetary market of the interest rate and associated income combinations. The bigger the inclination of this straight line is as the bigger the sensitivity of the money request to the income fluctuation (k) is, and as the lesser the sensitivity of the money request to the interest fluctuation (h) is.

$$M^D = k*Y-h*r \qquad (28)$$

Starting from the request and offer curve on the monetary market, it shall be possible to set the adequate LM curve (Fig.4, Fig.5)
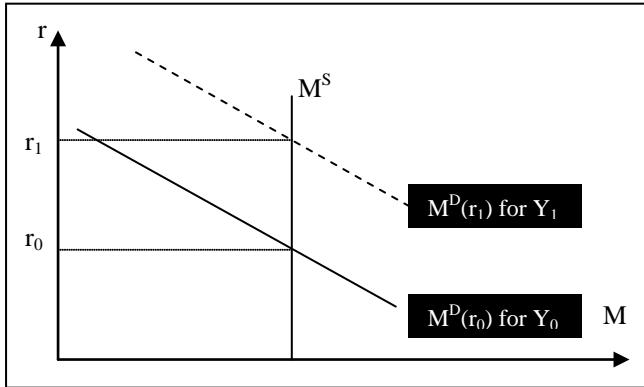

Fig.4

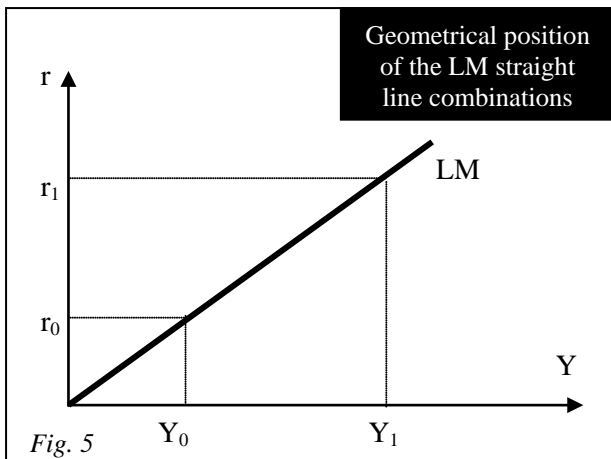Geometrical position of the LM straight line combinations

Fig. 5

The LM has a positive inclination as, further to a constant money offer, the income level increase, and, therefore, the money request increase, shall be accompanied by an interest rate increase. An interest rate increase leads to the decrease of
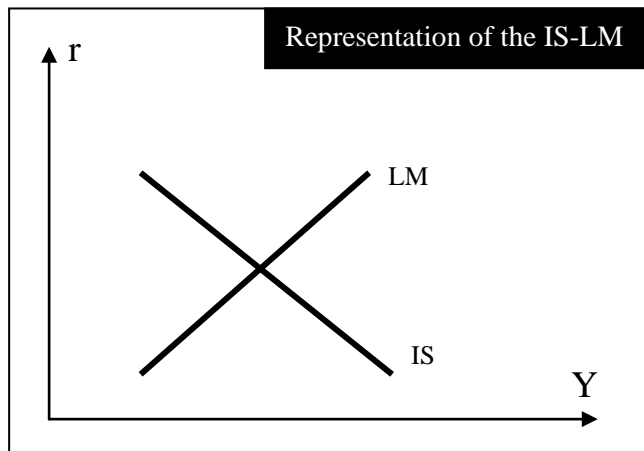

Representation of the IS-LM

Fig.6

the real currency request, and to manage that the request keeps being equal to the fixed offer, the incomelevel should be increased. Or otherwise asserted, an expansion monetary policy to increase the money offer shifts the straight line of the money stock offer, which triggers the interest decrease further to the need to maintain the balance on the market (Y_0), and also triggers the shift of the LM curve to the right and downwards depending on the money request flexibility while related to the interest rate.

The simultaneous balance of the two markets, the goods market and the monetary market, respectively, shall be reached at the intersection point of the two curves (fig.6)

The following equations shall be placed at the basis of this mathematical pattern:

$$D=C+I+G \qquad (29)$$
$$NX=X-Im \qquad (30)$$
$$C=C_0+c_y(Y-T) \qquad (31)$$
$$I=I_0+I_yY+i_rr \qquad (32)$$
$$T=t_yY+T_0 \qquad (33)$$
$$I_m=mY \qquad (34)$$
$$M^D=m_yY+m_rr+m_0 \qquad (35)$$
$$M^S=M^D \qquad (36)$$

If we mark the autonomous expenses by :

$$A = G+X+I_0+C_0 \qquad (37)$$

and replace the previous equations from the basic equation, we shall obtain:

$$r = (1-c_y(1-t_y)+m)Y/i_r-A/i_r \qquad (38)$$

If we take into account the fact that the multiplier

$$k = 1/(1-c_y(1-t_y)+m) \qquad (39)$$

we shall obtain the algebraic equation of the IS curve:

$$r=Y/ki_r-A/i_r \qquad (40)$$

In an analogous way, to set the algebraic equation for the LM curve, we shall obtain:

$$M^S = m_yY+m_rr+m_0 \qquad (41)$$

respectively,

$$r=(M^S-m_0)/m_r-Ym_y/m_r \qquad (42)$$

where:

M^S – money offer

M^D - money request

m_y - money request flexibility while related to the income

m_r - money request flexibility while related to the interest

r - interest rate

I_0 - autonomous investment

i_r - investment sensitivity to the interest rate modification

i_y - investment sensitivity to the earnings modification

A - autonomous expenses

m_0 – population money stock

This way, we can identify the existing aspects within the money component parts: cash – reserves – deposits.

The relationship *cash / deposits* is influenced, first of all, by the population's behavior, population that decides, in the end, the weight of the cash detainings and of the deposits. The evolution of this one is, essentially, determined by the payment habits of the public, by the convertibility and accessibility of the money, by the costs related to the withdrawal taxes and to detaining, by individuals, of cash. Based on the empirical analyses of the historical data, it can be asserted that as the weight of the consumption in the Gross National Product (PNB) shall increase, the request for cash

shall increase, as well, and, consequently, this report shall increase only under the conditions of maintaining, at a constant level, the national production. At the same time, since the request for deposits is directly correlated with the PNB evolution, the value of the report shall decrease if the national production increases.

The relationship *reserves / deposits* is based on the influence of two big groups of factors: first of all, the bank system is the subject of regulations that are imposed by the Central Bank under the form of statutory minimum reserves; and, secondly, there exists the possibility that banks might wish to keep an excess of reserves that they anticipate from their accounts. To this there shall be added the lack of trust with reference to the amplitude of the net deposit flow, the costs with the loan the bank operators shall have to apply to when they run out of reserves, while the cost generated by the lost interest as a sequence of the detained reserves is, generally, equal to the market interest.

By means of the money policy administration mechanism, the National Bank of Romania shall control the money stock as an independent variable, and, consequently, the National Bank of Romania also controls the interest rate and the available income that act as associated variables.

III. MONETARY POLICY TRANSMISSION MECHANISM

All through this Section, we shall approach the issue of the consequences generated by the increase of the real quantity of money on the interest rate from the transmission mechanism point of view.

It is by means of the monetary policy management mechanism that the National Bank shall control the money stock as an independent variable, and, consequently, shall also control the interest rate and the available income as associate variables.

If we define the open – market operations as being the security sale / purchase action, while in exchange for the money there shall be carried out the money stock administration, it could be understood that the financial institution resorts to the money issue as far as this transaction is concerned. In fact, the purpose of the operations consists in modifying the existing money offer, and, subsequently, in modifying the population's attitude. To be more specific, when an operation to purchase values / titles on the market is being carried out, there shall be reduced the offer by those titles, and, this way, the tendency is to increase the price / title or to modify the return on the investment. Given the circumstances, it is only from a certain turning to good account rate that the population shall agree to turning the titles they own into money stock and the other way round.

An IS-LM approach of the process to adjust the economy based on the money quantity increase means:

- to shift the LM curve downwards and to the right;
- to decrease the interest rate from E_0 to E_1;
- to increase income or production to the new balance point.

Graphically, these effects shall be represented as in the following figure (fig.7):
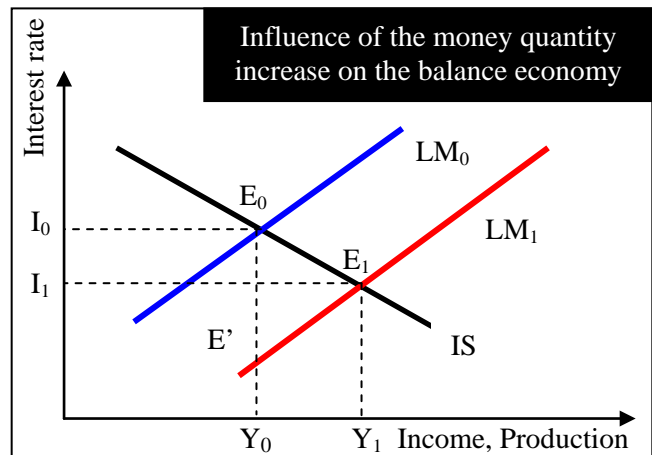

Fig.7

The M / P real money offer (where M = active money stock, and P = price index) corresponds to the initial balance E_0, situated on the LM straight line.

Further on, by means of open – market operations, the BNR regulation authority, there occurs the nominal money stock increase, and, subsequently, the increase of the real money quantity. The consequences of this fact consist in shifting the curve to LM_1, in accordance with the new balance point E_1, with the higher production volume Y_1 and with the decreasing interest rate at I_1.

The more the LM curve becomes more abrupt, the more the variation caused to the income or to the products becomes higher. Or in other words, if the request for money is very sensitive to the interest rate, then a variation of the money offer on the market shall trigger a low variation of the interest rate. To the opposite, should the request for money be not sensitive to the interest rate variation, then, a given variation of the money offer shall trigger a higher variation of the interest rate which would have significant consequences on the investment request.

The adjustment mechanism to be freely applied by the market operation psychology calls for the necessity to adopt certain standard attitudes depending on the characteristics of the identified imbalance. This way, the graphical explanation of this aspect implies the following structuring (Fig.8):

- There are noticed four windows inside which we can identify the characteristics that are related to the IS-LM pattern:
- an excess of the money offer is registered above the LM curve;
- an excess of the money offer is registered under the LM curve;
- an excess of the goods offer is registered above the IS curve;
- an excess of the goods offer is registered under the IS curve.
- The adjustment implies the adoption of a reasoning that means "a decrease of the production" there where there exists an excess of the offer, and "an increase of the production", respectively, there where there exists an excess of the request.
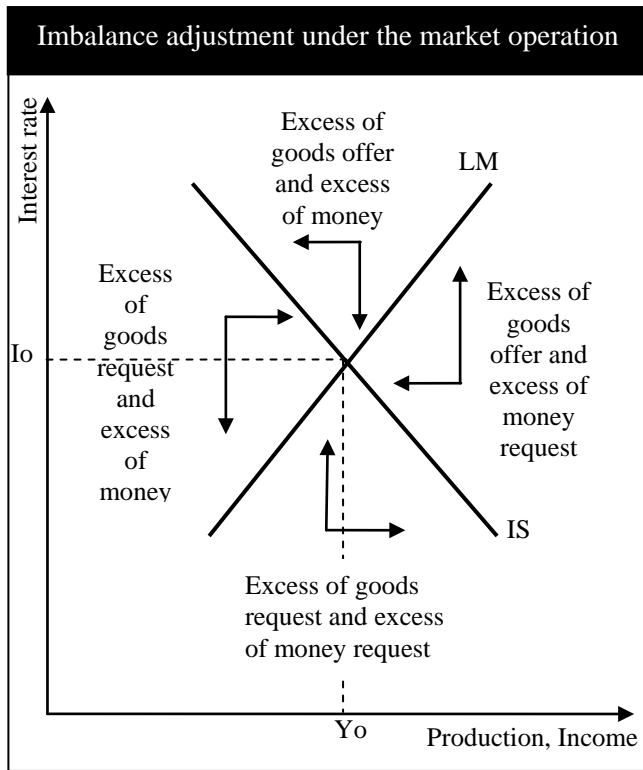
Fig.8

Fig. 9

- The adjustment directions are indicated by means of arrows. This way, the window that includes an excess of the goods offer and an excess of the money request, the adjustment shall imply the increase of the interest rate and the decrease of the production. The adjustments indicated by the arrows shall finally lead to the balance position.
- The work rule shall be issued based on the principle according to which *the monetary market can be easily and quickly adjusted*, *while the goods market can be adjusted at a slower rate*, as the modification of the production plan takes time.

The presentation of the determination relationships between the variables that make up the IS-LM pattern, both for the goods market, and for the monetary market, as well, observes the below organization chart (fig. 9):

- The icon "+" means the fact that the modification to the first variable triggers a modification to the same direction for the variable that follows;
- The icon "-" means that the modification induced in the second variable shall be to the oposite direction.

As concerns the monetary policy consequences, more attention has been granted to two situations that have been classified as rather extreme. The first situation is referred to as the "solvency trap", and the second situation is referred to as the "opposite to the solvency trap".

The solvency trap relates to the extreme situation in which the population wishes to own, at the existent interest rate, any quantity of money that the market offers, meaning that the LM straight line is horizontal. In this case, the monetary policy has no consequences either on the interest rate, or on the income.
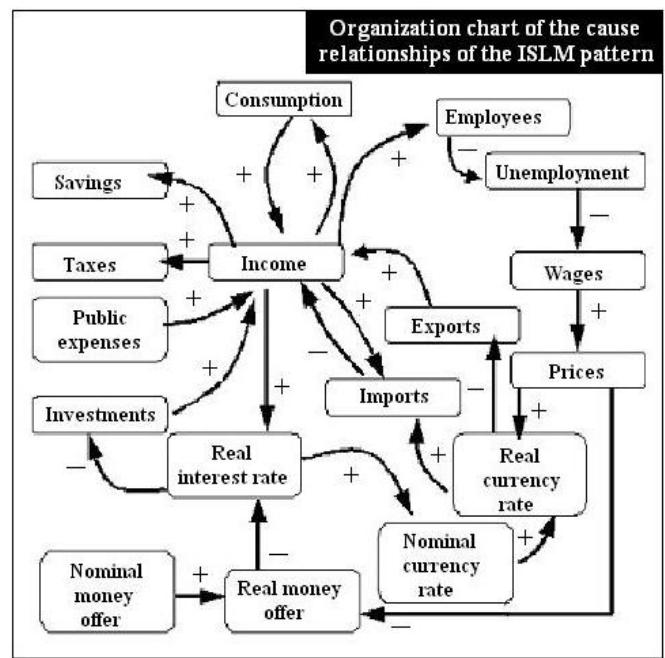
This concept can be best explained if we relate to the situation in which the interest is equal to zero. Under such circumstances, the individuals do not wish to own assets as long as money can grant the advantage of being used in transactions. Henceforth, the increase of the money quantity that has been launched on the market could not persuade the individuals to purchase assets, and this way, to lower down the interest rate under zero, as a consequence of the request migration.

The opposite of the solvency trap relates to the case of the vertical LM curve. This situation occurs when the request for money is not sensitive to the interest rate, and it depends only on the income level. This situation is related to the money classical quantity theory that asserts that the level of the income is determined only by the quantity of money.

The two extreme situations suggest the fact that the angle or the inclination of the LM curve is the decisive element of the monetary policy efficiency, namely with reference to the impact on the production, on the nominal income, respectively.

IV. MONEY MULTIPLIER. INTERACTION BETWEEN CENTRAL BANK AND BANKING SYSTEM

Under certain circumstances, the multiplier modeling process can make it possible to render evident a possible interaction between the central bank and the other banks as concerns the money offer. This interaction implies an adjustment mechanism that consists in re-defining the monetary base, in re-formulating the multiplier, and in studying the money – credit relationship.

A) Re-defining the monetary base.

By *effective monetary base*, it is understood the entire amount of the money issued by the central bank. I shall refer to it by using the letter H. As in the case of each effective

variable, this variable results from the confrontation between a H^O offer function and a H^D effective monetary base request function. In the simplified Balance Sheet of the Central Bank, the effective offer contains three component parts: public bonds (T), international reserves in gold and in convertible estimates (O), credits granted by banks as per re-financing requests (RF). There results:

$$H^O=O+T+RF \qquad (43)$$

At the same time, the effective monetary base request from the banks complies with the need for bank notes (B) and with the need to build a global reserve (R), and the result is:

$$H^D= B+R \qquad (44)$$

Adjusting by difference by means of the compulsory reserve (Ro) that is *sterilized* on the occasion of the crediting process by the Central Bank, thus not contributing to the monetary expansion, and considering the re-financing request as an endogenous variable that is obtained further to the banks' initiative / request, it is by means of combining the previous relationships that there shall be obtained the monetary base that is exogenous to the $H^{O'}$ offer and the monetary base that is exogenous to the $H^{D''}$ request:

$$H^{O'} = O+T-Ro \qquad (45)$$
$$H^{D''} = B+R-Ro-RF \qquad (46)$$
$$H'= H'' \qquad (47)$$
$$O+T-Ro=B+R-Ro-RF \qquad (48)$$

B) Multiplier re-defining.

The banks' consolidated Balance Sheet contains the below equation:

Credit + Reserve = Deposit + Re-financing source $\qquad (49)$
$$C+R= D+RF \qquad (50)$$
$$D-C=R-RF \qquad (51)$$

The monetary base that is exogenous to the request shall be obtained by replacement:

$$H^{D''} = B+D-C-Ro \qquad (52)$$

Further to defining A as the rate between the bank-granted credits and the deposits attracted by these ones:

$$A=C/D \qquad (53)$$
$$r=Ro/D \qquad (54)$$
$$b'=B/D \qquad (55)$$

respectively, there shall be obtained:

$$H^{D''}= b'D+D-AD-rD=b'D+(1-A-r)D \qquad (56)$$

As far as the balance is concerned, the exogenous monetary base shall be:

$$H'=H^{D''} \qquad (57)$$
$$\Leftrightarrow H'=(1-A-r+b')D \qquad (58)$$

While considering that as far as the balance is concerned, the attracted deposits represent the scriptural currency $\Leftrightarrow$

$$D=H'/(1-A-r+b') \qquad (59)$$

and while defining the money stock

$$M=B+D=(b'+1)D \qquad (60)$$

by replacing D from the equation (59), there results:

$$M = H'(b'+1)/ (1-A-r+b') = k' H' \qquad (61)$$

Under the circumstances of a monetary base that is exclusively controlled by the central bank, the credit granting policy of other banks is proportional with their resources:

$$C= H' A / (1-A-r+b') \qquad (62)$$

C) Credit – currency relationship.

Based on the acceptance of the fact that the C function of the credit has, as significance, the C^o bank credit offer, and based on considering the A coefficient (defined as a relationship between the credits granted by means of banks and the deposits attracted by these ones), as depending on the *i* crediting interest rate, the *i'* re-financing interest rate and the *r* compulsory minimum reserve, there results that the credit offer shall look like the below equation:

$$C^o= H' A_{(i,i',r)} / (1- A_{(i,i',r)}-r+b') \qquad (63)$$

and

$$M = H'(b'+1)/ (1- A_{(i,i',r)}-r+b') \qquad (64)$$

From the point of view of the multiplier function (C^o, i, i',r), there has become obvious that the Central Bank plays the part of the monetary issuing motor, and is, therefore, the major determinative of the currency offer (exogenous variable). The money stock M is consequently a multiplier of the existing currency that is available to the H monetary authority.

V. CONCLUSION

The solvency trap and *The opposite of the solvency trap* suggest the fact that the angle or the inclination of the LM curve is the decisive element of the monetary policy efficiency, namely with reference to the impact on the production, on the nominal income, respectively.

An IS-LM approach of the process to adjust the economy based on the money quantity increase that means to shift the LM curve downwards and to the right, to decrease the interest rate from E_0 to E_1, to increase income or production to the new balance point.

From the point of view of the multiplier function (C^o, i, i',r), there has become obvious that the Central Bank plays the part of the monetary issuing motor, and is, therefore, the major determinative of the currency offer (exogenous variable). The money stock M is consequently a multiplier of the existing currency that is available to the H monetary authority.

Achieving a favorable environment to the monetary integration of Romania implies the implementation of a sustained and credible strategy of fiscal consolidation, which can lead to the diminishing of inflationist pressures, as well as to macro-economic lacks of balance. Another sensitive problem is the coherent adoption of the community acquirement as regards the juridical independence and integration of the Central Bank into the Eurosystem.

So, the people are no isolated actors on the world scene. They enter in competition and co-operation. This real scenario is the basis of the parallel computing and finally, the basis of the parallel computers.

The real world offers a lot of models and paradigms for engineers in the area of the computer science and engineering.

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