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SYSTEM DYNAMIC MODELING OF KNOWLEDGE ACCUMULATION PROCESSES

The large difference in economic development among countries is associated with knowledge development. The distribution of factors takes into account two sectors – research and development (R&D) sector and good-production sector.

We assume that some fraction of labor force as well as some fraction of capital are used in R&D sector. Rest of them are used in goods production sector. The whole amount of knowledge A is used in both sectors. Output (Y) is divided between consumption and investment according to saving rate. Investment contributes to physical capital accumulation where as the new knowledge increase its current amount. The relevant equations are:

$$Y(t) = K(t)^{\alpha}[A(t)L(t)]^{1-\alpha} \tag{1}$$

$$\dot{K}(t) = sY(t) \tag{2}$$

$$\dot{A}(t) = BY(t) \tag{3}$$

$$L = 1 \tag{4}$$

$$\frac{\dot{g}_K(t)}{g_K(t)} = (1-\alpha)[g_A(t) - g_K(t)] \tag{5}$$

$$\frac{\dot{g}_A(t)}{g_A(t)} = \alpha[g_K(t) - g_A(t)] \tag{6}$$

Where output is given by equation 1, Capital accumulation by equation 2 Knowledge accumulation occurs as a side effect of goods production equation 3. L is constant and equal to 1. We derived the equation that correspond to behavior of

growth rate of capital and growth rate of knowledge – there are equation 5 and 6 and Based on these theoretical results I built System Dynamic model for this problem.

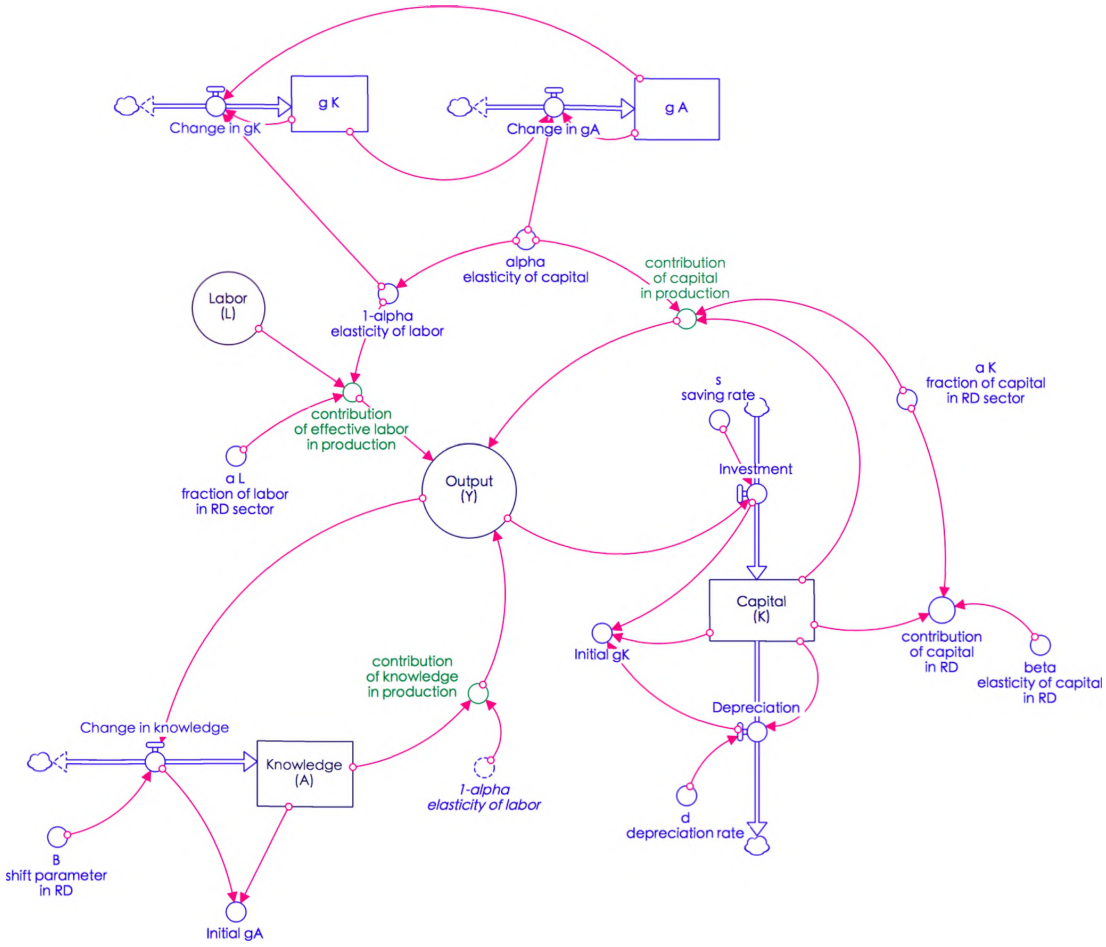

Figure 1. The System Dynamic model

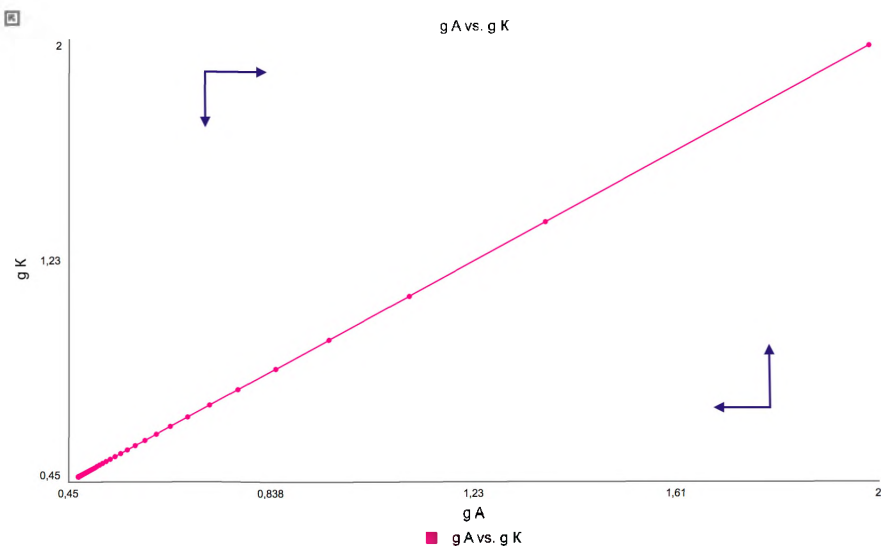

Figure 2. The line $g_A = g_K$

The analysis of model shows that g_A will be rising when $g_K > g_A$ so it is right to the $\dot{g}_A = 0$ line and g_A will be falling left this line.

For this model we can see that economy will eventually arrive to the situation where $g_K = g_A$ and then will be constant.

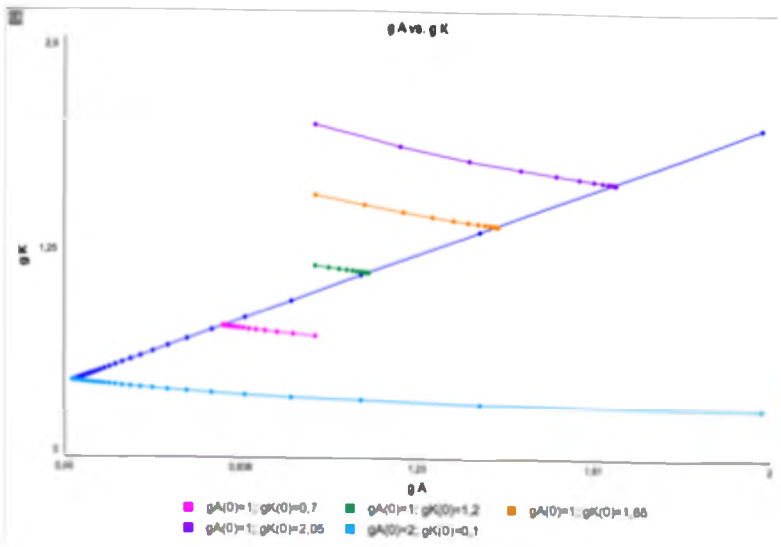

Figure 3. Convergence from different points below the line $g_A = g_K$

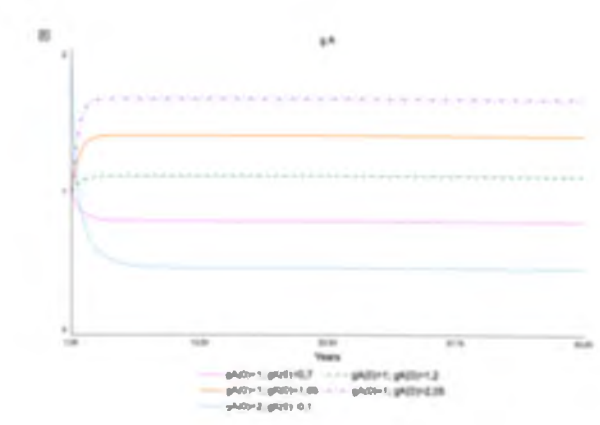

Figure 4. Growth rate of knowledge

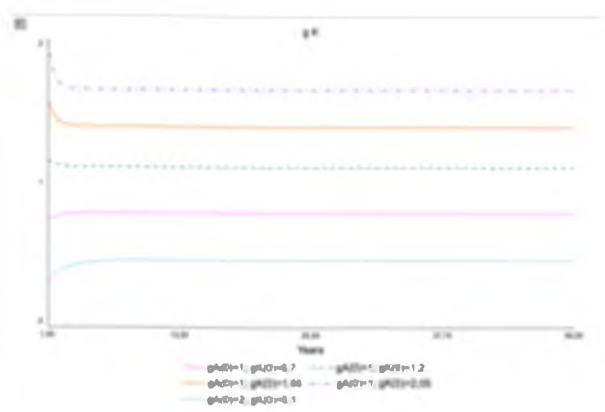

Figure 5. Growth rate of capital

Regardless of the initial value of capital and knowledge growth rates if they are below and above the line economy converge to the some point on the line.

Therefore, we get the behavior of the growth rate of knowledge and capital that eventually reach steady state. The saving rate affects long-run growth because the contribution of capital is now larger. Increase in capital raises output not only through

its direct role in production, but also indirectly. Capital contribute to development of new ideas and make all other capital more productive.

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SYSTEM DYNAMIC MODELING FOR BANKING SYSTEM

One of the consequences of the banking crisis in 2014-2016 in Ukraine was the closure of a significant number of banks (fig. 1). During that period 90 banks were declared insolvent. In 2014 the National Bank of Ukraine was unable to prevent the closure of a large number of banks, as it was not ready to act during a sharp deterioration in the economic and political situation. After this banking crisis the NBU began to pay a considerable attention to stress testing of the banks, the purpose of which is to check the resilience of the banks to possible shocks. Therefore, the aim of research is to reflect the impact of changes in performance indicators of the banks and economic situation on bank's stability. The model was built for Privatbank, the stability of which is very important for the Ukrainian banking system. PrivatBank is the largest Ukrainian state-owned bank in terms of assets, which was fully recapitalized by the government in 2017 after the NBU declared it insolvent.