The Relationship between Inflation, Interest Rate, Unemployment and Economic Growth

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THE RELATIONSHIP BETWEEN INFLATION, INTEREST RATE, UNEMPLOYMENT AND ECONOMIC GROWTH
RELAȚIA DINTRE INFLAȚIE, RATA DOBÂNZII, ȘOMAJ ȘI CREȘTEREA ECONOMICĂ

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This paper presents a quarterly estimated structural macro econometric model for the Republic of Moldova, denoted macro econometric data model (MDM). This model has been developed with four uses in mind: the assessment of economic conditions in the Republic of Moldova, macroeconomic forecasting, policy analysis and deepening
understanding of the functioning of market economy.

Five key features of the model are highlighted. First, it treats the Republic of Moldova as a small and open economy. Second, it is a medium sized model which, while detailed enough for most purposes, is nonetheless sufficient small to be manageable in the context of forecasting and simulation exercises. Third, the model is designed to have a long run equilibrium consistent with classical economic theory, while its short run dynamics are demand driven. Fourth, the current version of the MDM is mostly backward-looking, i.e. expectations are reflected via the inclusion of lagged variables. Finally, the MDM uses a quarterly frequency data, allowing for a richer treatment of the dynamics, and is mostly estimated on the basis of historical data (rather than calibrated).

The paper comprises elements of stochastic long run simulations. The relationship between: inflation, interest rate, unemployment and economic growth is significant.

Key words: *Republic of Moldova, macroeconometric modelling, open and small economy; inflation; interest rate; unemployment; economic growth; classical economics; Keynesian economics.*

JEL classification: *C13; E30; E44, E41, E21.*

Această lucrare prezintă un model macroeconometric structural trimestrial estimat pentru Republica Moldova, denumit model de date macroeconometrice (MDM). Acest model a fost dezvoltat având în vedere patru utilizări: evaluarea condițiilor economice din Republica Moldova, prognozarea macroeconomică, analiza politicilor și aprofundarea înțelegerea funcționării economiei de piață. Sunt evidențiate cinci caracteristici cheie ale modelului. În primul rând, tratează Republica Moldova ca o economie mică și deschisă. În al doilea rând, este un model de dimensiuni medii care, deși este suficient de detaliat pentru majoritatea scopurilor, este totuși suficient de mic pentru a fi gestionabil în contextul exercițiilor de prognoză și simulare. În al treilea rând, modelul este conceput pentru a avea un echilibru pe termen lung, în concordanță cu teoria economică clasică, în timp ce dinamica sa pe termen scurt este determinată de cerere. În al patrulea rând, versiunea actuală a MDM este în mare parte orientată înapoi (backward-looking), adică așteptările se reflectă prin includerea variabilelor întârziate. În cele din urmă, MDM utilizează date trimestriale de frecvență, permițând un tratament mai bogat al dinamicii și este în mare parte estimată pe baza datelor istorice (mai degrabă decât calibrate).

Lucrarea cuprinde elemente ale simulărilor stochastice pe termen lung. Relația dintre: inflație, rata dobânzii, șomaj și creșterea economică este semnificativă.

Cuvinte-cheie: *Republica Moldova, modelare macroeconometrică, economie deschisă și mică; inflația; rata dobânzii; şomaj; creştere economica; economie clasică; economie keynesiană.*

"Whether it is currency or stock speculation, the world has become one vast casino where gambling tables are spread over all meridians and latitudes.... Speculation everywhere is boosted by

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credit-issuance, since one can buy without paying and sell without owning.... All our difficulties stem from ignoring the fundamental reality, that no [market system] may properly operate if uncontrolled credit creation of means of payment ex nihilo allows (at least temporarily) an escape from necessary adjustments. ***In an Aug. 27, 1992 interview with the Spanish newspaper El País, Allais stated:*** *The Western stock exchanges are nothing but complete manipulation. It's a game, taking positions, and then playing not at forecasting events, but playing at divination, what others may think of those events. There is one image which illustrates the problem: people living and working beside Mount Aetna. No one knows when the next eruption will occur. We are in the same situation today."*

Introduction

Recent economic development rekindles the debate about the effectiveness of government policy to deliver "balanced" growth. Three broad, divergent interpretations of economic phenomena exist to understand how government macroeconomic policy might stabilize output. First, according to real business cycle theory, government fiscal and monetary policy will be largely ineffective; second, according to Keynesian macroeconomic theory, government expenditure as a component of aggregate demand can influence output, but monetary policy is largely ineffective; and third, according to monetarist theory, monetary policy can influence output but fiscal policy is largely ineffective. These interpretations are mutually exclusive, yet most economists do not subscribe fully to any particular interpretation, instead recognizing that each interpretation may offer insight about economic phenomena under different conditions. Similarly, most policymakers do not subscribe to any one interpretation, instead choosing piecemeal from different interpretations as political needs dictate.

A simple test is presented to evaluate the viability of stabilizing instruments important to monetary and fiscal policy. The method used is an update of the St. Louis equation[1]

The structure is as follows: this introduction followed by a brief discussion of the model and data, a presentation of the results, a summary of conclusions, and a list of references.

The Model:

We assume a standard Phillips Curve (PC), with adaptive-structural EuroMode[2] specification.

- Forward-looking component (inflation targeting objective and rational expectation (BNM, National Bank of Moldova; liquidity trap[3])

$$YER_t = \Pi_{t-1} + \Pi_{t-2} + E(X_i|\Pi_{t-1}) + E(X_i|\Pi_{t-2}) + \mathrm{URX}_{t-4} + YER_{t-2} + MTN_t + MTN_{t-1} + MTN_{t-2} + \sigma_1 \quad (1)$$

- Backward-looking component (standard Phillips curve)

$$\Pi_t = \alpha_1 \sum_{k=1}^{k} \Pi_{t-k} + \beta_0 Z_t + \beta_1 Z_t^2 + \gamma(L)\Pi_{t-1} + \sigma_2 \quad (2)$$

$\Pi_t =$ *inflation rate at period t*

$Z_t =$ output gap, YER-YEP/YEP at period t

YER= real gross domestic product

$L =$ polynomial lag operator, knowed as lag operator

$E(X_i|\Pi_t)$ = conditional expectations generated at period t

[1] Andersen, Leonall C., and Jerry L. Jordan. 1968. "Monetary and fiscal actions: A test of their relative importance in economic stabilization". Federal Reserve Bank of St. Louis Review, 50: 11-24.

[2] In the context of Free Trade Agreement with EU, DCFTA.

[3] Liquidity trap, is usual a phenomen which accur, when desinflationary trend combinned with low-interest rates at medium term, typically 2 years, MTN – Medium-Term-Nominal interest rate is variable used in the model.

$\varepsilon_t = \underline{\sigma_1 + \sigma_2}$

$\alpha_0, \alpha_1, \beta_0, \beta_1$ *and* γ = represents constant term

- Expected

inflation (Fisher equation)

MTN=STN+τ^e (3)

Where τ^e is the expected rate of inflation, r is the contracted real interest rate and i is the nominal interest rate. We can substract r from i to obtain τ^e. Nominal interest rates are published and therefore observable. Contracted real interest rates are not observable, but if we knew them we could calculate the expected rate of inflation. And the expected inflation rate is not observable either --- if we knew it we could calculate the contracted real interest rate.

Additional equations:

Special case[1]

- Three stage least-squares estimation (Klein's Model I)

In their original article dealing with tree-stage least-squares estimation, Zellner and Theil provide an insightful illustrative example. In the example, 2SLS and 3SLS estimates of a simple macroeconomic model are compared. The model, known as Klein's Model I, includes three behavioral equations and three identities. The behavioral equations are:

Consumption: C=

$\alpha_0 + \alpha_1 \Pi + \alpha_2 (W_1 + W_2) + \alpha_3 \Pi_{-1} + u_1$ (4)

Investment: I=

$\beta_0 + \beta_1 \Pi + \beta_2 \Pi_{-1} + \beta_3 K_{-1} + u_2$ (5)

Demand for labor: W_1=

$\gamma_0 + \gamma_1 (Y+T-W_2) + \gamma_2 (Y + T - W_2)_{-1} + \gamma_3 t + u_3$

Where C= consumtion

Π = profits

W_1 = *private wage bill*

W_2 = *government wage bill*

I = *investment*

K = *capital stock*

Y = *national income*

T = *indirect taxes*

t = *time, years*

Π = *profits*

The three behavioral equations are linked by three identities:

Y+T=C+I+G (6)

Y=$W_1 + W_2 + \Pi$ (7)

K=$K_{-1} + I$ (8)

[1] Pindyck, R.S. & Rubinfeld D.L. (1991) Econometric Models and Economic Forecasts. Third Edition (McGraw-Hill, Inc.)

In total, the model includes six endogenous variables ane eight predetermined variables. All three behavioural equations are overdetailed. The results of the 2SLS and 3SLS estimations are provided in Table below. The reader should pay particular attention to the variances of the coefficient estimators associated with moth estimation processes. In all cases (as guaranteed by the estimation process), 3SLS parameter estimates have smaller variances than their 2SLS counterparts. The gain in efficiency associated with 3SLS is usually in the neighbourhood of 5 percent.

- Saint Louis equation

For that reason, the relapse of output on money is known as the St. Louis condition. Here we consider an illustration of the St. Louis condition. The left-hand-side variable is the alter within the log of real GDP. The most right-hand-side variable is the change within the log of the money stock, as measured by M2; since any impact of money on output may happen with a slack, the contemporaneous and four slacked values are included. The relapse moreover incorporates a steady and a time slant (to account for patterns in output and money development). The information are quarterly, and the test period is 2000Q1 2020Q4.[1]

The results are:

$$\Delta lnY_t = C + \Delta lnm_t + \Delta lnm_{t-1} + \Delta lnm_{t-2} + \Delta lnm_{t-3} + \Delta lnm_{t-4} - t \qquad (9)$$

where the numbers in parentheses are standard errors. The entirety of the coefficients on the current and four lagged values of the money-growth variable is 0.26, with a standard mistake of 0.10. In this way the estimates suggest that a 1 percent increment within the money stock is related with an increment of 1% percent in output over the another year, and the invalid theory of no affiliation is rejected at high levels of significance. Does this regression, at that point, give critical evidence in support of money related over real investments of variances? The answer is no. There are a few essential issues with a regression like this one. To begin with, causation may run from output to money instead of from money to output. A straightforward story, formalized by Lord and Plosser (1984), is that when firms arrange to extend generation, they increment their money property since they will ought to buy more intermediate inputs. Essentially, household agents may increment their money possessions when they arrange to extend their purchases.

Total measures of the money stock, such as M2, are not set specifically by the National Bank of Moldova but are decided by the interaction of the supply of high-powered money with the behavior of the keeping money framework and the public. Hence shifts in money demand stemming from changes in firms' and households' generation plans can lead to changes within the money stock. As a result, we may see changes within the money stock in progress of output movements indeed in the event that the changes in money are not causing the output movements. The moment and indeed more extreme issue with the St. Louis condition involves the determinants of monetary approach. Assume the National Bank of Moldova adjust the money stock to undertake to balanced other components that impact total output.

At that point on the off chance that financial changes have real impacts and the NBM's endeavors to stabilize the economy are fruitful, we are going to observe fluctuations in money without movements in output. In this way, fair as we cannot conclude from the positive relationship between money and output that money causes output, in case we fall flat to watch such a relationship we cannot conclude that money does not cause output. A prosaic difficulty with the St. Louis condition is that there have been huge shifts within the request for money over this period. At slightest a few of the shifts are likely due to money related innovation and deregulation, but their causes are not completely caught on.

Data:

[1] The start date is determined by data availability. The end date is chosen to not to omit the enormous financial and monetary changes associated with the COVID 19 Recession.

The data series used in the empirical analysis have a quarterly frequency and were obtained from the National Bureau of Statistics for the Economy of the Republic of Moldova, as well as from the Area Wide Model (AWM) database (for more details see Fagan et al., 2005 as well as the website - https://eabcn.org/page/area- wide-model). The analysed periods are 2000: 1–2021: 1. Regarding the determination of potential GDP, the HP filter was used to estimate it. As primary references or used two sources mainly as follows: https://www.mathworks.com/help/econ/hpfilter.html but also the article by Robert J, Hodrick and Edward C. Prescott[1] from 1999. Phillips used in its unemployment rate model, however lately, the output gap is being used more and more frequently due to the problems encountered by measuring NAIRU, the natural unemployment rate, this being the reason why we used the production gap. We assumed that there are different models of dynamic Phillips Curve (PC)- price adjustment in a common framework. The system draws intensely on the model of exogenous ostensible inflexibility and the model of inflation targeting. Time is discrete. Each period, incompletely competitive firms deliver output utilizing labor as their as it were input. As within, the production function is one-for-one; in this way total output and total labor input are rise to. The model excludes government purchases and worldwide exchange, total consumption and total output are equal. Households maximize utility, taking the ways of the real wage and the real interest rate as given. Firms, which are claimed by the households, maximize the present discounted value of their profits, subject to constraints on their price-setting (which shift over the models we'll consider). At last, a central bank decides the way of the real interest rate through its conduct of money related arrangement.

Click here to download a zipped folder containing all EViews files (27 KB)
Click here to download a zipped folder containing all Excel files (311 KB)
Click here to download a zipped folder containing all Time Series – Description files (5 KB).

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[2] art. 13 para. (1) of the Code on Science and Innovation of the Republic of Moldova, no. 259/2004 (Official Monitor of the Republic of Moldova, 2018, nr.58-66, art.131)