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SYSTEM DYNAMIC SIMULATION OF LINEAR IS-LM MODEL

IS-LM model is a Keynesian macroeconomic model that describes the relationship between the market for economic goods and money market. IS means "Investment-Saving" and LM means "Liquidity preference-Money supply". The model is represented as a graph in which IS represents one curve, LM represents another curve and the point of intersection gives the long-run equilibrium between interest rate and national income.

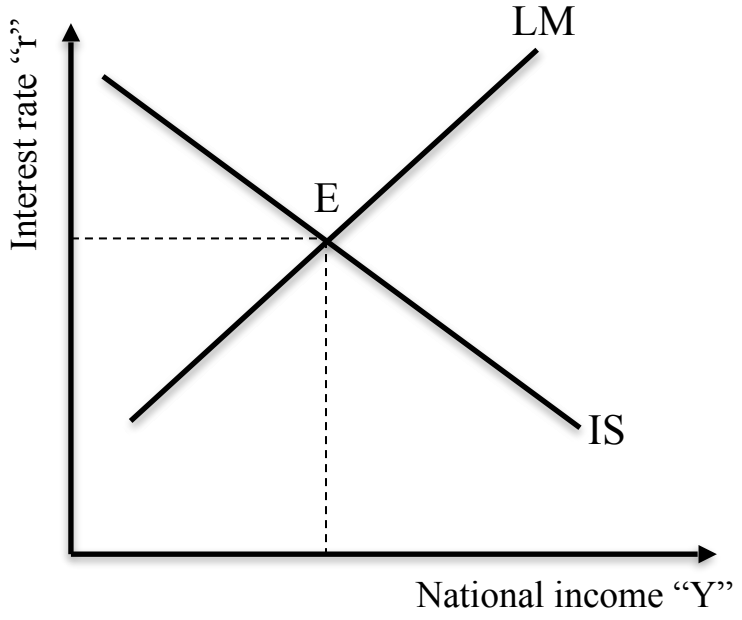

Figure 1. IS-LM model

Let assume a closed economy when total expenditure is the sum of expenditure, investment expenditure and government expenditures. In equilibrium income is equal to total expenditures. The goods market and money market are described by following equations:

1. Goods market

$C=a+bYd, \quad 0\le b\le 1$	*C – consumers` expenditure*
$Yd=Y-tX$	*Yd – disposable income*
$Tx=Tx0+txY, \quad 0\le tx\le 1$	*Tx – total taxes*
$I= I0-hr, \quad h>0$	*r – interest rate*
$E=C+I+G$	*I – investment expenditure*
$Y= \alpha E-Y, \quad a>0$	*G – government expenditure*

2. Money market

Md= M0+kY-ur, k>0, u>0 *Md – demand for money*

Ms=M *Ms – supply of money*

r=βMd-Ms, β>0

Let`s consider the numerical example and create a model to illustrate the dynamics suggested by Ronald Shone in his book “An introduction to economic dynamics”:

Ct=15+0,75Ydt	Et=Ct+It+G
Ydt=Yt-Tx(t)	Yt=0,05(Et-Yt)
Txt= 0,25Y(t)	Mdt=0,25Yt-0,5r(t)
It=10-1,525r(t)	Mst=8
G=25	rt=0,8(Mdt-Mst)

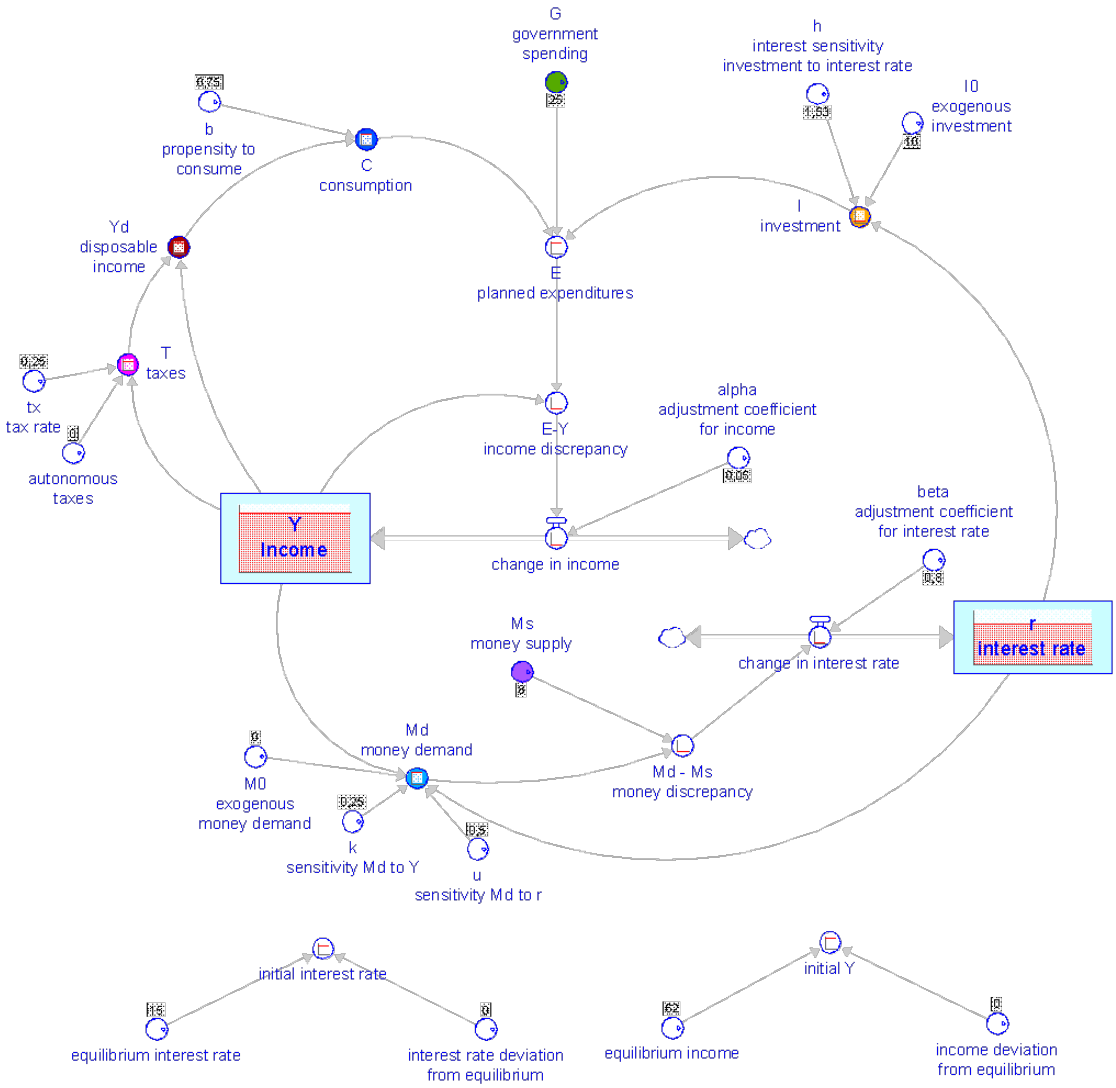

Figure 2. IS-LM dynamic model

Empirically we determined that economy reaches equilibrium point Y* = 62, r* = 15 and it doesn't depend on initial conditions Y(0) and r(0).

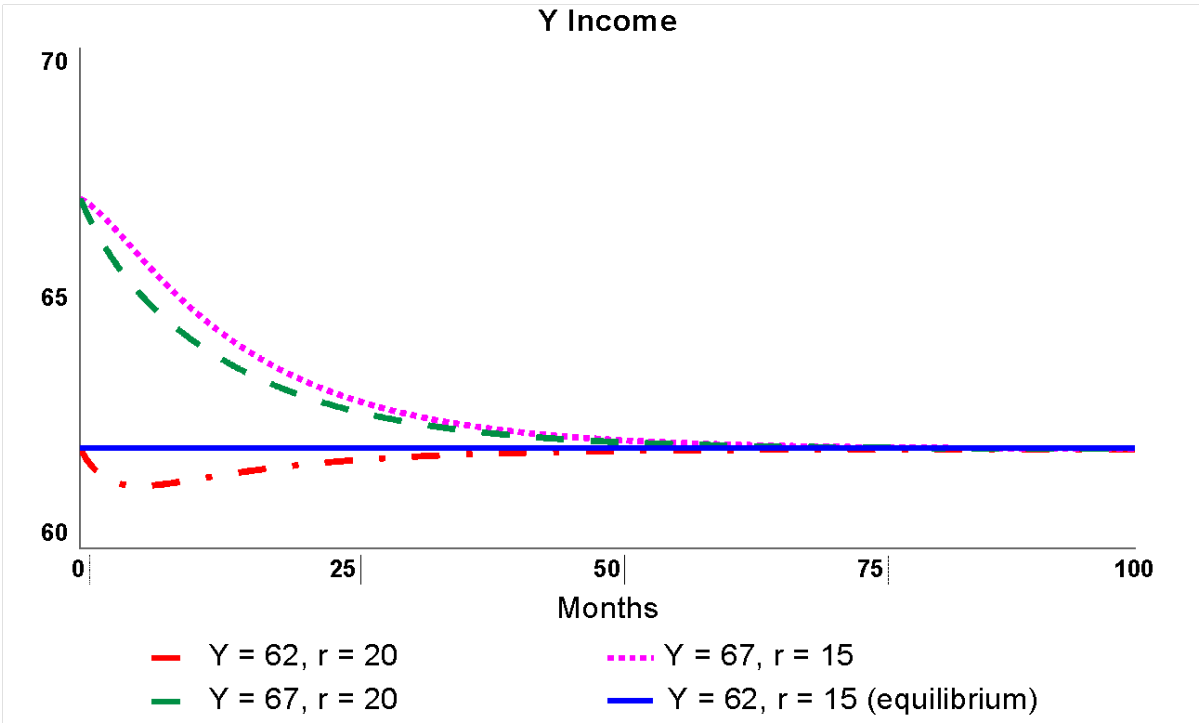

Figure 3. Dynamics of Y income (runs in equilibrium and with deviation)

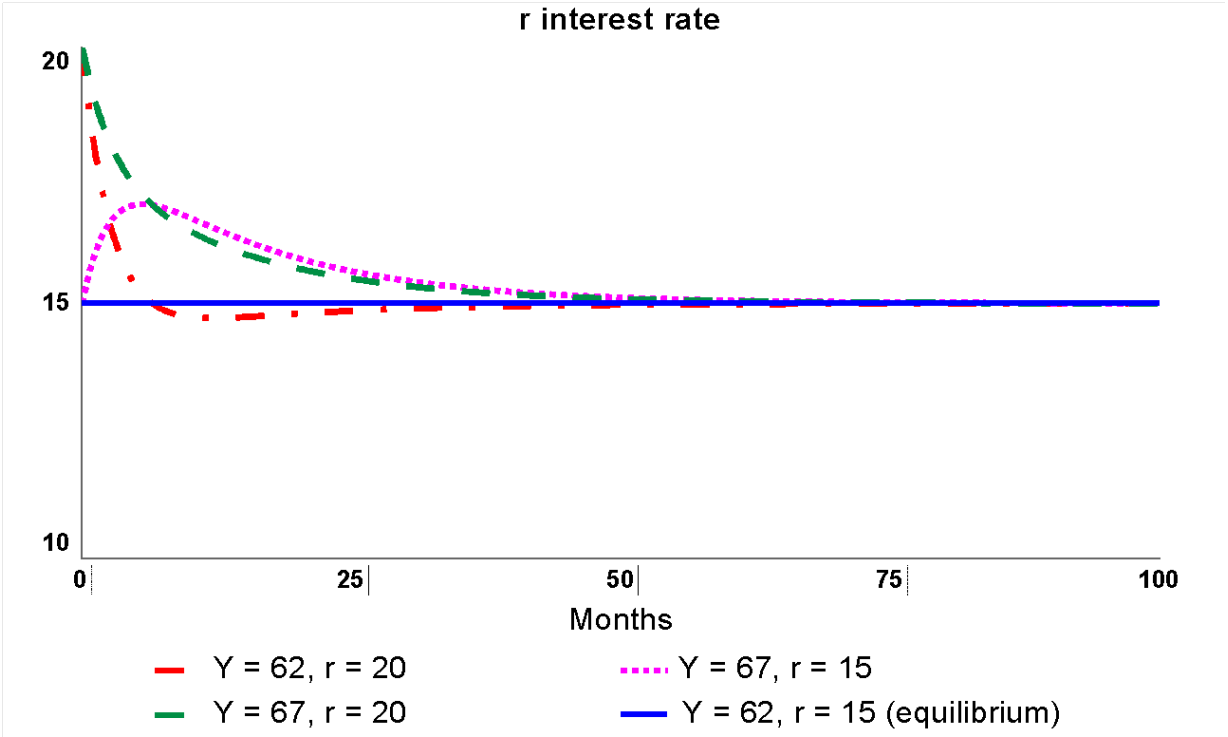

Figure 4. Dynamics of r interest rate (runs in equilibrium and with deviation)

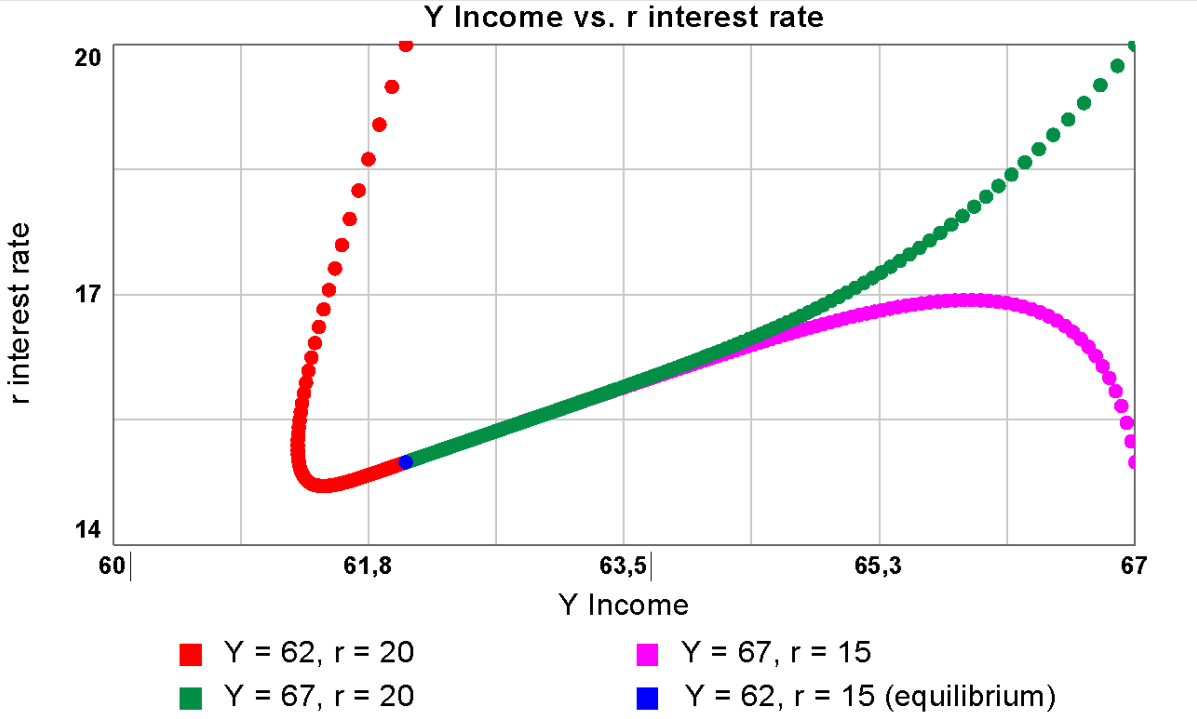

Figure 5. Y income vs. r interest rate (runs in equilibrium and with deviation)

Fig. 3 represents the behavior of income in equilibrium (Y = 62, r = 15) and its convergence to equilibrium level from different original states of economy. We can see that the dynamic trajectory from Y(0) = 62, r(0) = 20 comes to equilibrium much faster than the trajectory from Y(0) = 67, r(0) = 20. In comparison, the curve form Y(0) = 67, r(0) = 15 comes to equilibrium the longest.

Fig. 4 represents the behavior of interest rate in equilibrium (Y = 62, r = 15) and after adding to the initial state some deviations. These curves come to the equilibrium in the same order as in the Y income graph.

Fig. 5 shows that the initial state of the system doesn't matter, the economy always converges to equilibrium values Y = 62, r = 15. However the spped of convergence is different.

If some parameters of model change the equilibrium level of income aa well as interest rate change relatively. We can also extend our model and consider an open economy. It can exhibit quite different results and will include new additional variables.

References

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3. Wheat, D. I. (2007). The Feedback Method: A System Dynamics Approach to Teaching Macroeconomics. PhD thesis, University of Bergen.