Monetary Mechanism to Propagate Macroeconomics Policies

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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.

Key-Words: - macroeconomics modelling, cybernetic systems, money supply, multiplier process, interest rate, monetary base

1 Earings 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:

$$C+I=Y=C+S \quad (1)$$

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:

$$Y=C+I+G+NX \qquad (2)$$

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

$$YD=C+S=Y+TR-TA \qquad (3)$$

thus obtaining

$$C=Y+TR-TA-S \qquad (4)$$

Nevertheless, if we replace in the equation (2), then:

$$S-I=G+TR-TA+NX \qquad (5)$$

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:

$$S=Y-C=Y-cY=Y(1-c) \text{ and } 0<c<1 \qquad (6)$$

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

$$s = 1-c \qquad (7)$$

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,

$$I=Io+I_r{}^*r \qquad (8)$$

where: Io 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
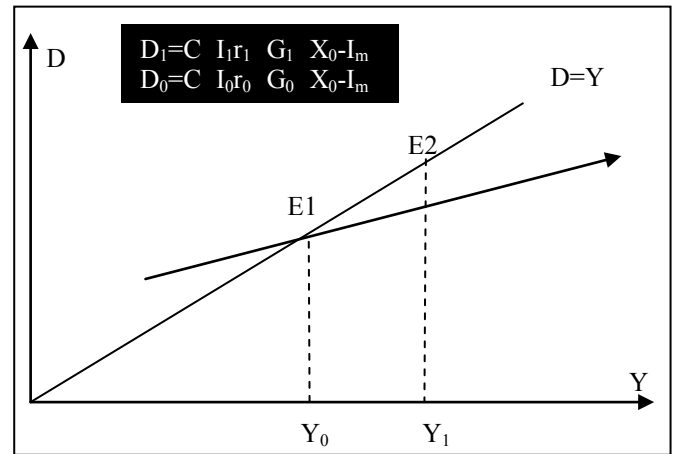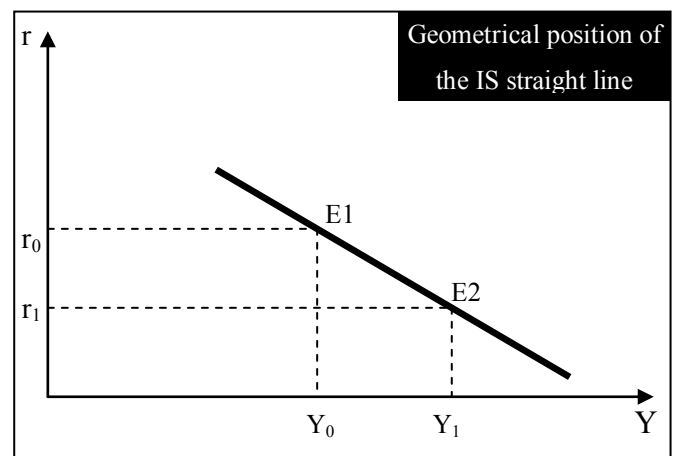
interest rate.

Figure 1

Figure 2

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.

$$M^D = k^*Y-h^*r \qquad (9)$$

Starting from the request and offer curve on the monetary market, it shall be possible to set the adequate LM curve (Figure 3, Figure 4)

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 the real currency request, and to manage that the request keeps being
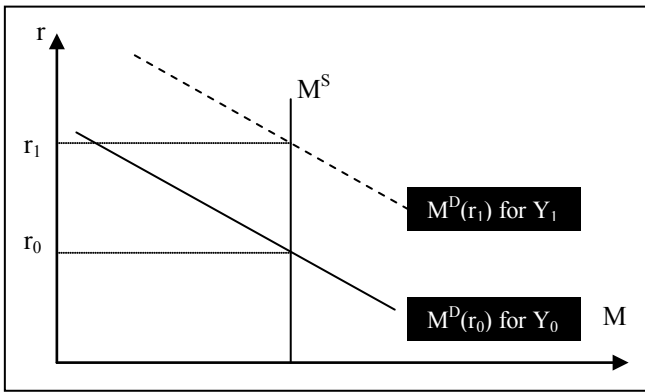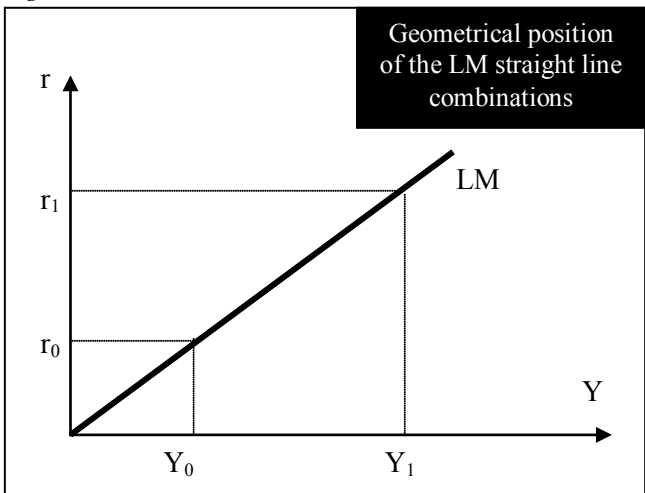
Figure 3

Figure 4

equal to the fixed offer, the income level 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
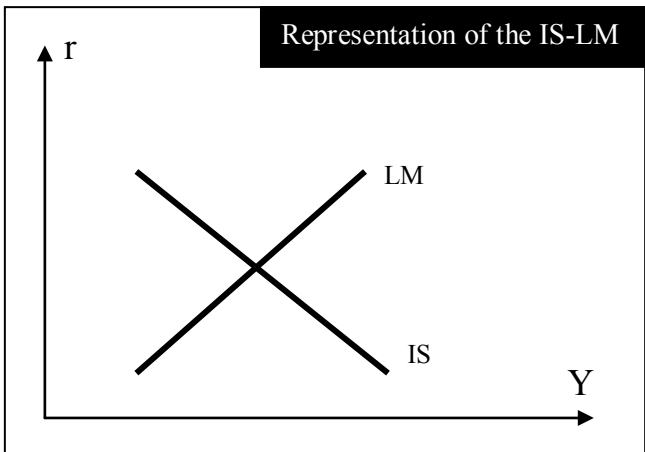

Figure 5

reached at the intersection point of the two curves (figure 5)

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

$$D=C+I+G \qquad (10)$$
$$NX=X-Im \qquad (11)$$
$$C=C_0+c_y(Y-T) \qquad (12)$$
$$I=I_0+I_yY+i_rr \qquad (13)$$
$$T=t_yY+T_0 \qquad (14)$$
$$I_m=mY \qquad (15)$$
$$M^D=m_yY+m_rr+m_0 \qquad (16)$$
$$M^S=M^D \qquad (17)$$

If we mark the autonomous expenses by :

$$A = G+X+I_0+C_0 \qquad (18)$$

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

$$r = (1-c_y(1-t_y)+m)Y/i_r-A/i_r \qquad (19)$$

If we take into account the fact that the multiplier

$$k = 1/(1-c_y(1-t_y)+m) \qquad (20)$$

we shall obtain the algebraic equation of the IS curve:

$$r=Y/ki_r-A/i_r \qquad (21)$$

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

$$M^S = m_yY+m_rr+m_0 \qquad (22)$$

respectively,

$$r=(M^S-m_0)/m_r-Ym_y/m_r \qquad (23)$$

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

2. 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.

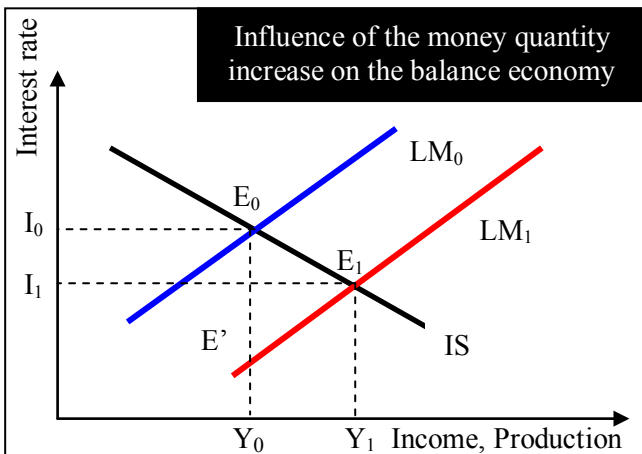Graphically, these effects shall be represented as in figure 6:

Figure 6

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 (Figure 7):
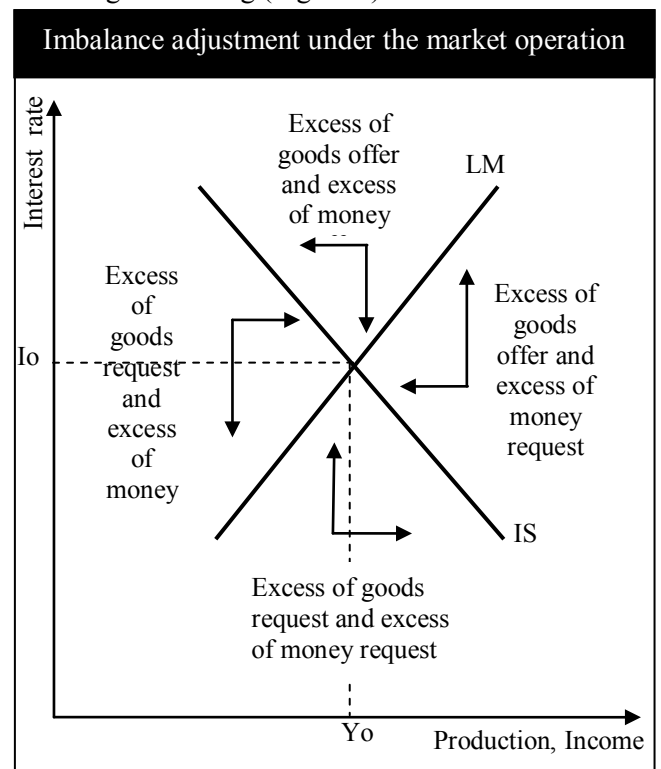

Figure 7

- 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.

- 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 (figure 8):
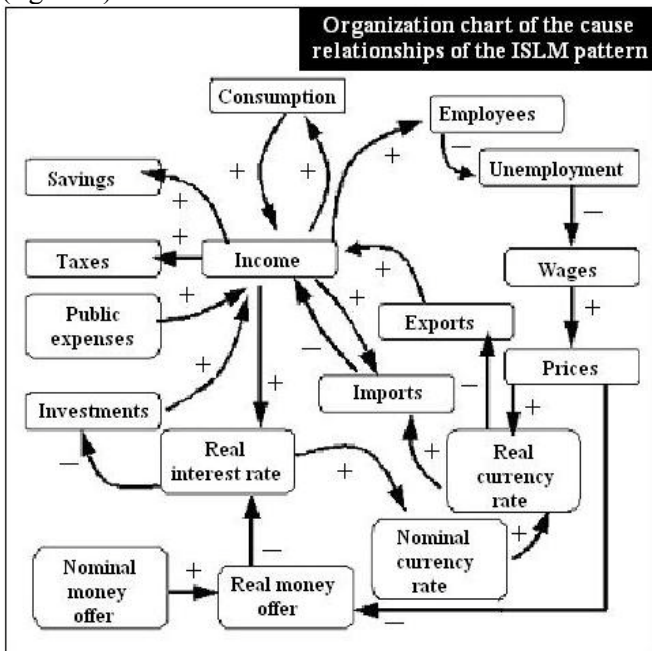

Figure 8

- 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.

3. 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.

3.1. 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:

$$H^O=O+T+RF \qquad (24)$$

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:

$$H^D= B+R \qquad (25)$$

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:

$$H^{O'} = O+T-Ro \quad (26)$$
$$H^{D''} = B+R-Ro-RF \quad (27)$$
$$H'=H'' \quad (28)$$
$$O+T-Ro=B+R-Ro-RF \quad (29)$$

3.2. Multiplier re-defining.

The banks' consolidated Balance Sheet contains the below equation:

Credit + Reserve = Deposit + Re-financing source (30)

$$C+R= D+RF \quad (31)$$
$$D-C=R-RF \quad (32)$$

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

$$H^{D''} = B+D-C-Ro \quad (33)$$

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

$$A=C/D \quad (34)$$
$$r=Ro/D \quad (35)$$
$$b'=B/D \quad (36)$$

respectively, there shall be obtained:

$$H^{D''}= b'D+D-AD-rD=b'D+(1-A-r)D \quad (37)$$

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

$$H'=H^{D''} \quad (38)$$
$$\Leftrightarrow \quad H'=(1-A-r+b')D \quad (39)$$

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

$$D=H'/(1-A-r+b') \quad (40)$$

and while defining the money stock

$$M=B+D=(b'+1)D \quad (41)$$

by replacing D from the equation (40), there results:

$$M = H'(b'+1)/ (1-A-r+b') = k' \, H' \quad (42)$$

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:

$$C= H' \, A / (1-A-r+b') \quad (43)$$

3.3. 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:

$$C^o= H' \, A_{(i,i',r)} / (1- A_{(i,i',r)}-r+b') \quad (44)$$

and

$$M = H'(b'+1)/ (1-A_{(i,i',r)}-r+b') \quad (45)$$

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.

4. 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.

References:

[1] Abraham Frois G.: *Dynamique Economique*, Dalloz, Paris, 2007

[2] Andreas Freytag: *Why Have Some Monetary Reforms Succeeded and Others Not? – An Empirical Assessment*, Wopec, 2006

[3] Freedman C.: *The Role of Monetary Conditions and the Monetary Conditions Index in the Conduct of Policy,* In Bank of Canada (ed.), The Transmission of Monetary Policy in Canada. Ottawa, 2000

[4] Giucca, P., A. Levy: *Monetary Aggregates and Monetary Policy Coordination on the Way to Economic and Monetary Union: the Role of Cross-Border Deposits*, Temi di Discussione, Banca d'Italia, 1996.

[5] Hoffman D. L., R. H. Rasche: *Aggregate Money Demand Functions – Empirical Applications in Cointegrated Systems*, Kluwer Academic Publishers, Boston, 2000

[6] Moisa Altar, Financial Engineering, course support, http://dofin.ase.ro/lectures.php

[7] Roner D: *Advanced macroeconomics,* McGraw Hill, 2005