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Forecasting effectiveness of government measures regarding the economic development of Ukraine

Abstract. The protracted COVID-19 pandemic and Russia's invasion of Ukraine have caused a severe and profound crisis in Ukraine and colossal physical destruction. The restoration of the country, its economy, and the entire socio-economic system determine the urgency of providing predictive indicators to identify the fastest results. The purpose of the article was to forecast the effectiveness of the government's economic policy based on the Mandel-Fleming model for the development of Ukraine's economy. The paper used the method of analysis and synthesis and the system approach, the method of economic modeling, economic forecasting, mathematical and vector analysis, the graphic method, as well as the main provisions of the Mandel-Fleming macroeconomic model for open economics in the short term. The article proposes to forecast the effectiveness of government measures under the condition of using multipliers of the Mandel-Fleming model for Ukraine's economic development after the deep socio-economic crisis caused by the war. In predict applied, chain schemes are presented that show the effectiveness of specific monetary and fiscal policy measures. An approach was proposed to forecast the effectiveness of implementing the government's monetary and fiscal policy measures, taking into account positive or negative multiplicative coefficients according to the Mandel-Fleming model, depending on the exchange rate regime for the recovery of the economy and economic development of Ukraine. The research has an applied aspect and is suitable for use in the decision-making process by the government regarding the implemented economic policy

Keywords: economic policy, economic forecasting, monetary policy, fiscal policy, multiplier, the Mandel-Fleming model, multiplier effect

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INTRODUCTION

The current political, and socio-economic situation in Ukraine: Russia's invasion of Ukraine and the protracted COVID-19 pandemic shows that the economy needs a speedy and urgent recovery and further development. Its scale must be grand because Ukraine has faced an unexpectedly deep socio-economic crisis due to political unrest and hostilities in Ukraine. The severity and depth of the crisis caused by the war cannot be predicted. However, Ukraine will likely face a large budget deficit with a significant increase in government spending on reconstruction and further economic development of the country. Therefore, it seems essential to set forecast indicators to identify the fastest results. Economic forecasting is of great importance for determining

working practices of economic recovery. Forecasting economic variables is a very complex process. Forecasts are particularly problematic at a time when they are most needed, namely: economic variables are very volatile, the economic situation needs to be corrected as soon as possible, and information is lacking. Therefore, the urgent need for timely and comprehensive action proves the urgency of the use of defined and tested models and forecasting the effectiveness of their use.

Economists worldwide [1-3] have fundamental controversies over how to regulate the economy during a crisis or rapid growth. Specific consequences await global business after the COVID-19 pandemic [4]. Equally important is

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the extent of intervention in the economy during the crisis for its recovery and economic growth, namely: the policy should be conducted according to the established rules; it is necessary to use new theoretical achievements; rely on the judgment of the greater of the government, etc. Many scholars of the neo-Keynesian school consider crises and fluctuations in the business cycle, in general, to be negative for the socio-economic development of the country, therefore, according to the neo-Keynesian school, the state should try to smooth out any fluctuations and shocks in the cyclical existence of the economy [5]. Otherwise, the state must intervene in cyclical development and stimulate the economy during the recession and depression and restrain during the rapid recovery. Other economists, such as followers of M. Friedman [6; 7], believe that the state cannot take specific measures to get out of the crisis as soon as possible, and one of the reasons is that the stabilization measures used are not succeeding due to the backlog [8], and potential misconduct by the government on economic policy is likely to exacerbate crisis fluctuations. Therefore, the neoclassicists [9; 10] assume that in most cases the behavior of abstinence from economic policy measures stabilizes the economy. Thus, Ukrainian scientist V. Zakharchenko [11] considers basic modeling in the context of reforming the economies of different types, based on theories of neo-classical synthesis. I. Nazarkevich [1] considers the application of the levers of program-target management in ensuring structural transformations in the branches of the real sector of the economy. Many other Ukrainian and foreign scholars consider the crisis economy and its regulation. But the issue of forecasting the effectiveness of the implementation of outstanding models, namely the Mandel-Fleming model, in the economy of Ukraine has not sufficiently worked out for the speedy recovery and development of the state economy. The scientific novelty of this article is precisely the proposed approach of forecasting the effectiveness of the implementation of the government's monetary and fiscal policy measures, taking into account positive or negative multiplicative coefficients according to the Mandel-Fleming model, depending on the exchange rate regime for the recovery of the economy and economic development of Ukraine.

The purpose of the article was to analyze the forecasting effectiveness of the implementation of the government's monetary and fiscal policy measures, taking into account multipliers according to the Mandel-Fleming model depending on the exchange rate regime for the economic development of Ukraine.

MATERIALS AND METHODS

The research conducted was based on the study of the peculiarities of the use of the economic policy in Ukraine. These features relate to the implementation of this policy in different regimes of the exchange rate – flexible or fixed. The article uses the main provisions of the Mandel-Fleming macroeconomic model for small open economies in the short term [6; 7; 9].

The first stage of the research was the determination of the direction of the Mandel-Fleming model. In general, the Mandel-Fleming model has many directions and, in this regard, needs to be carefully specified. The Ukrainian economy is open because it has a proactive integration

character and high capital mobility, and it is small because it does not have a significant impact on the world economy. Ukraine's contribution to world GDP is comparatively small. Therefore, the author's choice was modeling for small open economies. The Mandel-Fleming model has proven very well in applied research [2]. In addition, to determine the efficiency of the economy's response to economic policy measures, it is not necessary to collect a cumbersome database. It is enough to decide on the currency regime.

Therefore, the second stage of the research was an argumentative proof of the choice of the exchange rate regime. Creating a system of equations based on the Mandel-Fleming model requires a clear orientation of the state government to a flexible exchange rate or a fixed exchange rate. This is explained by the fact that an open economy actively responds to exogenous variables. Exogenous variables are the basis of the economic policies carried out by the governments of developed countries [6]. For Ukraine, this is also fair and necessary for economic development and increased integration activity. The authors believe it is impossible to use the Mandel-Fleming model without reasoned proof of the consequences of the implementation of certain economic policy measures.

Therefore, at the third stage, the authors formed a chain of specific measures of monetary and fiscal policies under a flexible exchange rate regime to provide reasoned proof of the advantages of a flexible exchange rate regime. With the help of economic modeling, the advantages of the monetary policy compared to the fiscal policy under given specific conditions are presented. That is why chain circuits were created.

So, in the next stage, after justifying the choice of a flexible currency regime and monetary policy measures, a system of equations is created precisely in the direction of the Mandel-Fleming model for small open economies with high capital mobility. The solution of the developed system of equations according to the selected model and the defined currency regime needs substantiation. According to mathematical and vector analysis [8], the influence of the multiplier effect from the introduction of fiscal policy tools on the gross output of goods and services was mathematically substantiated. The multiplicative effect is justified based on the multiplicative coefficient, which can be both positive and negative. A positive multiplier indicates an increase in gross output; a negative one indicates a decrease. It is the increase or decrease in the gross output of goods and services that allows to draw conclusions and create forecasts regarding the effectiveness of the government's economic policy measures.

RESULTS AND DISCUSSION

Fiscal and monetary policies of the state are vital tools for stabilizing the economy and further socio-economic growth. Both fiscal, or budget and tax policy, and monetary policy are policies that have an indirect effect on the economy [12; 13]. Government actions regarding these types of policies remain invisible to the public. Fiscal policy uses two main instruments, namely, taxes and government spending, including transfers. There are three such instruments in monetary policy. This is the refinancing rate, national bank reserves, and open market operations [14; 15].

And that is why all the changes occurring in the world market play a crucial role in an open economy. That is, exogenous variables are of great importance for government measures.

The process of modeling monetary and fiscal policy is described by the effectiveness of the economic response to economic policy measures. The focus is on exogenous variables, which are most taken into account in economic policy. It is appropriate to use the mechanism of regulation of small national economies with high capital mobility according to the well-known Mandel-Fleming model. It should be noted that the modeling mechanism differs depending on the regime of capital fixation conducted by the government. If the Mandel-Fleming model is accepted as a working model for Ukraine, then it should be taken into account that different indicators of the exchange rate require different measures to restore the economy. Thus, with a floating exchange rate, monetary policy is more effective, and with a fixed – fiscal policy.

Let's prove it. Lowering interest rates in an open economy with a flexible exchange rate leads to the devaluation of the currency. In this case, the following chain is

very clearly traced: due to the devaluation of the national currency, the country's exports to the international market become cheaper; as a result, net exports are growing; net exports increase GDP, there is an increase in business activity and economic growth; interest rates rise again to equilibrium; the economy is recovering. Thus, the main goal of achieving economic recovery is reached. The author's vision of this process is shown in Figure 1. The figure shows that a decrease in the price of exports on the world market will lead to an increase in the demand for goods and services, other things being equal. As a result of increased demand, the volume of exports is increasing. Under the conditions of keeping imports in the same volume, the value of net exports increases, which indicates an automatic increase in GDP. If under the condition of depreciation of the national currency, the volume of imports decreases, the amount of net export will be even greater and the GDP will increase by a larger amount. At the same time, the increase in the volume of export stimulates business activity and economic growth is observed. The dotted line shows the applied results, inseparable from each other.

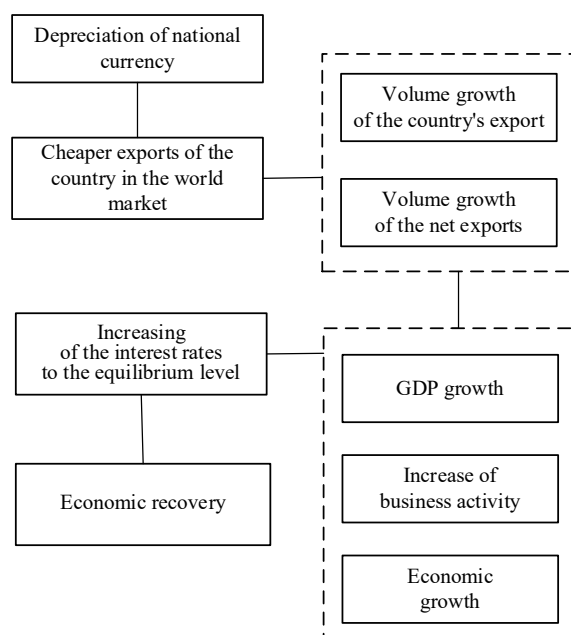


Figure 1. Use of monetary policy measures to restore the economy under a flexible exchange rate regime

Source: developed by the authors

At the same time, it is impossible to predict an effective fiscal policy with the chosen flexible exchange rate regime. As mentioned above flexible fiscal policy can be considered ineffective. Let's prove it. Fiscal policy is based on changes in government spending or taxes. Rising government spending increases the demand for money. This, in turn, will cause an increase in interest rates, which are the price of money for business activity. The rising price of money in the country is expected to inflow foreign capital which will strengthen the exchange rate to the level when exporting becomes unprofitable and its volume decreases. In turn, the decline in export will nullify the effect of increased government spending. The author's vision of this process is shown in Figure 2. The figure shows that

strengthening the national currency will mechanically make national goods and services more expensive in the world market. Therefore, it is possible to predict a decrease in demand for these goods or services. As a result of the decrease in demand, the volume of exports decreases. Under the condition of keeping imports in the same volume, the value of net exports decreases, which indicates an automatic decrease in GDP. If the volume of imports increases along with the national currency appreciation, the volume of net export will be even smaller, and the GDP will decrease greatly. At the same time, a decrease in the volume of exports will lead to a drop in business activity, and economic growth will subsequently slow down. The dotted line shows the applied results, inseparable from each other.

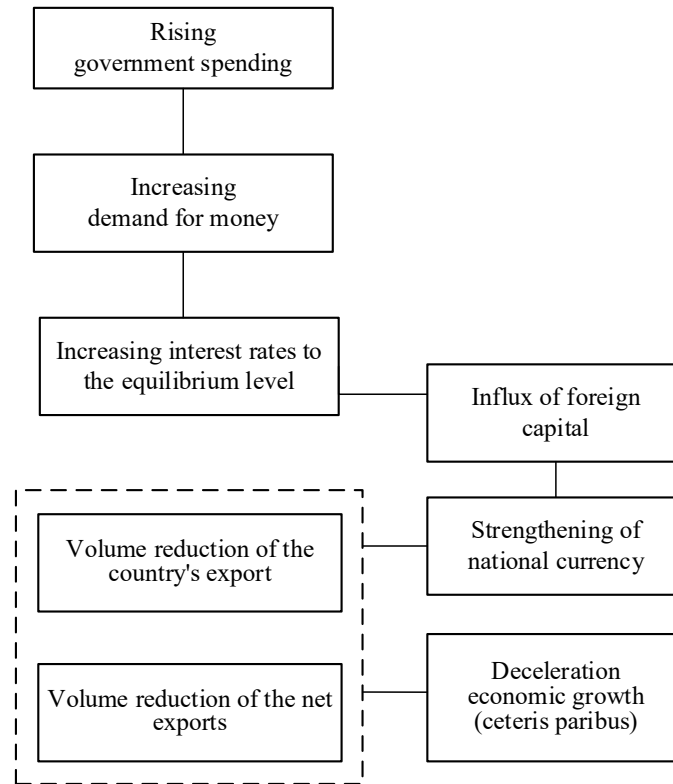


Figure 2. Ineffective use of fiscal policy measures to restore the economy under a flexible exchange rate regime
Source: developed by the authors

A special place in forecasting the effectiveness of certain applied practices is taking into account the multiplier effect, which is a mandatory attribute of fiscal or monetary policy pursued by the government. The multiplier effect mathematically proves the effectiveness of the use of economic policy instruments. Let's take one of the powerful tools of fiscal policy, namely, taxes. Most often, government measures involve an increase in taxes for many reasons, including filling the budget.

Consider the practice of using the model in the example of estimating the short-term impact of tax increases on gross output and interest rates in the country. To identify such a dependence, it is expedient to use the Mandel-Fleming equation. The equations of the model assume a simultaneous equilibrium of the goods and services market and the money market. This is the situation that the economy strives for. The first equation is formed as equilibrium is established in the market of goods and services. On the one hand, this is GDP, and on the other hand, all expenses of all economic entities. In turn, the costs of economic entities depend on GDP, taxes, interest rates, and the exchange rate of the national currency. The second equation is formed under the condition of equilibrium of the money market. Therefore, on the one hand, in the second equation, there is a supply of money on the money market in real terms. On the other hand, the liquidity of money in the money market depends on the real interest rate and the output. Thus, both equations are combined into a system based on variable indicators. Variable indicators are the interest rate, the amount of taxes, and the exchange rate of the national currency. Based on this model, income sources and

real money supply multipliers will be found to search for dependence and evaluate it. Notably, since the assessment is conducted in general, the result will be obtained as a negative or positive impact on gross output and the money market. Identification of variables is achieved by modeling all relevant processes in the form of equations or a set of equations in the models.

So, the equation will be established according to the Mandel-Fleming model, where defined through Y – gross output, $C(Y-T)$ – household expenditure on disposable income, $I(r)$ – business expenses, $NEX(e)$ – net exports of goods and services, M/P – money supply in the money market in real terms, $L(Y, r)$ – liquidity of money in the money market depending on the real interest rate and output:

$$Y = C(Y - T) + I(r) + G + NEX(e) \quad (1)$$

$$\frac{M}{P} = L(Y, r) \quad (2)$$

when differentiating these equations the following system is obtained:

$$(1 - C_{(Y-T)})dY - I_r dr = -C_{(Y-T)}dT + dG \quad (3)$$

$$L_Y dY + L_r dr = d(M/P) \quad (4)$$

Let's look at this equation using Cramer's rule:

$$\begin{pmatrix} 1 - C_{(Y-T)} & -I_r \\ L_Y & L_r \end{pmatrix} \begin{pmatrix} dY \\ dr \end{pmatrix} = \begin{pmatrix} -C_{(Y-T)}dT + dG \\ d\left(\frac{M}{P}\right) \end{pmatrix} \quad (5)$$

At the same time a negative determinant is available:

$$\det \begin{bmatrix} 1 - \frac{C(Y-T)}{LY} & -I_r \\ & L_r \end{bmatrix} = (1 - C_{(Y-T)})L_r + L_Y I_r < 0 \quad (6)$$

$$dY = \frac{-L_r C(Y-T)dT}{(1-C(Y-T))L_r + L_Y I_r} \quad (7)$$

$$\frac{dY}{dT} = \frac{-L_r C(Y-T) (>0)}{(1-C(Y-T))L_r + L_Y I_r (<0)} (< 0) \quad (8)$$

As can be seen from the resulting formula (8), the multiplier effect will be negative. This example of using the Mandela-Fleming model demonstrates the impossibility of the government raising taxes because, in the short term, it will lead to catastrophic results in gross production. This small segment of the general model shows how to use modeling to provide timely forecast data for economic policy actions.

Substitution of real data in the model, in this case, does not make sense, since the negative multiplicative effect makes it possible to conclude the further worsening of the situation in the economy. But it will make it possible to calculate the losses that such economic policy measures will lead to.

In the real economy, modeling the multiplier effect of the government's actions regarding fiscal or monetary policy measures is reduced to determining the result (< 0) or (> 0), and even a small positive effect makes it possible to talk about the effectiveness of the fiscal or monetary policy. In Ukraine, methods that take into account multipliers in economic modeling are practically not used. This especially applies to individual multipliers of indirect economic policy: fiscal and monetary. In general, by using the multiplier effect, it is possible to study the interdependence of many economic variables, which is very useful in macroeconomic modeling. Thus, Jonathan M. Harris in his research takes into account the multiplier effect in forecasting macroeconomic troubles. His current research focuses on the implications of large-scale environmental problems,

especially global climate change, for macroeconomic theory and policy [16]. These crucial findings show the possibility of using multipliers even for more global issues than those, considered in this study. However, it provides a positive example of implementing the theory of multipliers in the economy of Ukraine. Alejandro Royce calculates estimated values of current household income inequality and uses multipliers to reveal the impact of discrimination in education and employment on the current income gap [17]. The goals of his study are already much closer to the objective of this study. And they provide great inspiration for the spread of the theory of multipliers in real applied economics and practice. Therefore, if the National Bank deems it appropriate to introduce a fixed exchange rate regime, the government can confidently predict the effectiveness of the fiscal policy, in which net exports do not change due to a lack of capital inflows from abroad. These conclusions are confirmed by the world experience of countries that have been developing rapidly in recent decades [18; 19]. For example, in the last few years, China has been pursuing fiscal policies to grow its economy. Herewith the yuan's exchange rate is regulated so that it can be considered fixed. The above-mentioned allows the government to support economic growth through large-scale public investment. These investments under the floating exchange rate would not have a tangible effect because the strengthening of the yuan would cause a rise in the price of Chinese goods and the loss of existing positions in the world market [11].

Ukraine strives for quick restoration and development of the economy, so it is necessary to address the experience of countries with developed economies. The experience of developed economies proves the effectiveness of various measures that can be manipulated for stabilization purposes. Table 1 on the example of the United States shows the results of fiscal expansion measures carried out during the economic recession in 1987. The table shows the results of the multiplier effect in percentage terms regarding the implementation of the fiscal policy measures [20].

Table 1. The effectiveness of fiscal expansion measures in the United States during the economic recession in 1987

| Types of activities | The effect (%) | A group of people who benefit from the implementation of measures |
|---|----------------|---|
| Reduction of tax rates from 15% to 10% | 134 | Middle-income working population |
| Equalizing transfers | 124 | Middle-income working population |
| Tax-free benefits for children | 104 | Low- and middle-income families |
| Extension of the unemployment benefit period | 173 | Long unemployed |
| Joint taxation of spouses | 74 | Middle- and high-income families |
| Reduction of the maximum tax rate | 67 | High-income working population |
| Reduction of tax rates | 59 | High-income working population |
| Increase in depreciation deductions | 24 | Only for businesses |
| Reduction of dividend taxes and capital gains | 9 | Only for businesses |
| Reduction of inheritance | 0 | Only for businesses |

Source: [20]

As can be seen in the table, the greatest effects are observed for those fiscal measures that affect low- and middle-income people. The authors proposed a similar approach, but the author's research goals differ in a more comprehensive approach. However, concerning the use of the theory of multipliers, it is also possible to obtain applied results according to the author's research.

CONCLUSIONS

To restore the economy, when forecasting the effectiveness of the introduced monetary or fiscal policy, it is necessary to take into account the policy of the National Bank according to exchange rate regimes, namely: flexible or fixed. If the National Bank deems it necessary to introduce a floating exchange rate regime, the government can forecast the effective operation of monetary policy to recover the economy and further economic growth. In this situation, it makes sense to influence the volume of exports, obtain a sufficient amount of international currency, and increase GDP.

Under a flexible exchange rate regime, fiscal policy measures are ineffective. Forecasting the effectiveness of monetary and fiscal policy measures is realized mathematically using a multiplier effect. The flexible exchange rate regime is a priority for the policy of the National Bank of Ukraine, so the study is presented for the floating exchange rate.

The studies presented in this paper have an applied aspect and are suitable for use in government decision-making regarding the implemented economic policy. However, certain conditions are necessary for the practical implementation of these studies. First, such a grand evaluation analysis can be conducted only based on state institutions. Secondly, it is necessary to take into account the consequences of the internal coherence of all components of the large model. Thirdly, the results of modeling require a clear response to small changes in the model and need the intervention of economists with a high level of qualification. All these require further analysis of the data to create a working model, structuring variables into appropriate groups and other types of research.

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Прогнозування ефективності урядових заходів щодо економічного розвитку України

Анотація. Затяжна пандемія COVID-19 та вторгнення Росії в Україну викликали жорстку та глибоку кризу в Україні та колосальні фізичні руйнування. Відновлення країни, її економіки та всієї соціально-економічної системи обумовлює актуальність надання прогнозних показників щодо виявлення найскоріших результатів. Метою статті був прогноз ефективності економічної політики уряду за моделлю Мандела-Флемінга для розвитку економіки України. В статті було використано метод аналізу і синтезу та системного підходу, метод економічного моделювання, економічне прогнозування, метод математичного та векторного аналізу, графічний метод, а також основні положення макроекономічної моделі Мандела-Флемінга для малих відкритих економік у короткостроковому періоді. Для можливості прогнозування прикладних практик подано розроблені авторами ланцюжкові схеми, що показують результативність конкретних заходів монетарної та фіскальної політик. Запропоновано підхід прогнозування ефективності втілення заходів монетарної та фіскальної політики уряду з урахуванням позитивного або негативного мультиплікативного коефіцієнтів за моделлю Мандела-Флемінга залежно від режиму валютного курсу для відновлення економіки та економічного розвитку України. Дослідження мають прикладний аспект та придатні для використання в прийнятті рішень урядом стосовно запроваджуваної економічної політики

Ключові слова: економічна політика, економічне прогнозування, монетарна політика, фіскальна політика, мультиплікатор, модель Мандела-Флемінга, мультиплікативний ефект