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Metrics for Assessing the Effect of Household Income and the Money Supply on Inflation

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ABSTRACT

High inflation remains a key outstanding issue today. It is one of the central issues facing the national economy of just about any country around the world. Inflation is known to have a particularly negative effect on the economy of developing nations. Among the key effects of high inflation are slowing economic growth, declining real household income, growing socio-economic inequality in society, growing poverty and social tension in the country, and declining living standards and quality of life. The two key theories on the causes of inflation in the economy – the quantity (monetary) and institutional theories of inflation – lack consensus over how household income and the money supply influence inflation. To help resolve this issue, the authors suggest using the following two metrics: a coefficient for the elasticity of inflation with respect to household income and a coefficient for the elasticity of inflation with respect to the money supply. The use of these two metrics can help forecast the dynamics of inflation, depending on the dynamics of household income and the money supply in the national economy. Thus, the subject of this study is special metrics for assessing the effect of household income and the money supply on inflation. The object of this study is to explore the dependence of inflation on household income and the money supply via the use of special coefficients for the elasticity of inflation with respect to household income and the money supply. The authors' hypothesis is that growth in household income and the money supply will influence inflation in different national economies differently. In rich and developed economies, quick growth in household income and the money supply (a high degree of monetization of the economy) will have a smaller effect on inflation than in poor and developing ones. In developing economies, due to a high elasticity of inflation with respect to household income

and the money supply, the inflationary process is more precipitate and intense, with significant damage inflicted on the national economy as a result. The re-search carried out by the authors confirms this hypothesis. The aut-hors investigated the dependence of inflation on household income and the money supply using their coefficients for the elasticity of inflation with respect to household income and the money supply. Ba-sed on their calculations, the authors drew the following conclusion: in rich countries (i.e., nations with high and fast-growing household income and a high level of monetization of the economy), the elasticity of inflation with respect to household income and the money supply will be lower than in poor countries (i.e., nations with low household income and a low level of monetization of the economy). For this reason, poor countries tend to suffer more from inflation, as in the event of growth in income and as a result of unsecured money issuance all the funding obtained will be used to meet current ne-eds, which will result in an immediate, quick increase in prices, ie. high levels of inflation. The proposed coefficients for the elasticity of inflation with respect to household income and the money supply can help forecast the proneness of national economies to inflation when there is growth in household income and the money supply as a result of the government pursuing a policy of "cheap money" to stimulate the economy.

INTRODUCTION

High inflation remains a key outstanding issue today. It is one of the central issues facing the national economy of just about any country around the world. Inflation is known to have a particularly negative effect on the economy of developing nations (Lu et al, 2019; Ciegis and Dilius, 2019; Jia et al., 2019).

Among the key effects of high inflation are the following:

- slowing economic growth;
- declining real household income;
- growing socio-economic inequality in society;
- growing poverty and social tension in the country;
- declining living standards and quality of life. So-called 'hidden inflation' causes declines in people's standard of living (forcing them to consume fewer goods and services) and quality of life (forcing them to consume goods and services with poorer consumptive qualities and less utility).

1. LITERATURE AND RESEARCH REVIEW

The economic literature offers the following two major inflation theories:

- the quantity (monetary) theory of inflation;
- the institutional theory of inflation.

The *quantity theory* of inflation treats inflation as a purely monetary phenomenon (Frisch and Helmut, 1983). In the view of proponents of the monetary theory of inflation, inflation is always and everywhere a purely monetary phenomenon. Milton Friedman famously said, "Inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output" (Leeson and Palm, 1970). Those advocating the quantity (monetary) theory of inflation regard the following statement as true: if money supply grows, the overall price level in the economy grows too.

I. Fisher's equation of exchange is as follows [Irving, Fisher, (1994)]:

$$M \cdot V = P \cdot Q,$$

where (for a given period)

– *M* is the quantity of money;
– *V* is the velocity of money;

– *P* is the price level;
– *Q* is real output.

The velocity of money (or the velocity of circulation of money) is a measure of the number of times that the average unit of currency is used to purchase goods and services within a given time period.

The above formula can be modified and be written as follows to determine the velocity of money:

$$V = \frac{P \times Q}{M}$$

In present-day practice, the velocity of money (V) is computed in the following way:

$$V = \frac{GDP}{M2} \quad ,$$

where

– *GDP* is Gross Domestic Product;
– *M2* is money and quasi money (current LCU).

Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. Annual growth in M2 is a key measure of money supply (Alexandrov, 2014).

The quantity theory of money makes the following three assumptions:

– the velocity of money is constant;
– the volume of goods in the market (Q) does not depend on money supply;
– the direction of the cause-effect relationship is from money to prices. The quantity theory holds that the price level changes depending on the change in the quantity of money.

At a time of economic slump, the government, as per the quantity theory of money, is compelled to pursue a policy of “cheap money”. The mechanism for the effect of the change in money supply on the economy is referred to as the ‘money transmission mechanism’. The money transmission mechanism indicates in what way changes in money supply (changes in the situation in the money market) influence real output (the situation in the real market, i.e. the market of goods and services).

This mechanism can be represented by the following logical chain of events. If at a time of economic slump the central bank buys government bonds

→ commercial banks’ lending potential increases

→ which enables banks to issue more loans

→ with money supply growing multiplicatively

→ the interest rate (the cost of loans) dropping

→ firms eagerly taking out cheap loans

→ investment spending growing

→ cumulative demand increasing

→ and the production volume growing multiplicatively.

It is worth keeping in mind that changes in the interest rate are what will be reacted to not only by firms, which will change the size of their investment expenditure, but also households, which use cash loans and will increase their consumer spending if those loans become cheaper, as well as the foreign sector, which will increase its spending on net exports when the interest rate drops, as this leads to a drop in the exchange rate of the country's national currency, making its goods relatively cheaper and more attractive to foreigners (Ghauri et al., 2020).

If the central bank has to buy government bonds in order to finance the budget deficit, an increase in money supply may cause a rise in inflation in the country. Inflation works like a sort of tax for natural persons. It is often referred to as inflation tax, as it reduces the cost of cash.

Central banks need to make their political choice:

- heighten inflation, in an attempt to save their government via an expansionist monetary policy (El-Hodiri et al., 2020);
- do nothing and risk getting a recession in the country.

The *institutional theory* of inflation holds that (Mark, 1988; Lindberg and Maier, 1985):

- inflation is caused by firms that pass higher pay, rent, taxes, and other expenditure on to consumers in the form of higher prices;
- if the government increases the money supply so as to make demand sufficient for goods to be purchased at higher prices, the result will be inflation;
- if the government does not increase the money supply, there may be a rise in unemployment.

Both proponents of the quantity theory of inflation (monetarists) and supporters of the institutional theory of inflation (institutionalists) have converged on the view that, while there is a positive link between money and inflation, they have different causes and effects.

Monetarists are of the view that an increase in the quantity of money causes a direct rise in prices [8]. Institutionalists believe that growing prices force the government to increase the money supply or result in unemployment. Based on quantity theory, changes in money cause changes in prices ((M+ΔM) x V → (P+ΔP) x Q). In the view of institutionalists (Artis et al., 1982), growing prices force the government to increase the amount of money in circulation ((P+ΔP) x Q → (M+ΔM) x V).

Since inflation and economic growth have an inverse relationship, monetarists and institutionalists converge on the view that inflation must be reduced. However, where the views of monetarists and institutionalists differ is on how inflation influences economic growth.

Monetarists believe that low inflation must be a priority for policymakers. They are convinced that low inflation leads to economic growth because it:

- reduces price uncertainty, making it easier for businesses to invest in future production;
- urges businesses to enter into long-term contracts;
- simplifies the use of money significantly.

Institutionalists are less confident about there being a negative interrelationship between inflation and economic growth (Lindberg and Maier, 1985). They beg to differ as to any increase in prices causing inflation (Abbasov and Karimov, 2020). If inflation does arise, the government has the tools to get rid of it relatively easily.

2. MEASURING THE CHANGE IN THE LEVEL OF INFLATION DEPENDING ON THE CHANGE IN HOUSEHOLD INCOME AND THE MONEY SUPPLY

In the current situation, where there is no consensus over how growth in household income and the money supply influences inflation, the authors suggest employing two special metrics. The use of these

metrics will help compute the change in inflation depending on the change in household income and the money supply.

The dependence of inflation on household income and the money supply can be expressed using the proposed coefficients for the elasticity of inflation with respect to household income and the money supply via the following function:

$$\pi' = \pi(Y) + \pi(m) = \alpha \cdot Y + \beta \cdot m = E_Y^{\pi} \cdot Y + E_m^{\pi} \cdot m \quad (1),$$

where

– π' is the function of inflation describing the dependence of inflation (π) on the change in household income (Y) and the money supply (m);
– *Y* is national income.

While it is customary in English-language publications to denote national income as Y (yield), the authors suggest instead employing a more accurate metric – Yd (disposable income):

$$Yd = Y - Tx + Tr = Y - T \quad (2),$$

where

– *Tx* is taxes, which households pay to the state;
– *Tr* is transfers, which the state pays households;
– *T* is net taxes, i.e. taxes less transfers.

Note that the System of National Accounts (SNA) denotes Yd as HDI (household disposable income).

$m = M \cdot V$ **(3)** is the money supply, i.e. the product of the amount of money (M) and the velocity of money (V);

$$\alpha = E_Y^{\pi} = \frac{\Delta\pi}{\Delta Y} = \frac{\frac{\pi_2 - \pi_1}{\pi_1}}{\frac{Y_2 - Y_1}{Y_1}} \quad (4)$$

is the coefficient for the elasticity of inflation with respect to household income, which can be expressed in units or as a percentage (the fraction will have to be multiplied by 100%),

where

– $\pi 1$ is inflation in the base period;
– $\pi 2$ is inflation in the current period;
– *Y1* is nominal household income in the base period;
– *Y2* is nominal household income in the current period;

$$\beta = E_m^{\pi} = \frac{\Delta\pi}{\Delta m} = \frac{\frac{\pi_2 - \pi_1}{\pi_1}}{\frac{m_2 - m_1}{m_1}} \quad (5)$$

is the coefficient for the elasticity of inflation with respect to the money supply, which can be expressed in units or as a percentage (the fraction will have to be multiplied by 100%),

where

– $\pi 1$ is inflation in the base period;
– $\pi 2$ is inflation in the current period;
– *m1* is the money supply in the base period;
– *m2* is the money supply in the current period.

The coefficients for the elasticity of inflation with respect to household income (α) and the money supply (β) are an arithmetic fraction whose numerator is the change in inflation $(\Delta\pi)$ and whose denominator is the change in household income (ΔY) and the money supply (Δm).

Accordingly, when there is an increase in household income and the money supply (the fraction's denominator increases), the elasticity of inflation with respect to these two variables will decrease. Consequently, in rich countries (i.e., nations with high and fast-growing household income and a high level of monetization of the economy), the elasticity of inflation with respect to household income and the money supply will be lower than in poor countries (i.e., nations with low household income and a low level of monetization of the economy). For this reason, poor countries tend to suffer more from inflation, as in the event of growth in income and as a result of unsecured money issuance all the funding obtained will be used to meet current needs, which will result in an immediate, quick increase in prices, i.e. high levels of inflation.

For different countries, the values of the coefficients for the elasticity of inflation with respect to household income and the money supply will be different.

In practice, the coefficient for the elasticity of inflation with respect to household income can be computed as the elasticity of the consumer price index (CPI) with respect to household disposable income (HDI) in the following way:

$$\text{Elasticity CPI/HDI} = \frac{\Delta CPI}{\Delta HDI} = \frac{\frac{CPI_2 - CPI_1}{CPI_1}}{\frac{HDI_2 - HDI_1}{HDI_1}} \qquad (6),$$

where

- *CPI* is the consumer price index, in units or as a percentage;
- CPI_1 is the consumer price index in the base period;
- CPI_2 is the consumer price index in the current period;
- *HDI* is household disposable income, in units or as a percentage;
- HDI_1 is household disposable income in the base period;
- HDI_2 is household disposable income in the current period.

If CPI and HDI are used, we will compute the elasticity of *consumer inflation* with respect to household disposable income.

The coefficient for the elasticity of inflation with respect to the money supply can be computed as the elasticity of the consumer price index (CPI) with respect to the M2 money supply in the following way:

$$\text{Elasticity CPI/M2} = \frac{\Delta CPI}{\Delta M2} = \frac{\frac{CPI_2 - CPI_1}{CPI_1}}{\frac{M2 - M2_0}{M2_0}} \qquad (7),$$

where

- *CPI* is the consumer price index, in units or as a percentage;
- CPI_1 is the consumer price index in the base period;
- CPI_2 is the consumer price index in the current period;
- *M2* is the M2 money supply, in units or as a percentage;
- $M2_0$ is the M2 money supply in the base period;
- *M2* is the M2 money supply in the current period.

All the quantities – CPI, HDI, and M2 – are computed in units or as a percentage so as to be commensurable.

Formula 7 does not factor in the change in the velocity of money (V), which is assumed to be constant, with only the metric 'money stock' (M) being used in the form of the M2 money supply.

CONCLUSION

High inflation remains a key outstanding issue today. It is one of the central issues facing the national economy of just about any country around the world. Inflation is known to have a particularly negative effect on the economy of developing nations. Among the key effects of high inflation are slowing economic growth, declining real household income, growing socio-economic inequality in society, growing poverty and social tension in the country, and declining living standards and quality of life.

The authors investigated the dependence of inflation on household income and the money supply using two special coefficients – a coefficient for the elasticity of inflation with respect to household income and a coefficient for the elasticity of inflation with respect to the money supply. These coefficients are an arithmetic fraction whose numerator is the change in inflation and whose denominator is the change in household income and the money supply. When there is an increase in household income and the money supply (the fraction's denominator increases), the elasticity of inflation with respect to these two variables will decrease.

Consequently, the following conclusion can be drawn: in rich countries (i.e., nations with high and fast-growing household income and a high level of monetization of the economy), the elasticity of inflation with respect to household income and the money supply will be lower than in poor countries (i.e., nations with low household income and a low level of monetization of the economy). For this reason, poor countries tend to suffer more from inflation, as in the event of growth in income and as a result of unsecured money issuance all the funding obtained will be used to satisfy current needs, which will result in an immediate, quick increase in prices, i.e. high levels of inflation.

The proposed coefficients for the elasticity of inflation with respect to household income ($\mathbf{E}_{\mathbf{Y}}^{\boldsymbol{\pi}}$) and the money supply ($\mathbf{E}_{\mathbf{m}}^{\boldsymbol{\pi}}$) can help forecast the proneness of national economies to inflation when there is growth in household income and the money supply as a result of the government pursuing a policy of "cheap money" to stimulate the economy.

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