THE POLAK'S MONETARY MODEL AND ITS APPLICATION ON MACEDONIAN CASE

Gjorgji Gockov
Faculty of Economics, UKIM – Skopje, Republic of North Macedonia, ggockov@yahoo.com

Abstract: Macroeconomic stability is very important for each economy because it constitutes the basis of sustainable economic growth and development. It means stable prices with a low level of inflation (internal stability), a stable foreign exchange rate, a relatively low and sustainable current account deficit in the balance of payments and a solvent position in the external indebtedness of the economy (external stability). International Monetary Fund (IMF) provides financial support to countries that have problems with internal and external stability. The IMF approach to macroeconomic stabilization is based on a so-called "monetary approach" to the balance of payments. The first IMF model designed for dealing with balance of payments disequilibrium was the Polak's model on monetary programming. Its purpose is to integrate monetary, income and balance of payments analysis, and it represents the basis of the conditionality applied to IMF's credit arrangements. This model investigates and determines the effect on income and balance of payments arising from the two important variables in the economy: (1) changes in domestic bank credits, and (2) changes in exports of goods and services. In other words, the model indicates what macroeconomics policies are required to achieve a given set of outcomes i.e. it determines policy targets consistent with explicit macroeconomic objectives. It consists of a set of four equations and contains two behavioral relationships: the demand for money function and the function of the demand for imports, and two identities: for the money supply and for the balance of payments. As such, Polak's monetary model extends classical quantitative money theory to the example of an open economy. Republic of North Macedonia, as a developing country that is remarkably open to the world (large share of export and import of goods and services in GDP) and with close cooperation with the IMF, the application of so-called financial programming based on Polak's monetary model is of special importance. Based on the theoretical elaboration of the equations contained in the Polak's monetary model, the paper attempts for its application to the case of Republic of North Macedonia and tries to determine and quantify the dependence of the changes in net foreign assets (foreign reserves) and gross domestic product (GDP) from the changes in domestic credits of the Macedonian banking sector. For that purpose, the data on gross domestic product (GDP), money supply (M4) and exports of goods and services for the period 2003-2018 were used from the State statistical office and National bank of the Republic of North Macedonia. By calculating the values of income velocity of money and propensity to import, the interdependence of domestic credits with gross domestic product and net foreign assets of the banking sector is calculated and analyzed.
Keywords: domestic credits, balance of payments, velocity, propensity to import, net foreign assets

1. INTRODUCTION
International Monetary Fund (IMF) provides financial support to countries that have problems with internal (price stability) and external stability (foreign exchange rate, balance of payments, external indebtedness). Ensuring macroeconomic stability is very important for each economy because it constitutes the basis of sustainable economic growth and development. The IMF approach to macroeconomic stabilization of a country is based on a so-called "monetary approach" to the balance of payments. The first IMF model designed for dealing with balance of payments disequilibrium was the Polak[1]'s monetary model and it reflects the IMF monetary approach to the balance of payments. The main purpose of the model is to integrate the monetary, income and balance-of-payments analysis. Therefore it represents the basis for the "conditionality" of IMF credits to its member countries. The model indicates what macroeconomics policies are required to achieve a given set of outcomes i.e. it determines policy targets consistent with explicit macroeconomic objectives. Republic of North Macedonia is a small and open economy (large share of export and import of goods and services in GDP) with close cooperation with the IMF, and as such it is eligible for the application of so-called "financial programming" based on Polak's monetary model. The paper tries to implement the Polak's monetary model to Macedonian case and to determine and quantify the dependence of the changes in net foreign assets (foreign reserves) and gross domestic product (GDP) from the changes in domestic credits of the Macedonian banking sector. It starts with explanation of the theoretical design of the model, including

---

[1] Jacques J. Polak was director of the IMF Research Department in the period 1958-1979. He is considered the "founder" of the monetary model that the IMF has applied to date and therefore this model is known as the "Polak's model".

its foundation, implication and interpretations. Based on this theoretical explanation, the next part is focuses on practical implementation of the Polak's monetary model to Macedonian case. The final part of the paper discusses the results and findings of the implementation of the model on Macedonian case.

2. THEORETICAL DESIGN OF THE POLAK'S MONETARY MODEL

The Polak' monetary model was design to analyze the effects on income and the balance of payments from the two most significant exogenous variables in the economies of the largest number of countries in the world: (1) autonomous changes in exports of goods and services, and (2) the creation of domestic bank loans, or expressed in monetary terms: foreign and domestic "additions" to the money supply in a particular country. In order to understand the effects of the action of these two variables, it was necessary to develop a model that would explicitly represent the function of demand for money. The experiences of many countries indicate that the proportional national income demand, as the simplest form of such a function, would be a reasonable approximation[2].

The model itself consists of two behavioral and two defining equations. The first behavioral equation is:

$$\Delta MO = k * \Delta Y \qquad (1)$$

This equation indicates that the change in the money supply (ΔMO) is proportional to the changes in national income (ΔY) with factor k, which is an inverse function of the velocity of circulation of money (velocity, $v = Y / MO$), ie $k = 1/v = MO / Y$.

As a second behavioral equation, the model contains a function of demand for imports:

$$M = m * Y \qquad (2)$$

According to this equation, the demand for imports (M) is a function of a country's income (Y), with m indicating the marginal propensity to import of the country.

By definition, according to the identity established in the monetary survey, the change in the money supply (ΔMO) is equal to the change in the country's foreign exchange reserves (ΔR) plus the change in the domestic credits (or net domestic assets) of the banking system (ΔD)[3]:

$$\Delta MO = \Delta R + \Delta D \qquad (3)$$

This represents the first defining equation, or the third equation in the model.

Lastly, the fourth equation that contains the model refers to the identity established in the balance of payments, according to which the change in foreign reserves (ΔR) is by definition equal to the export (X) minus the imports (M) plus the net capital inflow from abroad of the non-banking sector (K)[4]:

$$\Delta R = X - M + K \qquad (4)$$

This model has a dynamic character, stemming from the fact that it contains data on both income and change in income. The model solution gives the values of the variables that are determined by this model, such as income and changes in foreign exchange reserves (endogenous variables), as weighted averages of the values of the current and past years of exports, the capital inflow of the non-banking sector and changes in domestic loans to the banking sector (autonomous variables). Accordingly, the net capital inflow and export are exogenously determined variables, just like the coefficients v and m.

From the above it can be concluded that Polak's monetary model extends the classical quantitative money theory to the example of an open economy. Also, what is very significant and relevant to many countries, regardless of their size, is that the model focuses on the key variable that the authorities could control - the creation of domestic credits - and this variable was taken as crucial for the correction the problems in the balance of payments.

Table 1 The IMF model on financial programming based on standard Polak model

Targets	Endogenous variables	Exogenous variables	Policy variables	Parameters
foreign currency reserve	stock of money, imports of goods and services	nominal income, exports of goods and services, net capital inflows of the non-bank sector	domestic credit	the income velocity of money, the marginal propensity to import

---

[2] Polak, J.J., (1997). *The IMF Monetary Model at Forty*, IMF working paper No. 97/49.

[3] Kemp, D.S., (1975). *A Monetary View of the Balance of Payments*, Federal Reserve Bank of St. Louis Review.

[4] International Monetary Fund, (2009), *Balance of Payments and International Investment Position Manual – BPM6*, IMF.

Source: International Monetary Fund

The set of four model equations constitutes the logical foundation of the IMF programs, also known as "financial programming". The greatest utility and use of Polak's model is in explaining how changes in domestic loans affect nominal income and foreign exchange reserves. It describes how the target in the balance of payment is transferred into a limiting framework in conducting the fiscal and monetary policy (Table 1).

## 3. IMPLICATION, INTERPRETATIONS AND MULTIPLIERS

By combining the first (the function of money demand) and the third (identity in the monetary survey) equation the dependence of the income on the changes in the foreign reserves, the domestic credits and the demand for money is derived:

$$\Delta R = (1/v)*Y - \Delta D \qquad (5)$$

By combining the second (import demand function) and the fourth (identity in the balance of payment), the following equation is derived:

$$R = X - m*Y + K + R_{-1}, \qquad (\Delta R = R - R_{-1}) \qquad (6)$$

The relationship and implications of the equations contained in the Polak's monetary model can best be explained by their graphic presentation. Thus, the connection and the implications of the last two equations can be shown as follows:
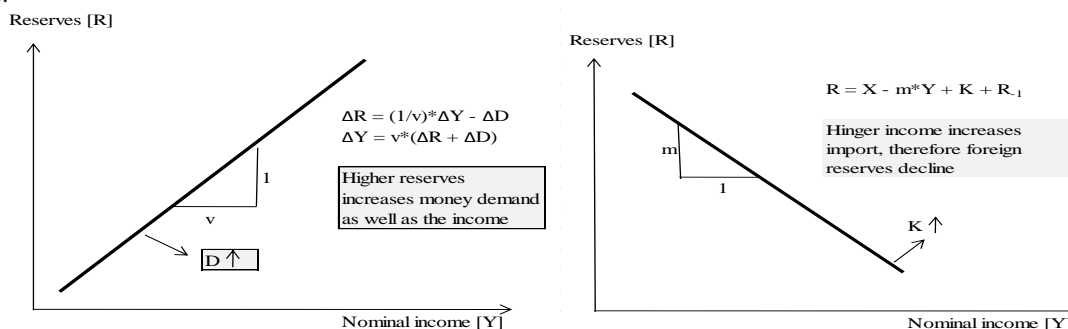
Considering the above graphs, many cases can be constructed and the following conclusions drawn:

1. With the increase in the import of goods and services, the second curve moves to the right, that is, the increase in both the reserves and the nominal income;

2. In conditions of expansion of domestic credits, the first curve shifts to the right, i.e. the nominal income increases and simultaneously the foreign reserves decrease. The channel takes place as follows:

growth in domestic credits ⟹ *growth of money supply* ⟹ *growth of nominal income* ⟹ *growth of imports* ⟹ *reduction of reserves*

3. In conditions of contraction of domestic credits, the first curve is shifted to the left, i.e. the nominal income decreases and simultaneous the foreign reserves increase:

decline in domestic credits ⟹ *decrease in money supply* ⟹ *decline in nominal income* ⟹ *decline in imports* ⟹ *increase in reserves*

Accordingly, improving the country's reserve position is accompanied by a reduction in nominal income. Compensation for the decline in income can be achieved by simultaneous depreciation of the exchange rate that causes the increase of foreign reserves (due to the increased export) and at the same time it helps to prevent the decline in income caused by the contraction in the banking sector lending activity. .

The two equations (5) and (6) contain two unknown variables: reserves (R) and nominal income (Y). By solving equations (5) and (6), the following solutions for R and Y are obtained:

$$Y = [v/(1+m*v)]*[D+R_{-1}+X+K]$$
$$R = [1/(1+m*v)]*[R_{-1}+X+K]-[m*v/(1+m*v)]*D$$

These solutions give the multipliers of nominal income and foreign reserves (net foreign assets), i.e. the impact of changes in domestic credits and exports on nominal income and foreign reserves:

$$dY/dD = v/(1+m*v); \qquad dY/dX = v/(1+m*v)$$
$$dR/dD = -m*v/(1+m*v); \qquad dR/dX = 1/(1+m*v)$$

4. APPLICATION OF THE POLAK'S MONETARY MODEL TO THE CASE OF REPUBLIC OF NORTH MACEDONIA

In this part of the paper we apply the equations of the Polak's model to the case of the Republic of North Macedonia. First it is necessary to calculate and analyze the values of the velocity of circulation of money (v) and the elasticity of the import of goods and services – marginal propensity to import (m). For this purpose, the time series of data on gross domestic product, money supply M4 and exports of goods and services for the period 2003-2018 are used. The obtained results for velocity (v) and propensity to import (m) are given in the next two charts.

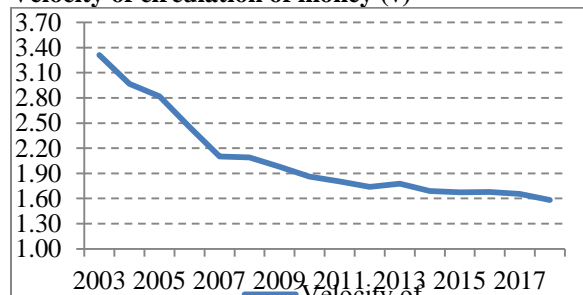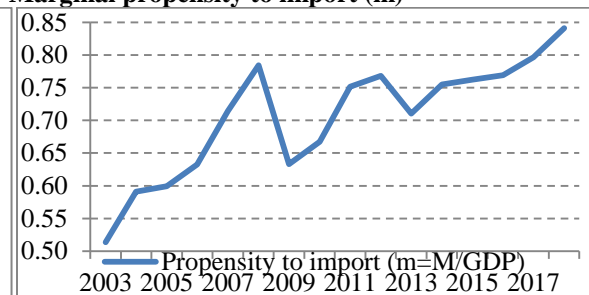**Chart 1**
Velocity of circulation of money (v)

Chart 2
Marginal propensity to import (m)

Source: Own calculations based on data from National bank and State statistical office of Republic of North Macedonia

The calculation and analysis of the velocity of circulation of money shows that this variable in the Republic of North Macedonia in the period 2003-2018 has a continuous downward trend: from 3.3 in 2003 to 1.6 in 2018. This shows that in the last 10-15 years the frequency at which the average unit of currency (money supply) is used to purchase newly domestically-produced goods and services has decreased. The reasons for this trend of decreasing the velocity of circulation of money are: (1) financial innovations (credit cards, ATMs, e-banking) that have intensified over the last years; (2) the liberalization of capital flows; and (3) the gradual development and the increase in the depth of the financial markets in the Republic of North Macedonia.

The average value of the velocity of circulation of money in the period 2003-2018 is 2.07 and this value will be used in the Polak's model equations. On the other hand, the elasticity of the import of goods and services in the period 2003-2018 ranged from 0.50 to 0.85, and on average it was 0.71. So in the case of the Republic of North Macedonia v = 2.07 and m = 0.71.

Applying these values in the last equations of the model, the following results and conclusions can be derived:

(1) $dY/dD = 2.07/(1+0.71*2.07) = 0.84$

(2) $dR/dD = -0.71*2.07/(1+0.71*2.07) = -0.60$

(3) $dR/dX = 1/(1+0.71*2.07) = 0.40$

The interpretations of the results are as follows:

(1) The increase in banking sector domestic credits, ceteris paribus, causes an almost identical increase in the nominal income (in this case GDP). That is, the credit multiplier in the Republic of North Macedonia is around 1 - an increase in domestic credits for one unit causes an increase in the nominal gross domestic product by 0.84. In other words the credit multiplier in Macedonian case is relatively high.

(2) The increase in the banking sector domestic credits, ceteris paribus, leads to decrease in foreign reserves – an increase in domestic credits for one unit causes a decrease in foreign reserves (net foreign assets) by 0.60. In other words, about 60% of the credit expansion of the banking sector goes abroad through transactions in the country's balance of payments.

(3) The increase in exports of goods and services per unit, ceteris paribus, causes an increase in foreign reserves (net foreign assets) by 0.40. That is, about 40% of the increase in exports of goods and services causes an increase in foreign reserves.

The following chart shows data on gross domestic product (GDP), domestic credits of the banking sector (NDC) and net foreign assets of the banking sector (NFA) in the Republic of North Macedonia for the period 2003-2018.

Chart 3 GDP, banks net domestic credits (NDC) and banks net foreign assets (NFA)
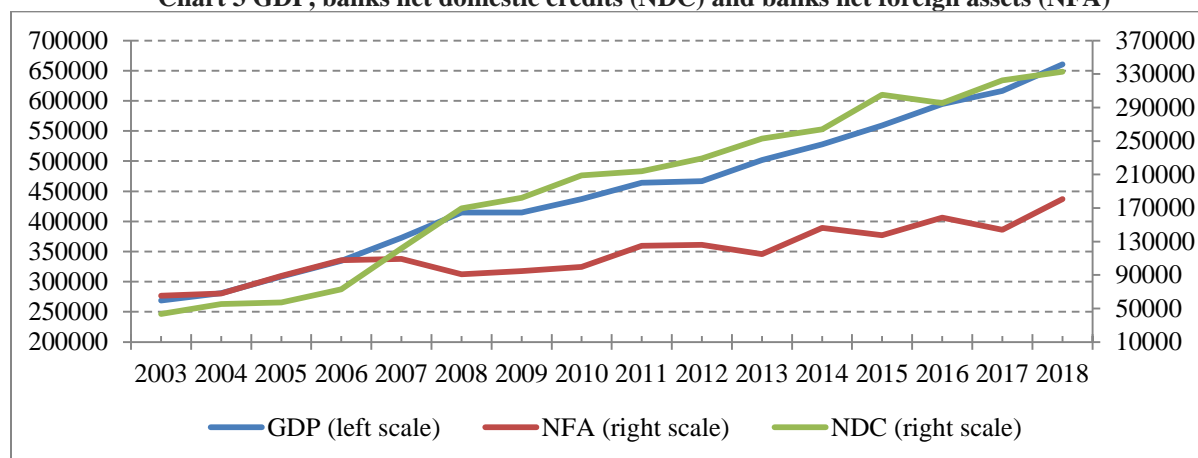
Source: Data from National bank and State statistical office of Republic of North Macedonia

The graph clearly shows (1) the previously calculated high interdependence in the movements of banks domestic credits (green line) and the gross domestic product (blue line), and (2) the previously calculated negative interdependence in the movements of banks domestic credits and the net foreign assets of banking sector (red line) in the Republic of North Macedonia. The negative interdependence is especially pronounced in 2007 and 2008, when the highest annual growth rates of domestic credits were registered (67% and 39%, respectively), which caused decrease in the net foreign assets of the banking sector (foreign reserves).

CONCLUSION

The Polak's monetary model is the basis of the IMF's stabilization program, which mainly deal on the relationship between internal and external stability. According to this model, in order to stabilize the level of foreign currency reserves and therefore achieve sustainable balance of payments, the monetary and fiscal authorities should take control over net domestic credit expansion. The excess growth of net domestic credit over money demand growth causes balance of payments current account deficit (external imbalances). Republic of North Macedonia, as a developing country that is remarkably open to the world and with close cooperation with the IMF, the application of Polak's monetary model is of special importance. The analysis shows that velocity of circulation of money in the Republic of North Macedonia has a continuous downward trend, while the elasticity of import of goods and services (marginal propensity to import) has a continuous upward trend in the last 15 years. Appling the equations of the Polak's model to the case of the Republic of North Macedonia one can conclude that the credit multiplier in Macedonian case is relatively high, meaning that banking sector domestic credits are important factor for GDP growth – an increase in banking sector domestic credits causes an almost identical increase in GDP. Simultaneously an increase in the banking sector domestic credits leads to a significant reduction in foreign reserves - about 60% of the credit expansion of the banking sector goes abroad through transactions in the country's balance of payments. On the other side, an increase in exports of goods and services causes an increase in foreign reserves by 0.40. The analysis clearly showed the strong positive interdependence of the movements of banks domestic credits and the GDP, and strong negative interdependence in the movements of banks domestic credits and the net foreign assets of banking sector in the case of Republic of North Macedonia.

REFERENCES

Barth, R.C., Hemphill, W.L., Aganina, I., (2007). *Financial Programming and Policies*, IMF Institute.

International Monetary Fund, (2009). *Balance of Payments and International Investment Position Manual – BPM6*, IMF.

International Monetary Fund, (2007). *The System of Macroeconomic Accounts Statistics – An Overview*, IMF Pamphlet Series No.56.

Grcic, B., (2001). *The Polak's Model Macroeconomic Monetary Mode*", Proceedings of the 19th International Conference of the System Dynamics Society, Atlanta, USA.

Host-Madsen, P., (1979). *Macroeconomic Accounts: An Overview*, IMF Pamphlet Series No.29.

Kemp, D.S., (1975). *A Monetary View of the Balance of Payments*, Federal Reserve Bank of St. Louis Review.

Polak, J.J, (2001). *The Two Monetary Approaches to the Balance of Payments: Keynesian and Johnsonian*, IMF
Working Paper.

Polak, J.J., (1997). *The IMF Monetary Model at Forty*, IMF Working Paper.

Sen, H., (1999). *The IMF and World Bank Approaches to Macroeconomic Management in Developing Countries*,
Journal of Economics and Administrative Sciences.