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SYSTEM DYNAMIC REPRESENTATION FOR NONLINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS

One of the most recent advances in mathematics has been the subject of chaos theory. Dynamic systems can differ dramatically with very small changes to the initial state. Even if the system is deterministic, it can still give the impression of randomness. Chaos does not require random nature. If we have something accidental, it cannot be predicted. On the other hand, the deterministic system is quite predictable. However, if the system depends on the initial conditions and moves quite differently for different initial conditions, even if they are very close, then the system becomes unpredictable. Chaotic systems only occur when we have nonlinearities. The goal was to build differential equations into a system dynamics model. Using the system dynamics model, to solve the differential equations and to investigate the chaotic behavior of the equations.

We considered the nonlinear system of two differential equations that describes the behavior of money supply and inflation. This system includes two variables, which are functions dependent on time, and one parameter.

$$m'(t) = i(t)$$
$$i'(t) = \mu(1 - m^2(t))i(t) - m(t)$$

I represent this system by system dynamics model, and based on this model, investigate the behavior of the solutions of these differential equations.

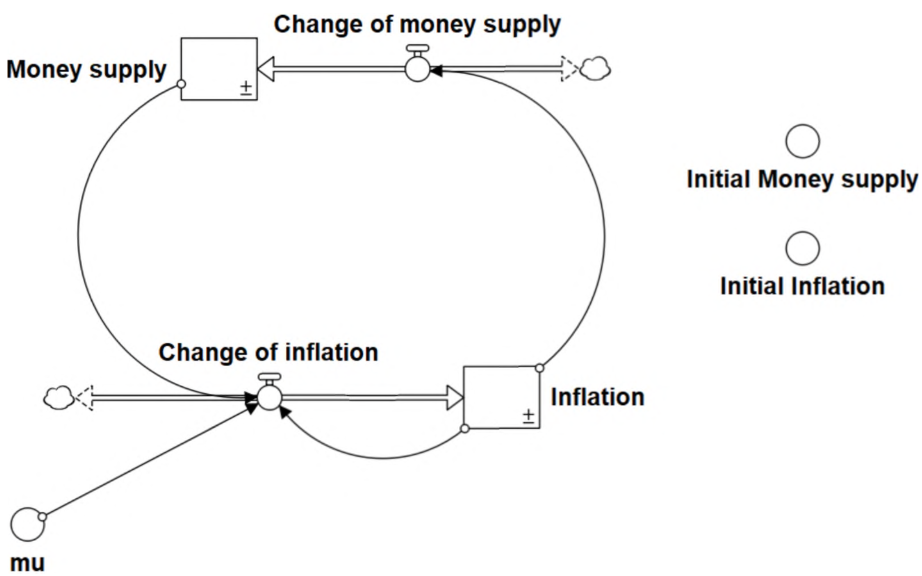

Figure 1. The system dynamics model of differential equations

At first, we set to μ =-2.5. From the Figure 2 we can see that the system is moving clockwise and directly to a fixed point. This result holds for any value of μ that is less than -2 or equal to -2. The point P = (0,0) here is called stable node.

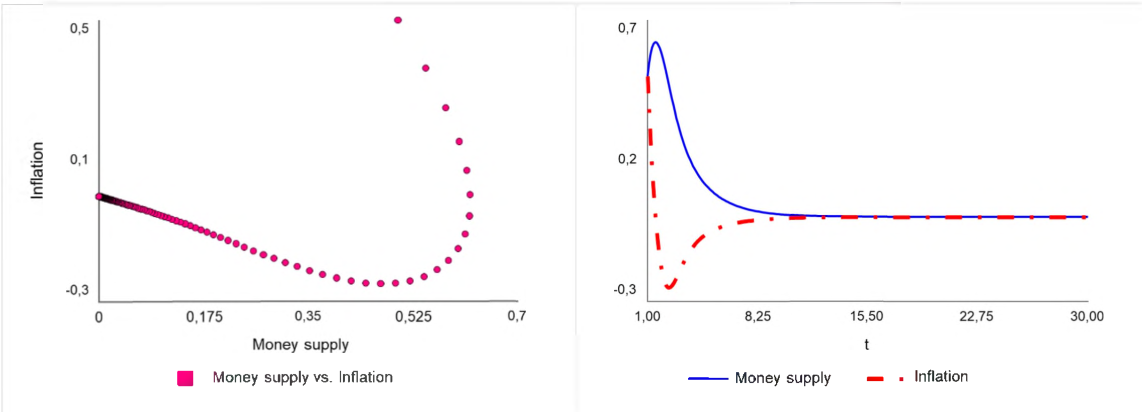

Figure 2. The behavior of the solutions for system with μ=-2.5

Then we take μ a bit higher than -2, for example, -1.5, and the system moves at a fixed point clockwise but in a spiral form.

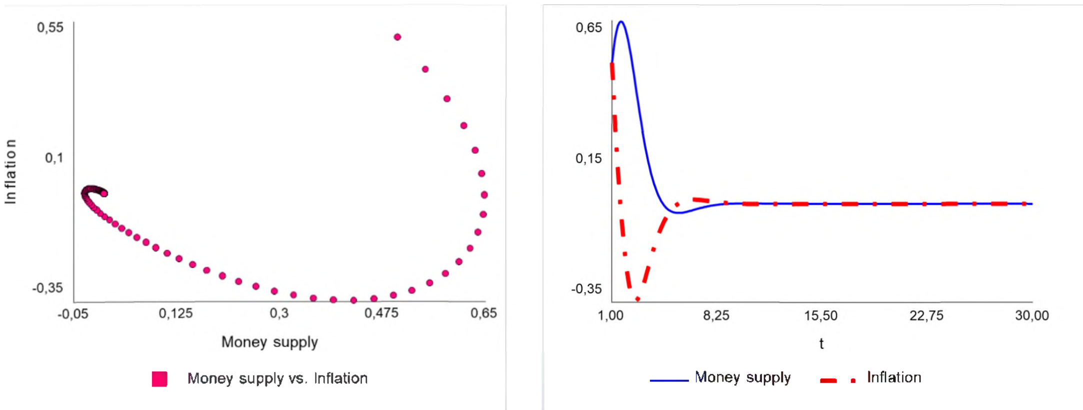

Figure 3. The behavior of the solutions for system with μ=-1.5

The spiral is even more noticeable when set μ= -0.5. This spiral path occurs for all values of μ in the range -2 <μ <0.

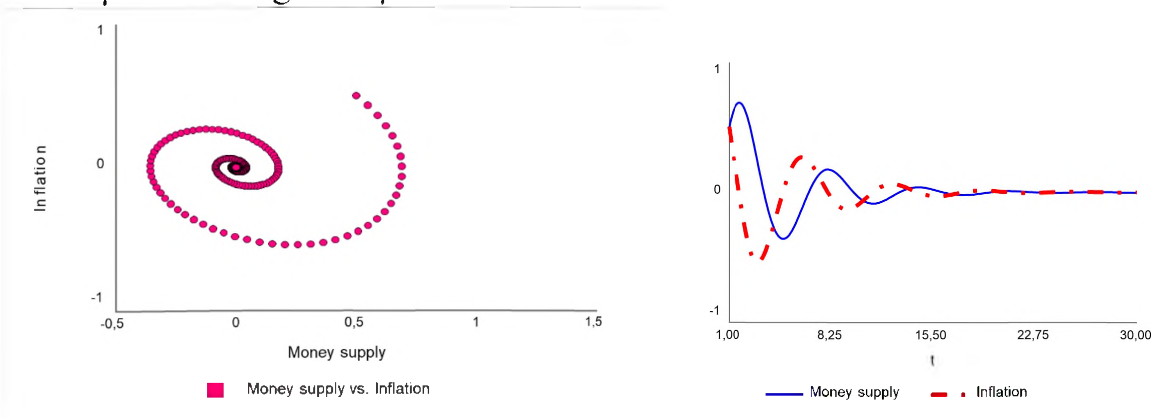

Figure 4. The behavior of the solutions for system with μ=-0.5

For μ= 0 the system has a center. Note, that the path to the system is clockwise.

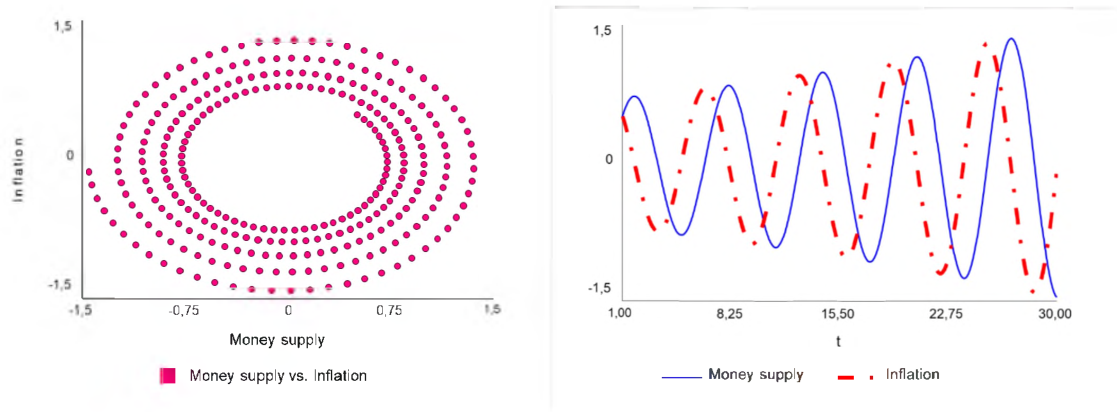

Figure 5. The behavior of the solutions for system with μ=0

For 0 <μ <2 , the system detects an unstable focus. It is unstable in the sense that it moves away from the fixed point P = (0,0) clockwise. However, it converges to the limit cycle. This feature of the boundary cycle occurs at positive values of μ up to about 8, and then the system becomes completely unstable.

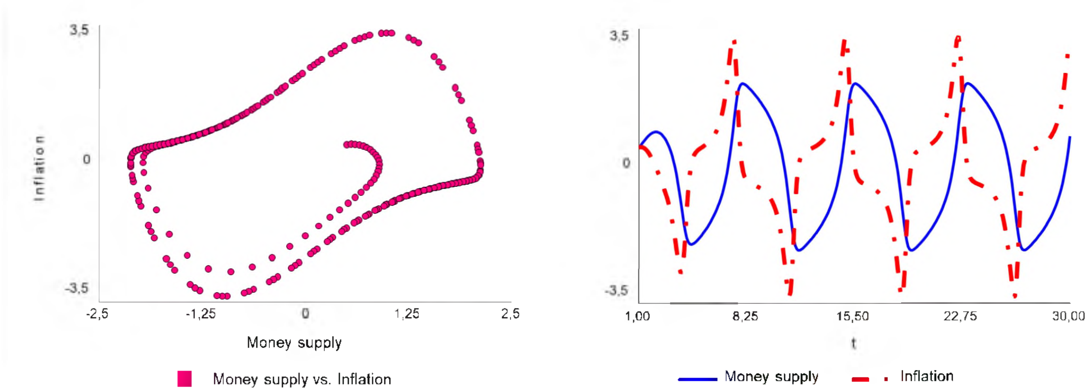

Figure 6. The behavior of the solutions for system with μ=1.5

At μ=0, the system changes dramatically, taking the form of a circle at this value. Then, as μ grows in the positive direction, the system takes a boundary cycle on the plane for any particular positive value of μ whose shape is no longer a circle - about to μ=8. The system changes dramatically as μ passes through zero. Therefore, the system detects bifurcation at the value μ=0. This is an example of Hopf bifurcations.

We considered a nonlinear system that exhibits chaotic behavior and has different types of bifurcations. Using the system dynamics model, I solved the differential equations and investigated the behavior of the solution for different values of parameter. The system dynamics models provide the opportunity to analyze the results of particular parameters interacting and reactions to individual factors changing.

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SYSTEM DYNAMIC MODEL OF CORPORATE INCOME TAX REVENUES IN UKRAINE

Tax competition in the world is increasing year by year, forcing countries to reform their tax systems in order to remain competitive in this sphere. Economic growth of the country is an important indicator of how effective its tax system is. Improving economic situation leads to economic growth of the country. Corporate income tax is a tool of investment and innovation stimulation, it increases production in the country and GDP, which in turn contributes to economic growth and, as a consequence, to filling the state budget with tax revenues.

There is a little reason to expect that different taxes have the same impact on the economy. We will look at corporate income tax which is one of the main budget-forming taxes and which is for more than 12% of total government tax revenues in total account. Rate of corporate income tax can have different impact on tax revenues because of existence of a shadow economy.

According to Laffer Curve, there is an optimum tax rate which are exceeded causes decrease of tax revenues. The Laffer Curve by itself doesn't say whether a tax cut boosts or lowers revenues. Revenue response to a tax rate change depends on the tax system in place, the time period being considered, the ease of moving into underground activities, the level of tax rates already in place, the prevalence of legal and accounting-driven tax loopholes, and the proclivities oft he productive factors. If the existing tax rate is too high, then a tax-rate cut results into increased tax revenues.

The object of the research is identification of the effect of corporate income tax changes on economic growth in Ukraine. First of all, in the future research it will be necessary to establish the sign of the impact of corporate income tax rate in Ukraine using the econometric tools. The research of the impact of corporate income tax rate on tax revenues in Ukraine may show whether tax rate in our country is at the optimum level, below or above it. The dynamic model of impact of corporate income tax on economic growth in Ukraine will be created after that.

We will focus on corporate income tax rate, corporate income tax revenues and trends that are specific to them. Starting in the second quarter of 2011, corporate