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DYNAMIC MODELLING OF MONETARY POLICY DECISIONS

Monetary policy refers to the measures and actions implemented by a country's central bank or monetary authority to regulate and control the money supply, interest rates, and financial conditions to achieve specific economic goals, such as price stability, full employment, and sustainable economic growth. A central bank is an essential financial institution responsible for supervising a country's monetary system, managing the supply of money, and overseeing financial institutions within its borders.

The main goals of the NBU: ensuring stability in prices, facilitating stability in the financial sector, encouraging sustainable rates of economic growth. The NBU accomplishes these objectives through the execution of monetary policy, overseeing financial institution operations, managing money circulation, supervising payment and settlement systems, and safeguarding the rights of financial service consumers. Also, one of the main tasks of the NBU is to maintain low and stable inflation.

The present model is a variation of the model examined by Svensson (1997) and Ball (1999b). It consists of two equations that describe the economy, one for aggregate demand and the other for aggregate supply. The model follows the traditional Keynesian approach. However, unlike standard Keynesian models, this model includes lags. The equation for aggregate demand shows that output is negatively affected by the real interest rate of the previous period. On the other hand, the equation for aggregate supply indicates that inflation is positively affected by the output of the previous period. Due to the lag structure, changes in the real interest rate do not affect output until the next period and do not affect inflation until the period after that. This reflects the common belief that policy works with a lag.

Let y_t – output; y_t^n – economy`s flexible-price output; y_t^* - Walrasian levels of output (all in logs); π_t – inflation; $r_{t-1} = i_{t-1} - E_{t-1}[\pi_t]$ – real interest rate; ε_t^{IS}, ε_t^Y – white noise. Then the model is:

$$y_t = -\beta r_{t-1} + u_t^{IS}, \quad \beta > 0, \tag{1}$$

$$\pi_t = \pi_{t-1} + \alpha\left(y_{t-1} - y_{t-1}^n\right), \quad \alpha > 0, \tag{2}$$

$$u_t^{IS} = \rho_{IS} u_{t-1}^{IS} + \varepsilon_t^{IS}, \quad -1 < \rho_{IS} < 1, \tag{3}$$

$$y_t^n = \rho_Y y_{t-1}^n + \varepsilon_t^Y, \quad 0 < \rho_Y < 1, \tag{4}$$

$$y_t^* - y_t^n = \Delta, \quad \Delta > 0. \tag{5}$$

The equation (1) describes *IS*-curve – aggregate demand, equation (2) – accelerationist Phillips curve – aggregate supply. Then (3) and (4) – driving processes: shock to the *IS*-curve and shock to the flexible-price level output respectively. The last (5) means, that it is possible to be a constant gap between the Walrasian levels of output and economy`s flexible-price output.

Let`s define the output gap $\tilde{y} = y - y^n$ and rewrite it as

$$\tilde{y}_t = -\beta r_{t-1} + u_t^{IS} - y_t^n, \tag{6}$$

$$\pi_t = \pi_{t-1} + \alpha \tilde{y}_{t-1},$$

$$\pi_{t+1} = \pi_t + \alpha \tilde{y}_t.$$

Let’s consider a simple backward – looking SD model.

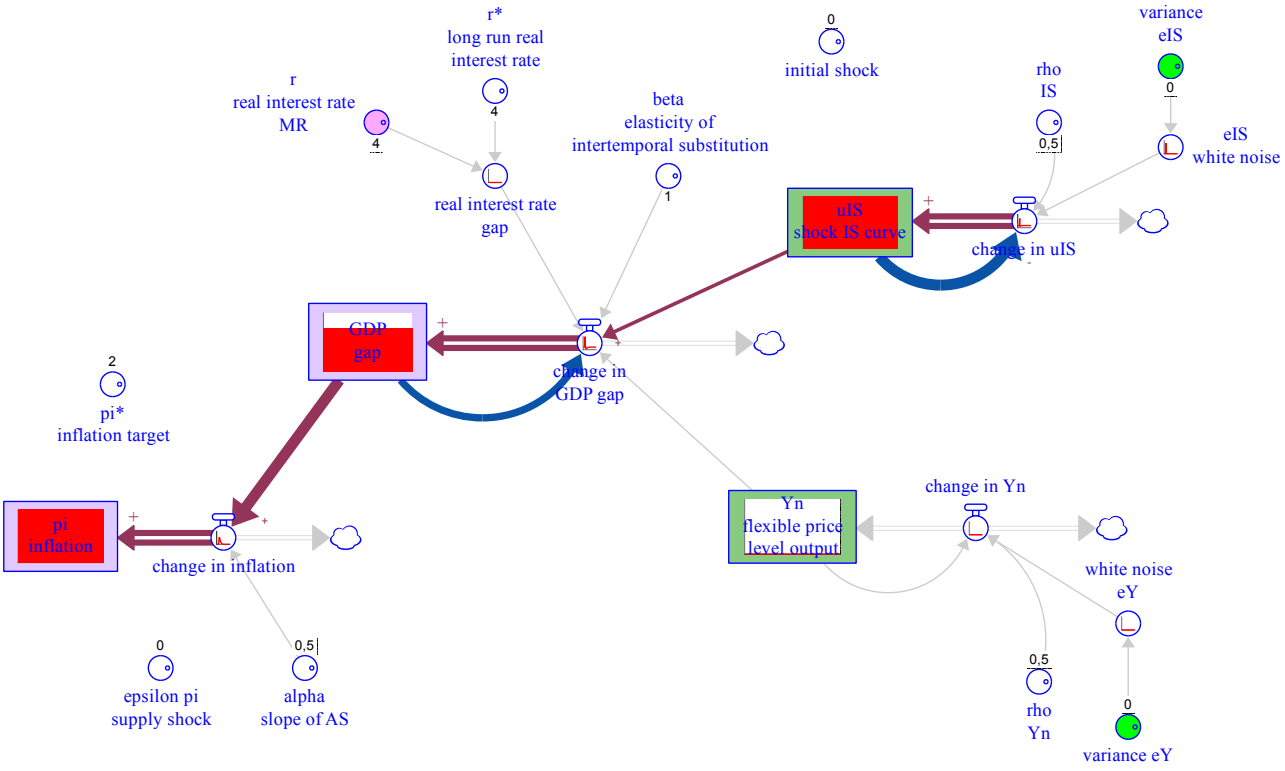

Figure 1. Simple Backward – Looking SD Model

Explain how it work. The General Bank chooses interest rate (r real interest rate). It changes GDP in the next period $\tilde{y}_{t+1}$. And then GDP change inflation in the next one more period π_{t+2}.

Consider the results of the model

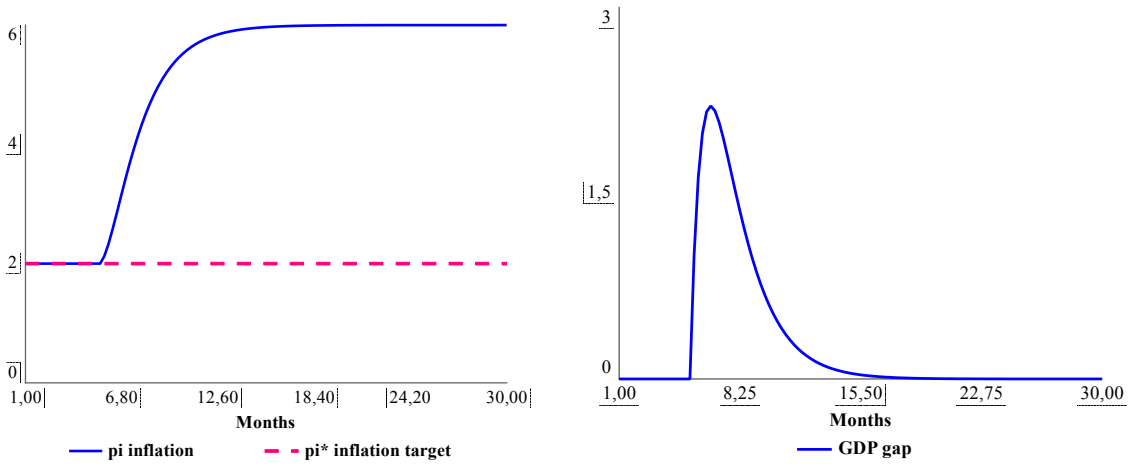

Figure 2. Inflation, inflation target and GDP after temporary shock

These results for the following values:

$r = r^* = 4,\ \beta = 1,\ \alpha = 0.5,\ \pi = 2,\ \rho_{IS} = \rho_Y = 0.5$.

Now let`s ε_t^{IS} white noise = 0, but *variance_eIS* = 0,2.

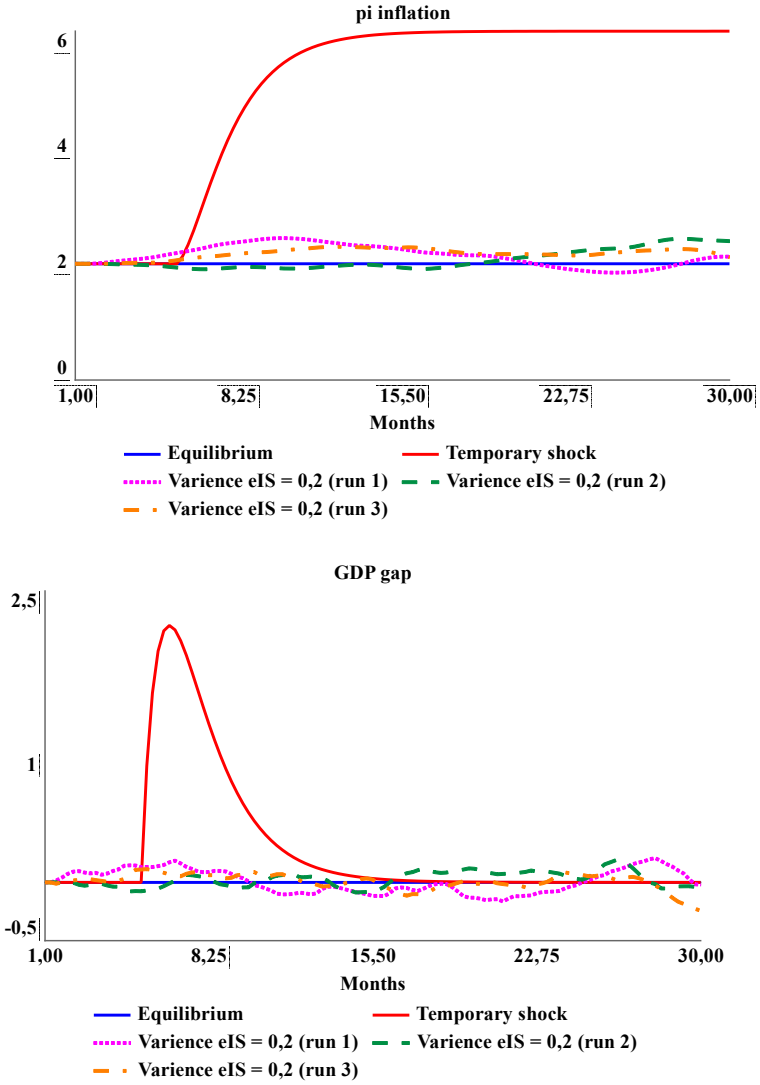

Figure 3. Inflation, inflation target and GDP with variance_eIS = 0,2

What does it mean? It is AR(1) process. While temporary shock is equal to 0, *variance_eIS* is a random variable, we see chaotic fluctuations of variables around equilibrium.

Those were the results for a temporary shock, now let's consider how permanent shock behaves.

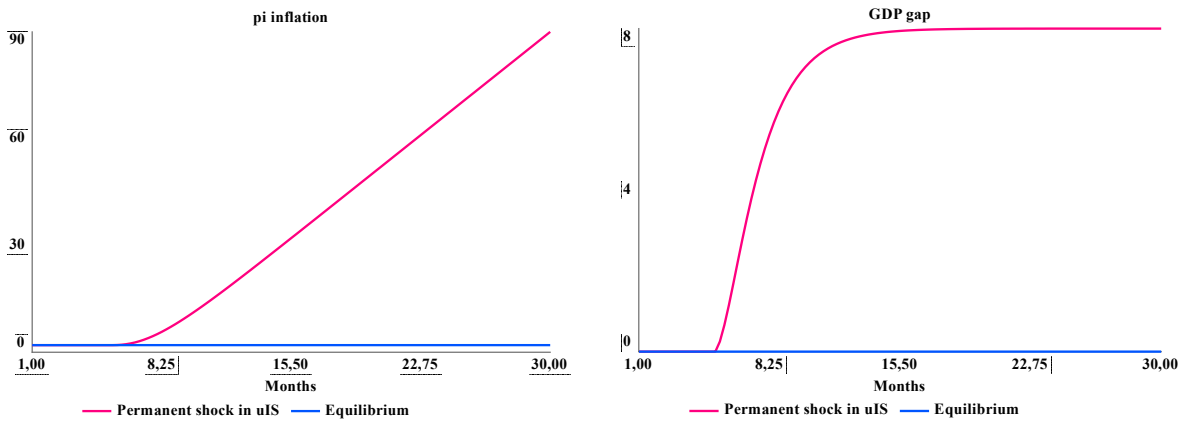

Figure 4. Inflation, inflation target and GDP after permanent shock

Analyzing these graphs, we can conclude how temporary and permanent shocks affect GDP and inflation. Hence, temporary shocks have a greater impact on GDP than permanent shocks. Temporary shocks can cause sudden drops or increases in economic activity in the short run, which can lead to significant changes in GDP. All because the NBU may not be ready for sudden changes, so it will not be able to resolve the situation quickly.

On the other hand, permanent shocks, despite their significant impact on individual sectors of the economy, usually have a smaller impact on GDP. All because of the NBU's readiness for such events, and the presence of a strategy that has been well practiced in previous periods. However, persistent shocks can have a significant impact on the long-term development of the economy. All due to the fact that with temporary shocks, the NBU will still be able to regulate the situation on the monetary market for some time. Whereas a constant shock does not allow time for adjustment since it acts continuously. A similar situation occurs with the impact on inflation. A temporary shock increases inflation sharply, but then remains at a stable level, while a permanent shock increases inflation continuously, but slowly and gradually.

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