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# SYSTEM DYNAMIC ANALYSIS OF INCOME AND INTEREST RATE DYNAMIC UNDER SHOCKS IMPACT

In these theses, IS-LM is presented as a dynamic framework. Hicks's IS-LM charts use an unprecedented rule as the basis of modern macro theory. Today, they are very useful tools for comparative static analysis.

The IS curve shows the equilibrium situations between investment and savings for different values of income (Y) and interest rate (r).

Consider a model that is continuous and allows for various adjustments in the capital market and the organized goods market. Precisely because adjustment in the organized commodity market is much slower than in the capital market, we build a continuous model based on these findings and define the coefficients in terms of the two adjustment equations. In an organized commodity market, we assume that income increases over time if there is excess demand and decreases if there is excess supply.

More precisely

$$\dot{Y}(t) = \alpha\,(E(t) - Y(t)),\ \alpha > 0,$$

where

$$E(t) = C(t) + I(t) + G.$$

Let the interest rate in the capital market rise if there is excess demand in this market, and fall if there is excess supply. More precisely

$$\dot{r}(t) = \beta\,(Md - Ms),\ \ \beta > \alpha > 0.$$

So, we have such a complete model

$$C(t) = a + bYd(t)$$
$$Yd(t) = Y(t) - Tx(t)$$
$$Tx(t) = Tx_0 + txY(t)$$
$$I(t) = I_0 - hr(t)$$
$$E(t) = C(t) + I(t) + G$$

$$\dot{Y}(t) = \alpha(E(t) - Y(t)), \quad \alpha > 0$$
$$Md(t) = M_0 + kY(t) - ur(t)$$
$$Ms(t) = M$$
$$\dot{r}(t) = \beta(Md(t) - Ms(t)), \quad \beta > 0.$$

In Figure 2 below, we can see how the graph changes. When Y income = 100, alpha = 1, G (government spend) = 25, Y income falls smoothly, after which equilibrium is reached.

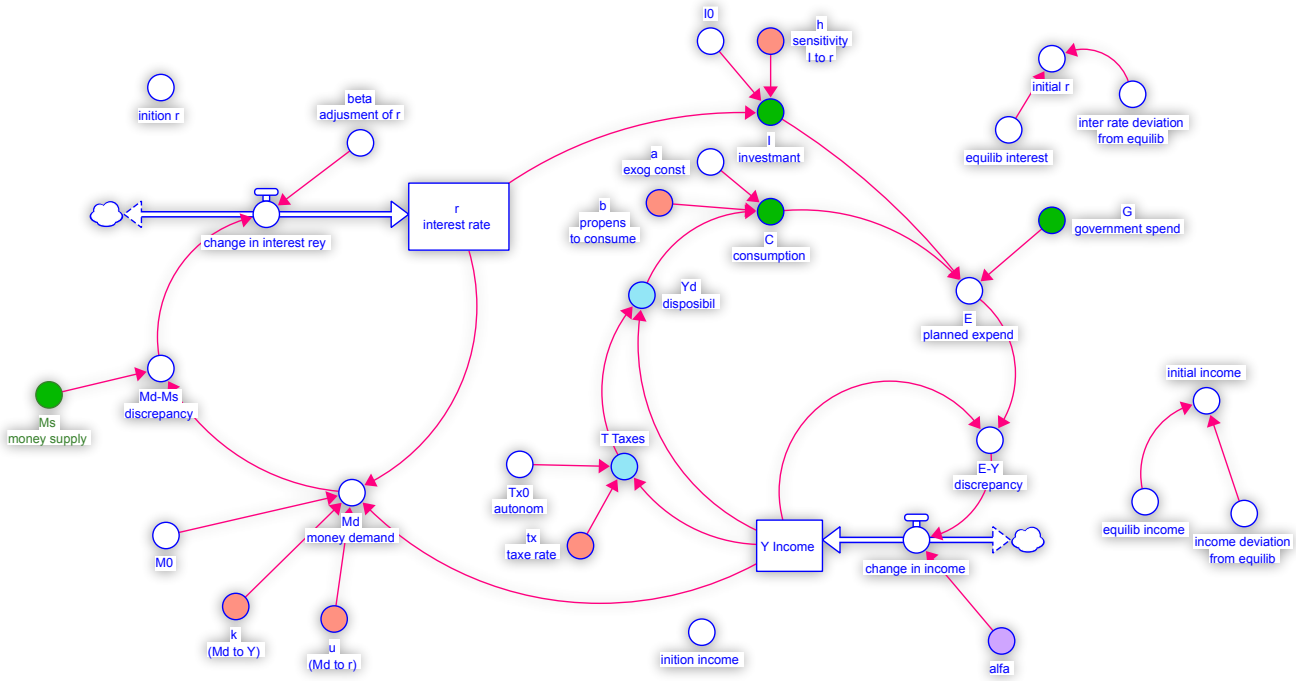


***Figure 1. IS-LM Model***

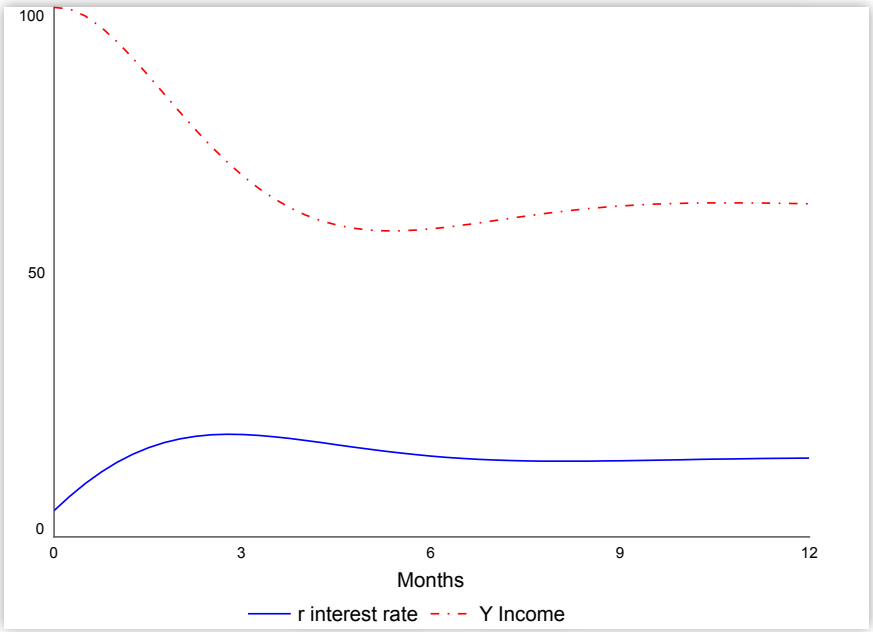


***Figure 2. Dynamics of income and interest rate – scenario 2***

In Figure 3,4 below, we can see how the graph changes. When Y income = 65, alpha = 0,5 , G (government spend) = 30. Our graphs converge to a point, after which they do not reach equilibrium.

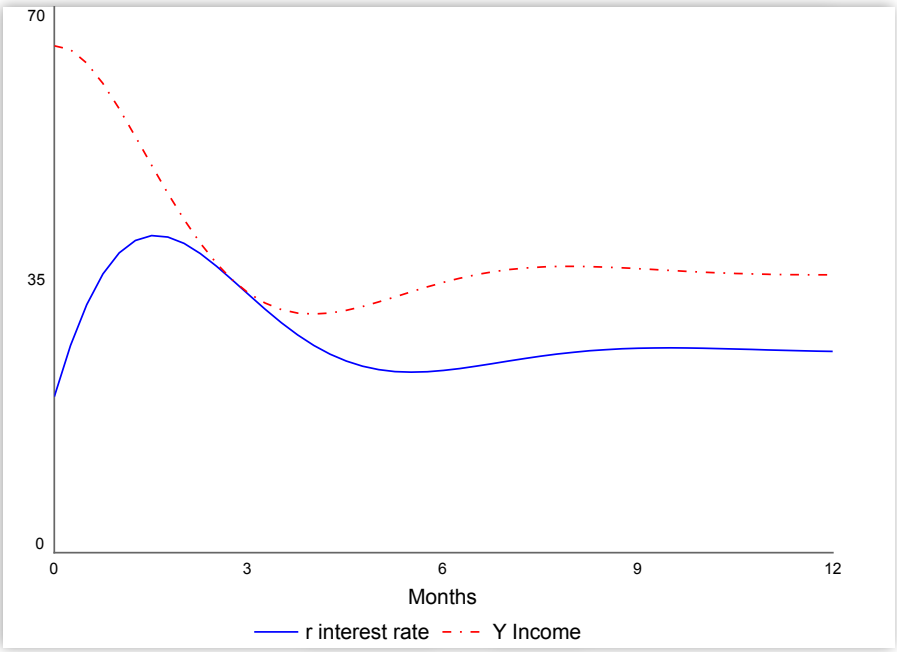


***Figure 3. Dynamics of income and interest rate – scenario 2***

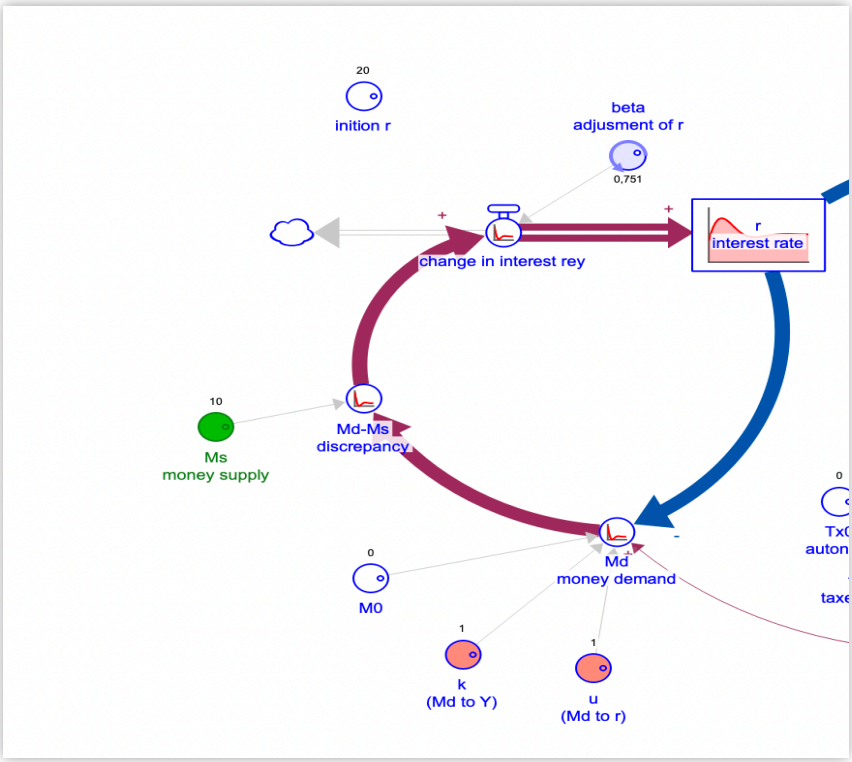


***Figure 4. Interest rate loop***

In Figure 5 (*Y income and r (interest rate)*), we add steps using the STEP command, which helps us see changes when investing funds in the next time period.

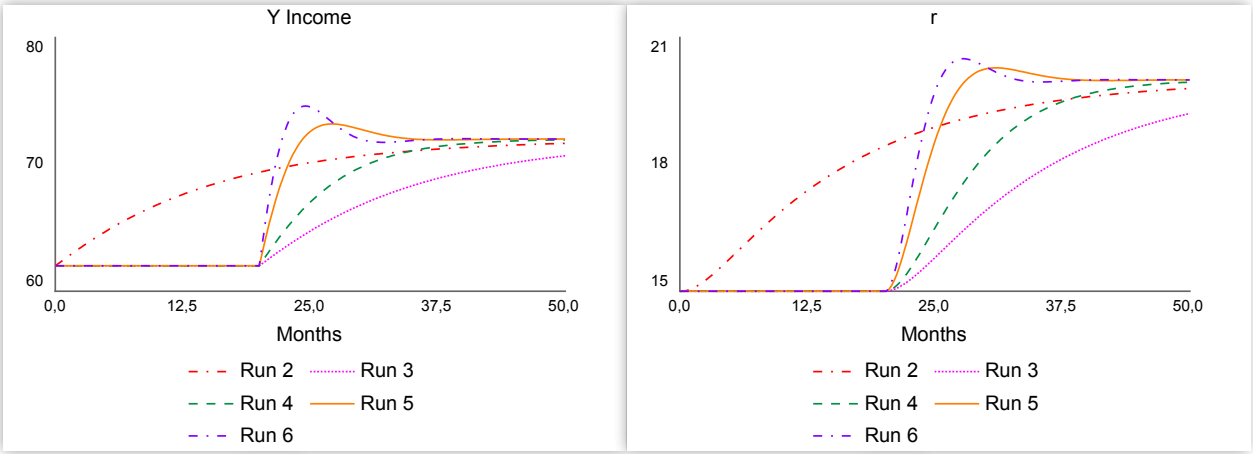


***Figure 5. Dynamics of income and interest rate in result of permanent shock***

Fig. 6 shows that system converges to one point regardless of different its initial state.

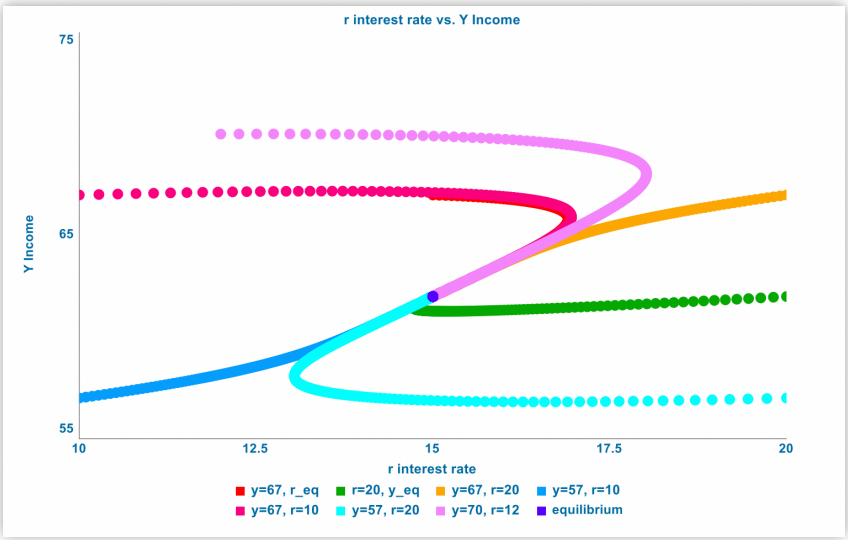


***Figure 6. Income and interest rate convergency***

We take the money supply in different periods of time. This is shown in Fig. 7. If the period increases with time, then it comes to equilibrium.

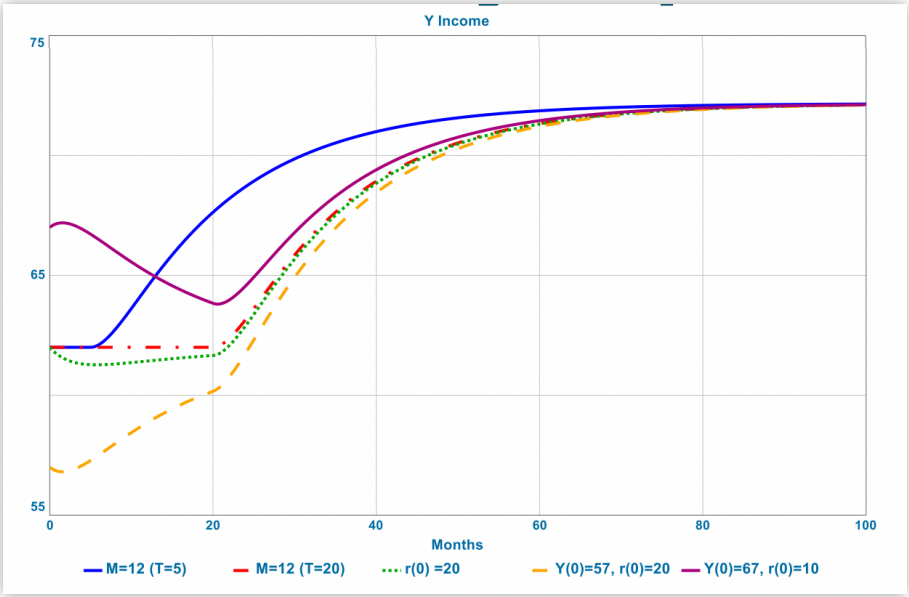


***Figure 7. Y (income) dynamics***

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