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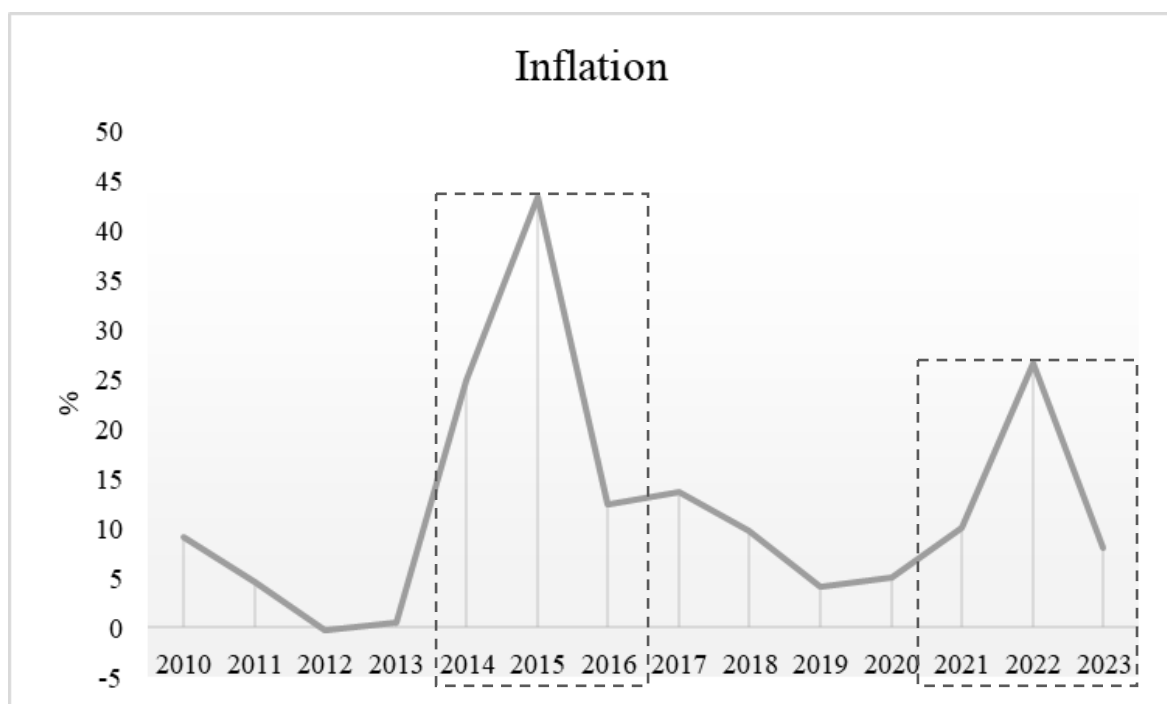
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**THE ONGOING RESEARCH ON INFLATION GROWTH IN UKRAINE  
DURING THE FULL-SCALE INVASION IS FACILITATED BY AN  
EXPLORATORY SYSTEM DYNAMICS MODEL**

Throughout Ukraine's period of independence, its economy experienced instability, enduring economic crises and revolutions. However, in the past nine years, the nation has faced a new challenge: war, exerting immense pressure on its economy and resulting in inflation. Inflation, defined as the rise in prices, is a common occurrence in stress conditions, but for Ukraine, it poses particularly severe difficulties. Graph 1 illustrates two significant "inflation jumps" in the span of nine years: one at the onset of the invasion in 2014, reaching 43.3%, and another at the start of the full-scale invasion in 2022, peaking at 26.6%.



*Figure 1. Inflation in Ukraine during 2010 – 2023 period.*

*Source: State Statistic Service of Ukraine <https://www.ukrstat.gov.ua/>*

According to data from the State Statistic Service of Ukraine:

- The minimum salary in Ukraine is approximately 170 euros.
- The average salary in Ukraine stands at around 400 euros.
- Food expenses constitute roughly 50% of expenditure.
- Manufactured goods and services represent about 38% of expenses.
- Total consumption expenditure makes up 91% of income.

Given this income distribution, heavily skewed toward essential needs like food and products, the 26% inflation rate is significantly burdensome for all Ukrainians. Inflation results in people having to spend more money on the same goods while earning the same income, essentially imposing an "invisible tax." This tax is not outlined in any tax law or visible in any tax declaration. The government and the National Bank of Ukraine are employing various measures to mitigate the inflation surge, but it's a multifaceted issue influenced by numerous factors. A system dynamic model could offer an alternative perspective on how inflation affects different aspects and explore potential management strategies. This model would uncover crucial correlations useful for decision-making by the National Bank of Ukraine and government entities regarding economic policies. By utilizing this model, policymakers can identify key areas of focus for future actions.

Figure 2 displays the causal loop diagram (CLD) of the constructed model, showcasing all variables incorporated within it and illustrating their interconnections. The model comprises a total of five loops, each depicted in the CLD. Within these loops, one operates as reinforcing feedback loop, while the remaining four function as balancing feedback loops.

*Reinforcing loop 1: Inflation expectations (RI).* Inflationary expectations of the population have an important influence on inflation. If people expect prices to rise in the future, they may begin to increase their own spending, buying goods and services now, before prices rise. This can cause an increase in demand for goods, which in turn can lead to higher prices. The key policy rate can change the population's expectations about future inflation. For example, if a central bank raises

the policy rate to control inflation, this may lead to the belief among citizens and businesses that the central bank is serious about fighting inflation. This can lead people to believe that inflation will be contained in the future, which in turn can reduce their expectations for price increases.

*Balancing loop 1: Bank impact (B1).* Key policy rate - is one of the main instruments, which uses the National Bank of Ukraine, to manage inflation through the transmission channel. Medium- and long-term interest rates affect consumption,. Increases in rates lead to reduced spending and increased savings, potentially restrain price growth, while decreased consumer spending results in lower demand, which may reduce inflation.

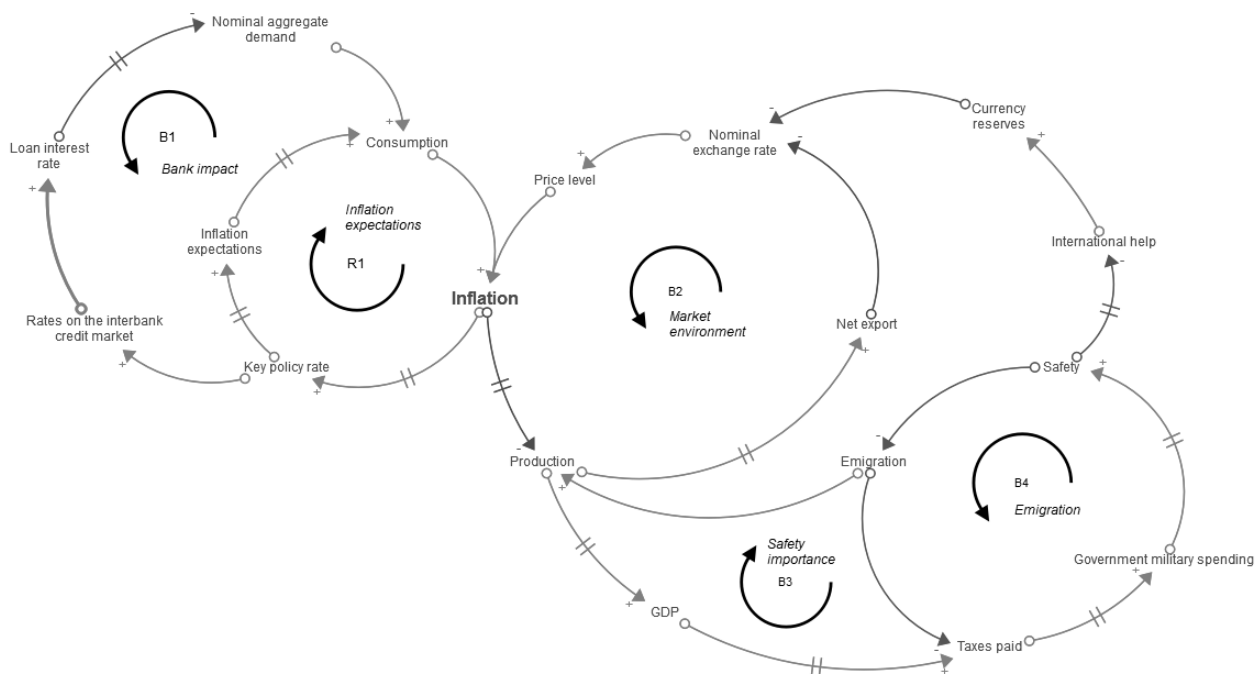
*Balancing loop 2: Market environment (B2).* An increase in the prices of resources, labor, and raw materials can lead to an increase in the total costs for the production of goods and services, which negatively affects production in general. Decreasing production can decrease exports (due to less amount of produced goods and services to sell) and increase imports (to fill the deficit on the local market), which negatively affects net export. Net export affects the amount of currency in the country, and as the nominal exchange rate is counted as the total amount of local currency divided by the total amount of foreign currency, increasing net export lowers the exchange rate. Inflation is carried out according to the value of the consumer basket (a set of goods and services consumed by a representative urban consumer during the year). Most of this basket is imported goods. If the hryvnia will depreciate, the cost of imported goods will increase. Since they make up a large part of the consumer basket, its value increases and inflation begins.

*Balancing loop 3: Safety importance (B3).* Safety became an important indicator, which highly affected the Ukrainian economy over the last 2 years. The safety in the country can be increased by the government's military spending, which provides better ammunition for the army and a bigger size of the army itself. As a source for government spending represented taxes paid, which directly depend on the GDP and in the first place - production.

The safety itself negatively affects the amount of international help, coming to Ukraine. As higher the safety, as less help is needed for the country. The inflow of

international help to the country's budget brings currency to the economy, which lowers the exchange rate. And as a result, lowers the price level.

*Balancing loop 4: Emigration (B4).* Ukraine is currently in a state of war, the environment is not safe, and the chances of getting injured or dying are really high. Ukrainians are forced to leave the country to seek a safe place abroad. Amount of taxes paid highly depends on the number of people in the country, who literally pay these taxes. Consequently, increasing emigration causes decreasing taxes paid, which drains the government budget, so less money can be spent on the army and protection, which provides safety for the country.

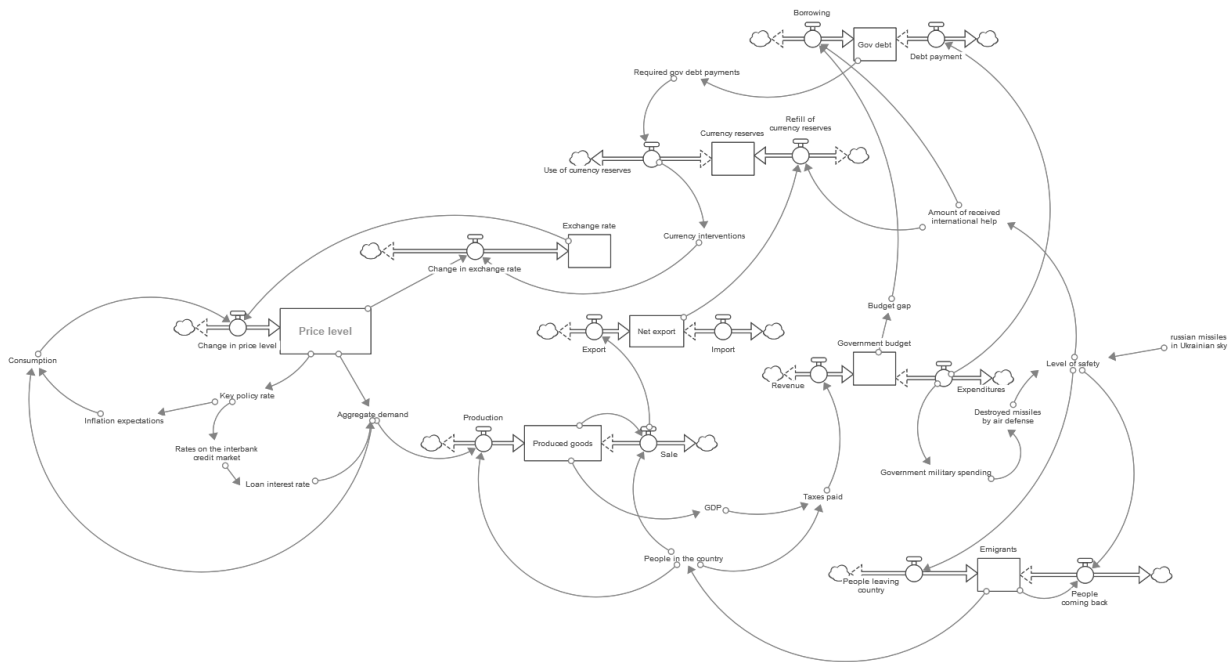


**Figure 2. The casual loop diagram (CLD)**

*Source: made by author in the Stella Architect software*

The comprehensive system encompasses seven stocks: Price Level, Exchange rate, Produced Goods, Net Export, Emigrants, Government budget and Government Debt, each featuring inflows and outflows (as depicted in Figure 3). Employing the system dynamics approach and the constructed model enables an assessment of the system's responsiveness to various factors. Through the analysis conducted, a deeper comprehension is achieved, shedding light on the interdependencies within the

system, including the concept of a debt spiral stemming from the reinforcing loops inherent in the model.



**Figure 3. The stock and flow diagram (SFD)**

*Source: made by author in the Stella Architect software*

The model demonstrates that the inflation in Ukraine is affected by two main factors, in particular Exchange rate and Consumption. As an instrument to regulate inflation NBU can use key policy rate to affect inflation expectations and aggregate demand, which will be affecting Consumption. For the managing exchange rate government should be focusing on:

- increasing safety in the country through the increasing military spendings to improve army and ammunition;
- creating favorable environment for emigrants for coming back to Ukraine, as well as people staying in Ukraine;
- increasing production to increase net export and taxes paid within the country.

Hence, managing inflation in Ukraine during wartime entails dealing with a complex system involving numerous variables, yet it remains within the realm of control for the government and the National Bank of Ukraine (NBU).

### *Referenses*

1. Khudaykulova M., (2022). Economic Consequences and Implications of the Ukraine-Russia War. *International Journal of Management Science and Business Administration*, May.  
URL:<https://doi.org/10.18775/ijmsba.1849-5664-5419.2014.84.1005>
2. State Statistic Service of Ukraine. URL: <https://www.ukrstat.gov.ua/>
3. National Bank of Ukraine. URL: <https://bank.gov.ua/>
4. Faryna O., (2014). A System Dynamics Model of Ukraine's Monetary Sector, *National University of "Kyiv-Mohyla Academy"*.  
URL: <https://proceedings.systemdynamics.org/2014/proceed/papers/P1452.pdf>
5. John K. (2012). Linking economic modeling and system dynamics: A basic model for monetary policy and macroprudential regulation, *Chemnitz University of Technology*. URL: <https://proceedings.systemdynamics.org/2012/proceed/papers/P1396.pdf>
6. Lukianenko, I., Wheat, D. and oth. (2017). Systematic analysis of state policy formation in conditions of macroeconomic destabilization, 463 p., URL: <https://ekmair.ukma.edu.ua/items/e41e9c99-e272-4b9d-a96d-dd5f4b85b74c>
7. Lukianenko, I. and oth. (2020). Financial policy in conditions of shadowing and imbalances in the labor market: methodology and tools, 441 p., URL: <https://ekmair.ukma.edu.ua/items/d8db5093-c416-4238-9802-a50c89e91bf7>
8. Прімерова О. К., Янчук В. О. Особливості монетарної політики в Україні на сучасному етапі. *Ефективна економіка*. 2017. № 10. URL : <http://www.economy.nayka.com.ua/?op=1&z=5797>
9. Galytska E., Primierova O., Tomilina M. Monetary policy during the war and post-war periods: foreign experience and Ukrainian practice // *International scientific journal "Internauka"*. Series: "Economic Sciences". 2023. №11. <https://doi.org/10.25313/2520-2294-2023-11-9381>