The main correlations
between the monetary-banking indicators

Mădălina-Gabriela ANGHEL
„Artifex" University of Bucharest, Romania
madalinagabriela_anghel@yahoo.com
Constantin ANGHELACHE
The Bucharest University of Economic Studies, Romania
„Artifex" University of Bucharest, Romania
actincon@yahoo.com
Ana CARP
„Artifex" University of Bucharest, Romania
karp_ana@yahoo.com

Abstract. *At the level of national economy, the essential problem is that of the use of financial resources. Of course, every society has its own resources, but that they are not always sufficient. To operate in a free market economy appears very often need to turn to the Bank's resources in the form of loans. Credit implies the existence of credit resources on the part of the banking system but, at the same time, it raises the question of the relationship between monetary mass in circulation and monetary mass necessary to ensure market equilibrium required.*
The banking system is defined and represented in the two sub-sectors, namely: monetary authorities that it is a country's National Bank and the system of commercial banks. Great economists have noted that the imbalance between the monetary mass necessary and the monetary mass in circulation may be, at some point, a problematic leading to financial crisis and broader financial and economic crisis.
In this article we try to make an analysis based on data sources that stand available to any researcher. Thus, as a first idea, we discuss about the Central Bank's balance sheet, one that offers the possibility of calculating the balance of equilibrium equation which shows a series of correlations are established on the market. The second source of analysis and interpretation of this market is the aggregate balance sheet of commercial banks. Based on this balance sheet is

calculated the balance sheet equation which can give an accurate picture on the ratio between the requirements and possibilities.

Also, in the article we referred to the monetary situation, especially consolidated monetary situation, one who has existing monetary mass market in passive, and international reserves and net domestic assets, in assets which are and must be in balance, i.e. the two indicators of assets must equal monetary mass so that no imbalances.

In the article, we refer to the main correlations between monetary aggregates to embrace the situation at a given time and to be able to conclude that evolution can be perspective in this area.

Keywords: monetary mass, correlation, balance sheet, the monetary aggregate, the monetary balance.

JEL Classification: E52, G17, G20.

Introduction

Monetary and banking statistics recorded an ascent over the past decades, together with the understanding and recognition of the monetary aspects of the four major imbalances: inflation, unemployment, the budget deficit and the balance of payments deficit. Monetary data analysis aims to evaluate the financial situation of the country in a way that makes it possible to assess financing options for national authorities, in line with the development of the real economy. Although there are still significant differences in terms of currency intervention on various manifestations of economic instability, outstanding advances have been achieved in the quantification of the various aggregates that allow the distinction of macroeconomic trends, connections between economic variables, financial and monetary.

The banking system is limited and assigned into two sub-sectors, namely monetary authorities (Central Bank) and commercial banks.

Statistical information of financial nature presents a few major advantages: they are available in a short period of time after the end of the reference period, shall be submitted for an itemized bill and contain a high degree of truthfulness.

By aggregating and consolidated accounts of banking institutions (at various levels) to obtain information the monetary issue, the monetary base, monetary mass, domestic credit and international reserves, allowing also make the connections with macroeconomic aggregates results, indicators of national public budget and balance of external payments. Thus, at the level of Central Bank analyzed monetary issue and the monetary base, while at the level of commercial banks is the process of creating a currency account (scriptural). Next, by aggregating the information provided at the level of the Central Bank and commercial banks, it follows what is called the „Monetary Situation", which outlines the volume and structure of monetary, credit and foreign exchange reserves of the country.

1. Literature review

Andrei and Bourbonais (2008), Anghelache and Anghel (2016) develop on the use of econometric instruments in economic analyses. Angelini et al. (2014) approach the correlation between capital requirements and monetary policy, Angeloni and Faia (2013) further develop on the case of fragile banks. Anghelache and Anghel (2016, 2015), Anghelache et al. (2013), Anghelache and Capanu (2004), Anghelache (2008), Anghelache (2007), are reference works in macroeconomic statistics. Anghel (2015) studies the structure of monetary mass that characterizes the Romanian economy since gaining the EU membership. Anghelache and Manole (2016) apply regression to study the relation between monetary situation and payments balance. Anghelache et al., (2016) present a model for financial and monetary studies. Anghel (2015) studies the principles and instruments of financial-monetary analysis. Anghelache et al. (2016), Anghelache (2011) describe the economic modeling, from theoretical and practical viewpoint. Barro

and Ursua (2008) realize a historical analysis of macroeconomic crises from 1870 on. Mankiw (2016) is an in-depth study on macroeconomics. Păunică (2014) presents the financial indicators related to projects developed for infrastructure in Romania. Smets (2014) evaluates the intensity of the correlation between financial stability and monetary policy. Taylor and Williams (2010) present a set of recommendation for the monetary policies. Anghelache et al. (2015) analyze some aspects of the macroeconomic monetary situation of Romania. Curdia and Woodford (2010) study the correlation between credit spreads and monetary policy. Blake and Kirsanova (2011) develop on the impact of inflation conservatism and policy in monetary and financial areas. Eichenbaum et al. (2017) evaluate the predictable character of nominal exchange rate, corroborated with monetary policy. Anica-Popa and Motofei (2010) study the indicators correlated to infrastructure and construction projects. Fuster et al. (2010) analyze the fluctuations at the macroeconomic level. Further aspects on monetary policies and their impact are presented by Gertler and Karadi (2015), Quint and Rabanal (2014), Van der Ghote (2016). Savor and Wilson (2013) research the investor's awareness and attitude towards the risk occurring at the macroeconomic level. Ilzetzki et al. (2013) analyze the magnitude of the fiscal multipliers. Gilbert (2011) studies the informational aspects of macroeconomic announcements. Svensson (2014) is preoccupied with inflation targeting.

2. Research methodology and data

In the analysis of the main connections between data sources and the monetary and banking, we use synthetic synthetic documents established in the Central Bank and commercial banks. These are included in the balance sheet of the Central Bank, on the one hand and the aggregated balance sheet of commercial banks, on the other hand. In the structure of these two balances, compared with consolidated monetary situation, extract elements of mathematical formalization of the correlation (using existing interconnections).

3. Central Bank balance sheet

Monetary issue (EB) and the monetary base (BM) are monetary aggregates which are determined at the level of monetary authorities (Central Bank), with the Bank's balance sheet data source. Through the function of broadcast and, implicitly, by the lending of the economy, the Central Bank has a primary role and mostly in monetary creation process with direct and indirect implications on important economic objectives: full use of labor force growth, inflation, and economic stability.

Synthetically, the Central Bank balance sheet is presented as follows:

Assets	Liabilities
1 Foreign assets -AEE **2 Domestic assets -AI**E **A Government loans - CGe** **B. Loans to commercial banks -CB**	1. **Foreign liabilities - PE**E 2. **Domestic liabilities - PI**E A. **Monetary** Base **- BM** - **Monetary issue -N** **= Cash population –N** **= Cash in cash offices of commercial banks -C** - **Reserves of commercial banks at the central bank -R** B. **Public deposits (government) -DG**E C. Other liabilities **(net) -APN**E

Balance sheet equation is:

$$AE_E + CG_E + CB = PE_E + N + C + R + DG_E + APN_E \qquad (1)$$

This balance sheet presents a collection of the main monetary authorities accounts, regrouping required for submission of further information and the construction of the monetary situation.

- Assets part contains three main ways that the central bank creates money.
- Foreign assets (AE_E) include assets to which the non-resident trader is final debtor: reserve of gold, foreign currencies, foreign currency deposits held abroad, special drawing rights, the reserve position at the IMF. The foreign assets represents, in general, international reserves established and administered by the Bank of issue in order to ensure that national monetary authorities ' reaction to actual or potential imbalances in the field of foreign payments and the stability of the exchange rate through intervention on the foreign exchange market.
- Government loans (CGE) granted by the Bank of issue are made up of direct financial obligations of the Central Administration of the monetary authorities in the form of bills, certificates, Treasury effects, loans and advances to the State Treasury.
- Loans to commercial banks (CB) aimed at ensuring the necessary liquidity at the level of the latter, through the process of rediscount. The counterpart of this post of a Central Bank in aggregate balance sheet of commercial banks, as liabilities (credits received from the Central Bank or refinancing loans).

- In the liabilities of the Central Bank's balance sheet included positions regrouping commitments (obligations of) monetary authorities and expressing the size and distribution of the primary currency holders. The main passive post is (BM) which includes monetary issue (EB) and compulsory reserve of commercial banks to issue Bank (R).

BM = EB + R.

The Bank's monetary or primary currency is therefore a currency issued and controlled by the Central Bank through which supplies banking system so that commercial banks can repay (banknotes) amounts deposited into the accounts of economic operators and of the population.

− Foreign liabilities (PE) include all monetary obligations to nonresidents (deposits created from external loans).
− Public Deposits (DGE) on the bank of issue are obligations of the monetary authority to the central government (availability of extra-budgetary funds and existing at a time).
− Other liabilities (net) is a residual post.

In conclusion, the monetary base is the most important counterparty post of the total net assets of the bank of issue:

BM = Amount Assets - Liabilities Amount included in BM.

That any changes in the assets and liabilities of the bank of issue can indirectly influence monetary base dimensions. Thus, any asset growth leads to increased BM, while increasing liabilities involves lowering BM. The last relation can be written as:

$$BM = (AE_E – PE_E) + (CG_E – DG_E) + CB - APN_E = AEN_E + CGN_E + CB - APN_E \quad (2)$$

It explains the three determining causes of currency issue:
▪ increase of net foreign assets (AEN_E); n this way, monetary issue is caused by increased foreign reserves by foreign loans and purchase of foreign exchange by the central bank;
▪ increase of net government credit (CGN_E); it appears to cover the budget deficit resulted from the existence of a time lag between budget expenditures and revenues at risk; generally, financial situations materialized by the budgetary imbalance (DB) is a prerequisite imbalance monetary causal relationship can be expressed by the relation:

$$DB = CB - VB = \Delta BM + \Delta DP, \quad (3)$$
where:
CB – budgetary expenditure;
VB – budget revenues;
ΔBM – monetary base growth;
ΔDP – public debt growth.

▪ growth of loans to commercial banks by the central bank (CB) in order to meet liquidity demands arising from banks holders of debit balance in its relations with other banks in the money market.

Through monetary base, the central bank controls the monetary creation process in the banking system, process quantified by reserve money multiplier (m).

$$m = \frac{M_2}{BM} \quad (4)$$
BM multiplier expressed the growth of the monetary mass in the broad sense (M2) to increase by 1 leu BM.

4. Aggregated balance sheet of commercial banks

Commercial banks also have, in addition to the bank of issue, a consideration in money creation, which are banks creating scriptural money or account. Commercial banks are characterized by basic operations represented by the formation of deposits (monetary resource mobilization) and their use in order to grant loans. It creates so, scriptural money (or account) through a multiplication process credit playing a very important role in saving-investment relationship, relationship decisive for growth.

Synthetically, the aggregated balance sheet of commercial banks is presented as follows:

Assets	Liabilities
1. Foreign assets - AEc	1. Foreign liabilities-PEc
2. Domestic assets - Ale	2. Domestic liabilities - Pic
A. Non-government loans - CNG	A. Sight deposits - DV
- to companies	B. Savings population - EP
- to households	C. Term deposits – DI
- other loans	D. Residents' Foreign currency deposits -V
B. Government loans - CGc	E. Public deposits - DGc
C. Reserves of commercial banks at the central bank - R	F. Loans from Central Bank - CB
D. Cash in cash offices of commercial banks - C	G. Other liabilities (net) - APNc

Balance sheet equation is:

$$AE_C + CNG + CG_c + R + C = PE_C + DV + EP + DT + V + DG_C + CB + APN_C \qquad (5)$$

The balance presents a consolidated situation of accounts in commercial banks. The most numerous posts in the table pose no need for additional statements, having a content similar to posts of monetary authorities. As passive operations we can enumerate deposits, and own capital, and as active operations we outline the governmental credits.

5. Monetary situation

Monetary situation (SM) shows how the economy, starting from the monetary base procure means of payment, which constitutes what is called "money". This makes it appear to the financial relationships between the Group of banking institutions (Central Bank, commercial banks), which provides the means of payment in the economy and the other economic subjects (businesses, public institutions, population). The major purpose of the SM is to allow analysis of the monetary aggregates, including inter-sectorial funding and links appearing in dealing with other macroeconomic aggregates.

The indicators are obtained from MS by aggregating and consolidation of information contained in the Central Bank's balance sheet and in the aggregate balance sheet of commercial banks.

$$AE_E + CG_E + CB = PE_E + N + C + R + DG_E + APN_E \qquad (6)$$

$$AE_C + CNG + CG_C + R + C = PE_C + DV + EP + DT + V + DG_C + CB + APN_C +$$

$$AE_E + AE_C + CG_E - DG_E + CG - DG_C + CNG =$$

$$PE_E + PE_C + N + DV + EP + DT + V + APN_E + APN_C \qquad (7)$$
or

$$AE + CI = PE + M2 + APN \qquad (8)$$

The following is presented schematically SM, built so that interbank flows have been eliminated.

Assets	Liabilities
Foreign assets **- AE**	Foreign liabilities **- PE**
Domestic assets **– AI**	Domestic liabilities **- PI**
- domestic credit **-CI**	**-monetary mass - M2**
= non-governmental credit -CNG	**= Narrow monetary mass - M1**
= government credit - CGN	**cash outside the banking system -N**
	* **Available funds -DV**
	* **= quasi-currency – QM**
	* **population savings –EP**
	* **term deposits –DT**
	* Residents' Foreign currency deposits **-V**
	- Other liabilities **(net) -APN**

It is noted that the monetary mass is presented as a heterogeneous size consisting of all assets that can be used to purchase goods and services and for the payment of debts. In other words, monetary mass is all the means of payment, respectively liquidity, existing at some point in the economy. It includes:

- narrow monetary mass – M1, i.e. cash outside the banking system (fiduciary currency) and availability, they exhibit a high degree of liquidity;
- quasi-currency – QM, which includes the population's savings, time deposits, foreign currency deposits of non-residents, they exhibit a low degree, as they are not directly usable as a means of payment, but can be relatively easily converted into currency by their keepers.

In practice, it builds, also, strengthened monetary situation (SMC), which is as follows:

Strengthened monetary situation

Assets	Liabilities
Net international reserves -RIN	**Monetary mass -M2**
Net domestic assets -AIN	
- domestic credit -CI	
= net **government credit -CGN**	
= non-governmental credit –CNG	
- other assets (net)-AAN	

Identity obtained describes the steady state in the banking system:

$$M2 = RIN + AIN. \qquad (9)$$

Net international reserves currency means that a country has to support its balance of payments, either via direct funding or by means of intervention aimed at influencing the exchange rate of the national currency. Net international reserves are simply no difference between foreign assets and liabilities. They represent the difference between

foreign reserve assets, immediately available in case of need and short-term foreign currency liabilities.

Domestic credit includes all loans of the banking system to the government, economic agents, population. All loans that banks allow them to other banks (for example, credit is granted by the Central Bank to commercial banks) disappear in the consolidation process.

Government credit is likely net so it is the difference between government credit and public deposits. Therefore, when the governmental credit net is negative, it appears that the Government is the lender and otherwise, net debtor. This treatment makes it easy to measure the impact of government operations on the Central liquidity in the economy, which is reflected in the structure of Government credit net public by measuring public debt, budgetary surpluses and deficits of the (State budget, local budgets, social insurance budget) and net deposits of extra-budget funds.

6. The connection between monetary situation strengthened (SNIC) and balance of payments (BP)

We have shown the connection between the report saving/investment, on the one hand, the current account balance of the BP (net external debt), on the other hand.

$$VND - ABS = EN - FNC = SCC = - SF = - \Delta DEN. \tag{10}$$

The increase in net foreign debt *(ΔDEN)* has the effect of either increasing net indebtedness to non-banking sectors (private and government sector) - $\Delta DEN_{PG,}$ modification of net international reserves of the banking sector. Accordingly:

$$\Delta DEN = \Delta DEN_{PG} – \Delta RIN. \tag{11}$$

The identity of expressing the steady state in the banking system ($M2 = RIN + SID$) transferred to the dynamic ($\Delta M2 = \Delta RIN + \Delta AIN$) and replaced the previous relation leads to an equation that can be identified by the approach of the balance of payments monetary.

$$VND-ABS=-\Delta DEN=\Delta ARIN- \Delta DEN_{PG} = \Delta M2-\Delta AIN- \Delta DEN_{PG}, \tag{12}$$
or

$$VND + \Delta DEN_{PG} – ABS = \Delta M2 -\Delta AIN = \Delta RIN,$$

This latter relationship indicates that any excess of the expansion of domestic credit (which forms the largest part of net domestic assets) than increasing dizer currency will dissipate in excess of absorption (consumption) over national disposable income and foreign loans granted system nonbank, leading to a reduction in net international reserves. This approach emphasizes the key role of domestic credit creation in the interpretation of the balance of payments.

However, the relationship clearly shows the main sources of financial support for growth: domestic loans, foreign reserves of the state and foreign loans.

7. The main correlations between monetary aggregates

Major monetary correlations must ensure at the same time the increase of GDP growth in real terms, monetary mass and credit, reducing inflation and stabilizing the exchange rate in relative terms.

- The faster growth of monetary mass, compared to the annual inflation rate confirms the real growth of the money stock and continuing re-monetization of the economy process. This trend has the effect of increasing savings and domestic credit, thus supporting economic recovery and growth process.
- The faster growth of population savings than monetary mass and non-governmental credit. This correlation has the effect of maintaining confidence in the national currency, thus showing that forcing credit and monetary mass leads to inflation deviations.
- Growth in broad monetary mass (M2), faster than the narrow monetary mass (Ml) and than the monetary base as quasi-money (especially population savings) have an inflationary character.
- Keeping interest rates to levels higher than the inflation rate and the depreciation of the national currency (real positive interest), so be discouraged keeping currency. Of the fundamental macroeconomic variables, the monetary mass correlate primarily with GDP.

Milton Friedman, studying the evolution of monetary circulation in the U.S., over a period of nearly a century, consisted of the long-term existence of the objective of a stable correlation between size of Gross Domestic Product and the size of the monetary mass. Accordingly, in order to ensure a harmonious development of economic life, Friedman recommends ensuring an average annual growth of the monetary circulation rate (5-6% in conditions). This increase should be applied on a permanent basis without taking into account certain cyclical developments. The action of this long-term growth rates, coupled with the trend of economic growth, is provided basic monetarist concept of ensuring monetary equilibrium.

However, short-term correlation between money supply growth (RM) and the growth rate of gross domestic product (RPIB) have completed at least one variable (change in average interest rate -ΔRD) so that:

$$RM_n = f(RPIB_n, \frac{1}{\Delta RD}), \qquad\qquad (14)$$
where:
RM_n – the growth rate of nominal monetary mass;
$RPIB_n$ – the nominal growth rate of GDP.

In other words, monetary mass grows with nominal GDP growth and interest rate decrease. In real terms, the correlation becomes:

$$RM_r = f(RPIB_r, RI, \frac{1}{\Delta RD}), \qquad\qquad (15)$$
where:
RM_r – the growth rate of real monetary mass (calculated using the GDP deflator);

$RPIBr$ – the growth rate of real GDP;
RI= the inflation rate, calculated on the basis of GDP deflator.

8. Conclusion

From the way in which we presented the data in this article, it appears clear that between the money and needed at the level of national economy there is a close interconnection.

The correlations established between the two money and banking elements lead to the conclusion that macroeconomic Central Bank should have a leading role and to pursue through the levers at its disposal to obtain and achieve equilibrium. Correlations help to identify if certain circumstances arise imbalances and based on them to provide measures to achieve macroeconomic balance. Article has a theoretical content, but of course can be extended through an analysis using data provided by the National Bank which will give certain sizes of indicators which reflect the correlations between monetary mass or, better said, of the macro-economic monetary aggregates. For a more extensive analysis, these connections and correlations are determined will be synthesized into a model of analysis of the main connections that exist at the macroeconomic level in the field of monetary aggregates.

References

Anghelache, C., 2008. *Tratat de statistică teoretică și economică*, Editura Economică, București.
Anghelache, C., 2011. *Modelare economică și financiar-monetară.* Note de curs, Editura Artifex, București.
Anghelache C. (coord.), 2007. *Analiza macroeconomică. Sinteze și studii de caz*, Editura Economică, București.
Anghelache, C. and Anghel, M.G., 2015. *Statistică. Teorie, concepte, indicatori și studii ce caz*, Editura Artifex, București.
Anghelache, C. and Capanu, I., 2004. *Statistică macroeconomică*, Editura Economică, București.
Anghelache, C., Anghel, M.G. and Popovici, M., 2016. Financial-monetary analysis model, *Romanian Statistical Review,* Supplement, No. 7, pp. 19-23.
Anghelache, C., Anghelache, G.V. and Anghel, M.G., 2015. The monetary evolution, placements and resources, *Romanian Statistical Review*, Supplement, Issue 4, pp. 72-80.
Anghelache, C., Mitruţ, C. and Voineagu, V., 2013. *Statistică macroeconomică. Sistemul Conturilor Naţionale*, Editura Economică, București.
Anica-Popa, A. and Motofei, C., 2010. Înfiinţarea și modernizarea diferitelor tipuri de infrastructuri și implicaţiile asupra actorilor din industria materialelor de construcţii. *Romanian Statistical Review,* Supplement, (3), pp. 266-272.
Barro, R. and Ursua, J., 2008. Macroeconomic Crises since 1870, *Brookings Papers on Economic Activity,* Vol. 39, No. 1, pp. 255-335.
Blake, A.P. and Kirsanova, T., 2011. Inflation Conservatism and Monetary-Fiscal Policy Interactions. *International Journal of Central Banking,* Vol. 7, No. 2, pp. 41-83.
Curdia, V. and Woodford, M., 2010. Credit Spreads and Monetary Policy, *Journal of Money, Credit and Banking,* Vol. 42, Issue s1, pp. 3-35.

Eichenbaum, M., Johannsen, B. and Rebelo, S., 2017. Monetary policy and the predictability of nominal exchange rates, National Bureau of Economic Research, Cambridge, *Working Paper*, No. 23158.

Fuster, A., Laibson, D. and Mendel, B., 2010. Natural Expectations and Macroeconomic Fluctuations, *Journal of Economic Perspectives,* Vol. 24, No. 4, pp. 67-84.

Gertler, M. and Karadi, P., 2015. Monetary Policy Surprises, Credit Costs, and Economic Activity, *American Economic Journal: Macroeconomics,* Vol. 7, No. 1, pp. 44-76.

Van der Ghote, A., 2016. *Coordinating Monetary and Financial Regulatory Policies*, Tech. rep., Princeton University.

Gilbert, T., 2011. Information aggregation around macroeconomic announcements: Revisions matter, *Journal of Financial Economics,* Vol. 101, No. 1, pp. 114-131.

Ilzetzki, E., Mendoza, E. and Vegh, C., 2013. How Big (Small?) are Fiscal Multipliers? *Journal of Monetary Economics,* Vol. 60, Issue 2, pp. 239-254.

Mankiw, N.G., 2016. *Macroeconomics*. 9th edition. Worth Publishers. New York.

Păunică, M., 2014. Economic benefits of the infrastructure projects implemented in the Reservation of the Danube Delta Biosphere. *Theoretical and Applied Economics,* 21(11 (600)), pp. 95-104.

Quint, D. and Rabanal, P., 2014. Monetary and Macroprudential Policy in an Estimated DSGE Model of the Euro Area. *International Journal of Central Banking,* Vol. 10, No. 2, pp. 169-236.

Savor, P. and Wilson, M., 2013. How much do investors care about macroeconomic risk? Evidence from scheduled economic announcements. *Journal of Financial and Quantitative Analysis,* Vol. 48, Issue 2, pp. 343-375.

Smets, F., 2014. Financial Stability and Monetary Policy: How Closely Interlinked?, *International Journal of Central Banking,* Vol. 10, No. 2, pp. 263-300.

Svensson, L., 2014. Inflation Targeting and "Leaning against the Wind", *International Journal of Central Banking,* Vol. 10, No. 2, pp. 103-114.

Taylor, J. and Williams, J., 2010. Simple and Robust Rules for Monetary Policy. *Handbook of Monetary Economics*, Vol. 3, Elsevier, pp. 829-859.