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ЕКОНОМІЧНЕ ЗРОСТАННЯ І КООРДИНАЦІЯ ФІСКАЛЬНОЇ ТА МОНЕТАРНОЇ ПОЛІТИКИ

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Ключові слова: системний аналіз, економічне зростання, монетарна політика, фіскальна політика, загальний ефект, моделі панельних даних

ЭКОНОМИЧЕСКИЙ РОСТ И КООРДИНАЦИЯ ФИСКАЛЬНОЙ И МОНЕТАРНОЙ ПОЛИТИКИ

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Предметом исследования является взаимосогласованность фискальной и монетарной политики и оценивание ее воздействия на экономический рост как в Украине, так и в странах с рыночной и развивающейся экономикой.

Целью исследования является комплексный анализ каналов воздействия координации монетарной и фискальной политики на экономический рост страны; оценивание степени такого воздействия на основе эконометрических моделей панельных данных, и рекомендации по формированию государственной стратегии, направленной на достижение макроэкономической стабильности и стимулирование экономического роста в краткосрочной и долгосрочной перспективах.

В процессе исследования были использованы общенаучные методы анализа и синтеза, методы группировок, детализации, обобщения и систематизации данных, а также экономико-математические методы и модели, включая эконометрические модели панельных данных.

Результаты работы. Аргументировано, что монетарная и фискальная политики совместно оказывают воздействие на основные макроэкономические индикаторы, такие как инфляция, процентные ставки, обменный курс и др. На основе статистического анализа динамики основных инструментов фискальной и монетарной политики, роста реального ВВП и основных макроэкономических показателей как развитых, так и развивающихся стран определено, что, в среднем, скоординированная политика оказывает большее стимулирующее влияние на не инфляционный экономический рост, чем нескоординированная. Однако в общем случае результаты не являются однозначными, соответственно, проведенное дополнительное исследование на основе эконометрических методов, а именно разработанных моделей панельных данных в нескольких модификациях, позволило уточнить влияние как отдельных, так и синергетических эффектов монетарной и фискальной политики на экономический рост. Эмпирический анализ подтвердил существенное значение координации фискальной и монетарной политики для стимулирования экономического роста в краткосрочной и среднесрочной перспективах. Однако было определено, что в долгосрочной перспективе фундаментальные факторы, такие как начальный уровень ВВП, формирование капитала, человеческий потенциал, свобода торговли и др. оказываются более существенными для обеспечения экономического роста страны.

Результаты исследования могут быть использованы для формирования государственных программ и стратегий достижения макроэкономической стабильности и стимулирования экономического роста в краткосрочной и долгосрочной перспективах.

Выводы. Результаты проведенного теоретического, статистического и эконометрического анализа подтверждают важность координации фискальной и монетарной политики. В общем случае, для большинства стран достаточно хорошей смешанной политикой, оказывающей влияние на экономический рост, является политика монетарной экспансии и фискальной рестрикции в краткосрочной и среднесрочной перспективах, однако в долгосрочной перспективе более значимыми являются фундаментальные факторы. Обосновано, что для достижения более высоких темпов экономического роста украинской экономики в краткосрочной и среднесрочной перспективах возможно рассматривать варианты проведения умеренно сдерживающей фискальной политики и политики умеренной монетарной экспансии, тогда как в долгосрочной перспективе основное внимание должно быть сосредоточено на прогрессивных институциональных изменениях в экономике, а также усовершенствовании физического и человеческого капитала.

Ключевые слова: системный анализ, экономический рост, монетарная политика, фискальная политика, общий эффект, модели панельных данных.

ECONOMIC GROWTH AND FISCAL–MONETARY POLICY COORDINATION

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The object of the research is the coordination of fiscal and monetary policies and the methods of the estimation of its effect on economic growth in Ukraine as well as in the other developed and emerging countries.

The main aim of the research is to find out whether and how the coordination of fiscal and monetary policies affects economic growth in a country; estimate the impact of their coordination policy on economic growth on the base of the build econometric panel data models and elaborate the propositions about effective government strategies for macroeconomic stability achievement and stimulation of the economic growth in short and long run.

The study used general scientific methods of analysis and synthesis, methods of grouping, detailing, generalization and systematization of data, as well as economic and mathematical methods, including econometrics panel data methods and models.

The results. Fiscal and monetary policies jointly influence on economic growth through the key macroeconomic indicators such as inflation, interest rates, exchange rate etc. The joint statistical investigation of fiscal and monetary policies with real GDP growth and the main macroeconomic indicators in the developed and emerging countries revealed that, on average, coordinated policies are more supportive for non-inflationary economic growth than uncoordinated. However, in general, as statistical analysis has shown, evidence is mixed, so further quantitative investigation on the based of econometric tools has been done. In this context the panel data empirical model of economic growth and some of it modifications incorporating separate and joint effects of fiscal and monetary policy were elaborated. Quantitative econometric analysis of economic growth and coordination of fiscal and monetary policies, undertaken on the basis of neoclassical model of growth and panel data methodology, revealed that there is an impact of coordination of fiscal and monetary policies on the short- and medium-term economic growth. However, in the long run there are fundamental factors (initial GDP, capital formation, human capital, and trade freedom) that matter.

The results can be used to form government programs and strategies for macroeconomic stability achievement and stimulation of the economic growth in short and medium terms as well as in long run.

Conclusions. The results of the system theoretical, statistical and econometrics analysis reveal that coordination of fiscal and monetary policies do matter in the short to medium run. More specifically, it has been found that the «ideal» policy mix for economic growth is one of contractionary fiscal and expansionary monetary policy, however, in the long run there are fundamental factors that matter. As for economic policies in Ukraine, given the empirical findings it is desirable to pursue reasonably tight fiscal and reasonably expansionary monetary policies to achieve higher rates of economic growth in the short and medium run, while improving the economy's institutional framework, physical and human capital to sustain higher rates of growth in the long run.

Keywords: system analysis, economic growth, monetary policy, fiscal policy, joint effect, panel data models

Relevance of the research. The stimulation of economic growth is one of the key problems in any country elsewhere throughout the world, especially during the periods of the global instability and crisis. In this context, the reinforcement of the regulating function of the state on the base of the implementation of the suspended stabilization economic policy is very important and urgent. The economy of any country is extraordinarily complex and includes millions of households, firms, institutional and private investors which collectively determine in what direction the economy is going. But the most important constituents of any economy are the government and the central bank which have a mandate from a society to conduct economic policy which includes a variety of different and specific parts such as trade, industrial, competition and other very affluent policies. However, the most significant and, to a large extent, the most ambiguous economic policies are fiscal and monetary ones [1,2,3,8, 10]. According to this, the system analysis of the joint effect of the fiscal-monetary policies interaction on economic growth and the estimation of such effect on the base of econometrics tools with the aim to elaborate the effective economic strategy directed at the macroeconomic stabilization and the stimulation of the economic growth is very important [1,8, 10]

Degree of the investigation of the problem. A great body of literature, including the theoretical and empirical studies has significantly contributed to our knowledge on how fiscal and monetary policies work, when and how they should be used, and what benefits and drawbacks they have. The literature on this topic starting with Adam Smith's classic «The Wealth of Nations», through John Maynard Keynes' «The General Theory of Employment, Interest and Money», and all over the modern research can be divided into 3 major groups. The first one is dedicated to investigation of the effects that fiscal and monetary policies have on the economy through both theoretical New Keynesian models and empirical applications, such as dynamic stochastic general equilibrium models, vector-autoregressive models, dynamic simultaneous equations models etc [9,15,16,18]. The best recent representatives of this group are the papers [15,18]. The authors build New Keynesian as well as open-economy QUEST III dynamic stochastic general equilibrium model with fiscal and monetary policy rules, fit it to the data and simulate the model in order to examine how fiscal and monetary policies react to different shocks. They have found that the way fiscal and monetary policies interact depends on nature of shocks in the economy: output shocks cause fiscal and monetary policies to act in tandem, while inflation shocks or shocks to one of the policies cause them to move in opposite directions (substitute one for another) [15].

The second part of the literature is concerned with strategic interactions between fiscal and monetary authorities, uses game theory analysis, and answers the question of whether coordination of fiscal and monetary policy is

achievable. One good example of such papers is paper [17], which introduces a simple game with two players – fiscal and monetary authorities – which are trying to maximize their utility – achieve high employment and low inflation respectively – using instruments such as fiscal surplus and interest rates [17]. It has been demonstrated that if two policy-makers are independent and uncooperative they will produce outcome with both surplus and interest rates worse than desirable for either of them, underscoring the need for explicit policy coordination [17]. The third group of the literature investigates what practical arrangements should be put in place in order to promote coordination of fiscal and monetary policies [5,6,8,10,12]. For example in one of the recent papers of this group, seven main phases of the monetary and fiscal policies interconnections for Ukrainian economy have been distinguished. Effects of the regulatory actions during these phases allow for defining of the governmental regulation features [10]

Problem statement. Despite the fact that all analyzed research has significantly contributed to our knowledge on how fiscal and monetary policies work, when and how they should be used, and what benefits and drawbacks they have, however there still exists a some scientific gap in the field of fiscal and monetary policy research. The first insufficiently investigated question is a positive one – how do fiscal and monetary policies interact in different countries? And the second one is from the realm of normative economics – given the tendencies and laws of fiscal-monetary interaction, how should they be coordinated? These two questions are of great relevance for both economic science as such and economic policy-making. Therefore the issue of fiscal-monetary policies coordination is important for economics since the solution of this problem may significantly improve our understanding of how the economic system work, how the economy responds to these policies, allowing the profession to understand better what effects of fiscal and monetary policies are peculiar to them individually and what are the joint effects, spillovers, etc. And the relevance of fiscal and monetary policies' coordination for policy-makers is extreme for largely the same reasons – both the government and the central bank aim at maximizing the effects of their policies on the economy, accomplishing which requires 1) better understanding of fiscal-monetary interdependence and influence on one another, and 2) arrangements which will force them to cooperate for the best policy mix, maximizing social welfare with minimum costs and stimulating of the economic growth. Given the fact that the issue of coordination of fiscal and monetary policies is unsatisfactory studied, despite its enormous relevance to economic science and policy-making, this paper is an attempt to fill some scientific gap and find practical, theory- and evidence-based recommendations for economic policy through examination of existing research and application of statistical and econometric methods to analyze the features of the coordination of fiscal and monetary policies in Ukraine as well as in the other countries.

The aim and the tasks of the research. The main aim of the research is the system analysis to find out whether and how the coordination of fiscal and monetary policies affects economic growth in a country; estimate the impact of their coordination policy on economic growth on the base of the build econometric panel data models and elaborate the propositions about effective government strategies for achievement of the macroeconomic stability and stimulation of the economic growth in short and long run.

In order to accomplish the main objective the following tasks should be completed: find out in what areas of economic activity fiscal and monetary policies interact and how; investigate the ways in which both of them affect economic growth; examine the laws and data of a few countries in order to determine whether coordination of fiscal and monetary policies is achieved and whether there is a tendency that coordinated economic policies promote economic growth; build the panel data models to evaluate the effects of fiscal and monetary policies' coordination empirically.

Results of the reserch. Fiscal policy is generally defined as a set of government actions regarding its expenditures and taxation [11], while monetary policy is related to central bank's management of money supply and interest rates [14]. As a rule, fiscal policy is responsible for the achievement of full employment and economic growth, whilst monetary policy manages inflation [17]. Being, at the first sight, to a great extent independent, having an impact on separate aspects of the economy, they jointly influence on the macroeconomic conditions and on one another in many important ways.

First of all, both fiscal and monetary policies have an impact on *inflation*. For illustration of this statement in general the classic AD-AS model (aggregate demand – aggregate supply), which shows the relationship between the aggregate price level in the economy and the amount of goods and services demanded and supplied is usually used [4]. The dependence of inflation on fiscal policy is more thoroughly studied by Leeper, Sims and others, who formulate their position in the Fiscal Theory of Price Level, using more comprehensive dynamic stochastic general equilibrium models to prove their proposition It is worth mentioning that the «fiscalist» position was severely criticized by McCallum and other researchers who prove that monetary policy affect prices, while not rejecting that fiscal policy do this as well [13]. Closely related issue to the phenomenon of inflation is credibility of fiscal and monetary authorities and how it influences on prices in the economy. Inflation is usually seen as a function of expectations, either forward- or backward-looking, or both, such as [19]:

$$\pi_t = \omega^f E_t[\pi_{t+1}|I_t] + \omega^b \pi_{t-1} + \gamma x_t, \quad (1)$$

where π_t - realized inflation in the period t; $E_t[\pi_{t+1}|I_t]$ – expected value of inflation in the period (t+1) conditional on information I_t available at the time t, x_t – the measure of excess demand pressure, e.g. the output gap, $\omega^f, \omega^b, \gamma$ – respective weights of forward-looking, backward-looking, and demand components. The set of information I_t incorporates fiscal and monetary policies' stance in the current and previous periods, therefore giving attention to accumulated credibility of these authorities in the determination of inflation rate [2].

The next major economic phenomenon which fiscal and monetary policies affect simultaneously is *interest rates* [20]. This statement usually is illustrated through classical IS-LM model [11].

Closely related issue to the interest rates, affected by both fiscal and monetary policies, is the *exchange rate* of a national currency. Exchange rate plays an important role in any open economy, especially small ones [11]. The classic framework to study a small open economy and how fiscal and monetary policies affect it is the Mundell-Fleming model under floating exchange rate regime, given by:

$$Y = C(Y - T) + I(r^*) + G + NX(e) \quad (2)$$

$$\frac{M}{P} = L(r^*, Y), \quad (3)$$

where NX – net exports (exports - imports); e – exchange rate; r^* - world interest rate.

So, even on the base of very simple classical theoretical models the necessity of the coordination of fiscal and monetary policy can be confirmed regarding their common impact on the key macroeconomic indicators. It's necessary to stress that the efficiency of the coordination of monetary and fiscal policies regarding their impact on economic growth from the theoretical point of view can be also show on the base of the more complicated theoretical model and mathematical tools such as game theory [17].

Moreover, the need to coordinate fiscal and monetary policies is emphasized even more for developing countries, which often should undertake structural reform and liberalization of the financial sector. Such reforms may be successful if fiscal authorities conduct policies that are supportive to macroeconomic stability, fiscal discipline, and avoidance of distortionary taxation [2]. To support these ideas from the empirical point of view it's important to compare the historical experience of coordination of fiscal and monetary policy on the base of real statistical data in different countries, including Ukraine, the European Monetary Union (EMU) countries, USA etc. In this context it is essential to examine how fiscal and monetary policies' stances interplay with economic growth in the said countries, and with inflation because it is a conventional wisdom that economies want to achieve high, but non-inflationary growth.

It should be emphasized that the economic growth is measured in this case as change in real GDP; inflation – by Consumer Price Index. Fiscal policy stance is measured by general government structural deficit which is defined by Hagemann as actual budget balance of all levels of government purified from the estimated budget changes due to the effects of the business cycle [7]. We use the measure of structural deficit as a percent of nominal GDP. This indicator is more appropriate as a measure of discretionary fiscal policy due to the fact that it excludes the effects of automatic stabilizers. However, it should be noted that it is not perfect because, for instance, interest payments are not eliminated, despite the fact that they do not represent discretionary fiscal policy [21].

Furthermore, we employ here a different measure of monetary policy stance, as suggested by Ahrend et al. [1]. Real central bank discount rates are used as an indicator of monetary policy stance:

$$r = i - \pi_{core}, \quad (4)$$

where r – real discount rate; i - nominal discount rate; π_{core} - core inflation, which is calculated as:

$$\pi_{core} = \frac{\sum_i p_t^i q_{t-1}^i}{\sum_i p_{t-1}^i q_{t-1}^i}, \quad (5)$$

where p_t^i - price of a good i in the period t ; q_t^i - quantity of a good i in the period t ; $i = \{(Good_1), (Good_2), \dots\}$, i does not include food and energy items of a consumer basket [5]. For Ukraine we define real discount rates by subtracting GDP deflator (defl GDP) from nominal discount rates, given the unavailability of the data on core inflation for this country:

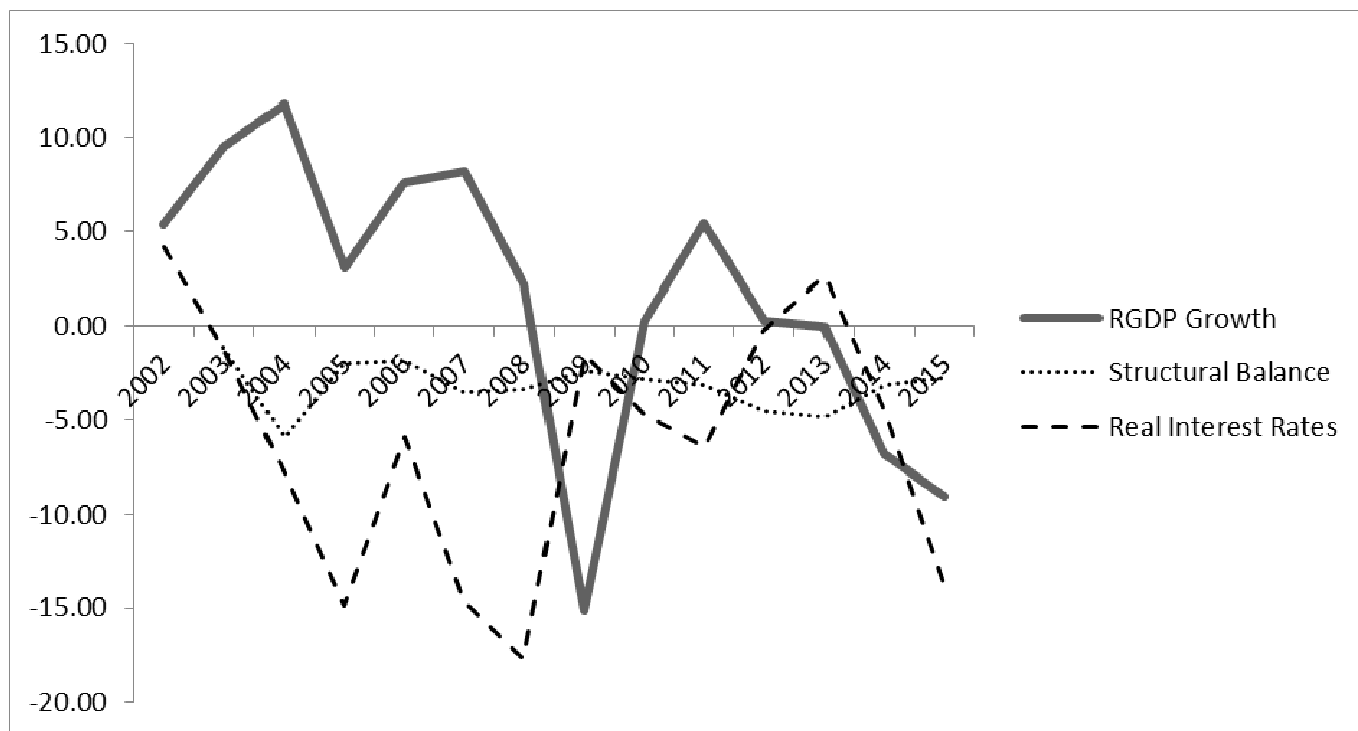
$$r = i - defl\ GDP. \quad (6)$$

All 4 indicators used are measured in percent: real GDP growth – percentage change year-on-year of real GDP; structural balance – in percent of nominal GDP; and real interest rates – simply in annual percent.

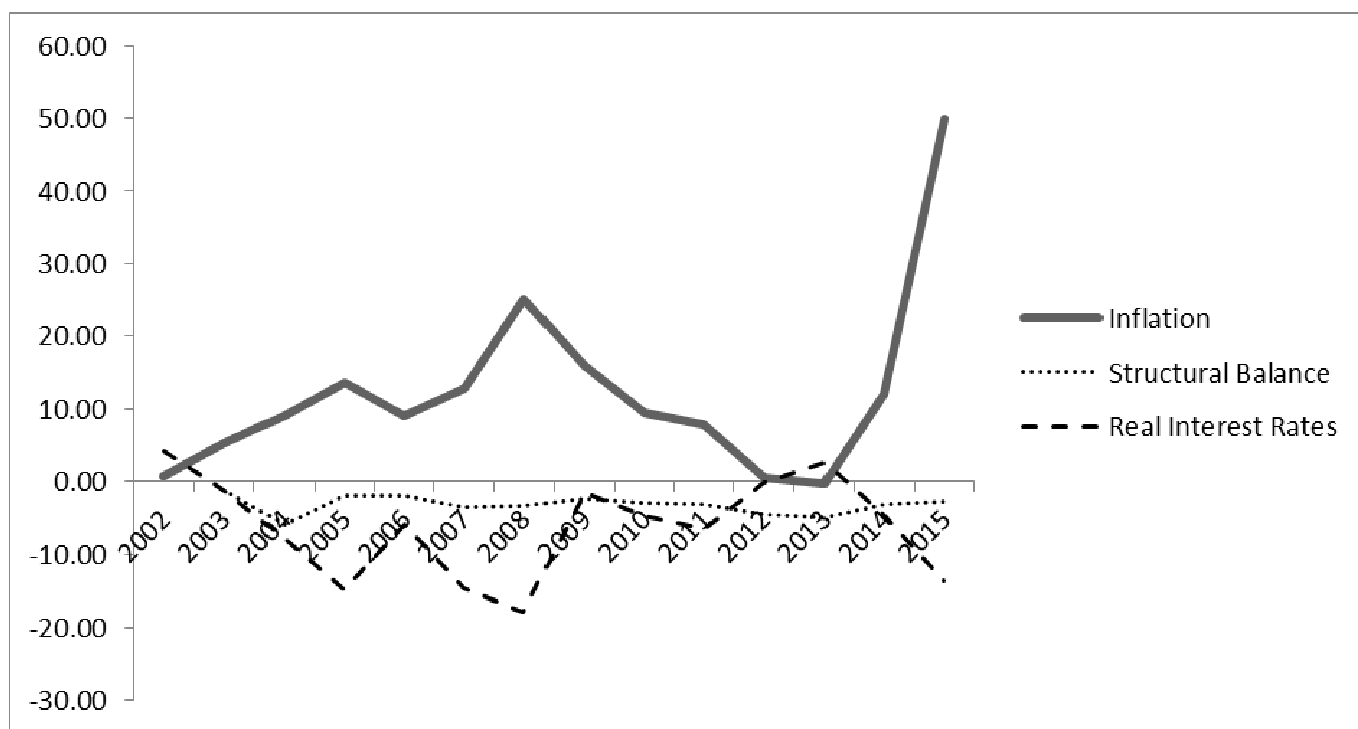
In pictures 1-4, as example, are presented the dynamics of the fiscal - monetary policy indicators and the economic growth as well as the dynamics of the fiscal-monetary policy indicators and inflation in Ukraine and in Germany during the period 2002-2015 years.

It can be inferred from the picture 1 that fiscal policy in Ukraine was mostly pro-cyclical – the government pursued more expansionary fiscal policy when the economy grew well, e.g. in 2002-2004, 2007-2008 and 2011. More recently, however, in the year 2013, fiscal policy became more anti-cyclical, expanding deficits during the beginning of economic turmoil. But in the last two years, the government once again turned away from expansionary fiscal policy, despite the deep recession which hit the economy of Ukraine.

Overall, structural balance was relatively stable, indicating that the government had actually very little room for discretionary policy (especially expansionary) due to the high cost of borrowing, underdevelopment of domestic financial markets, etc



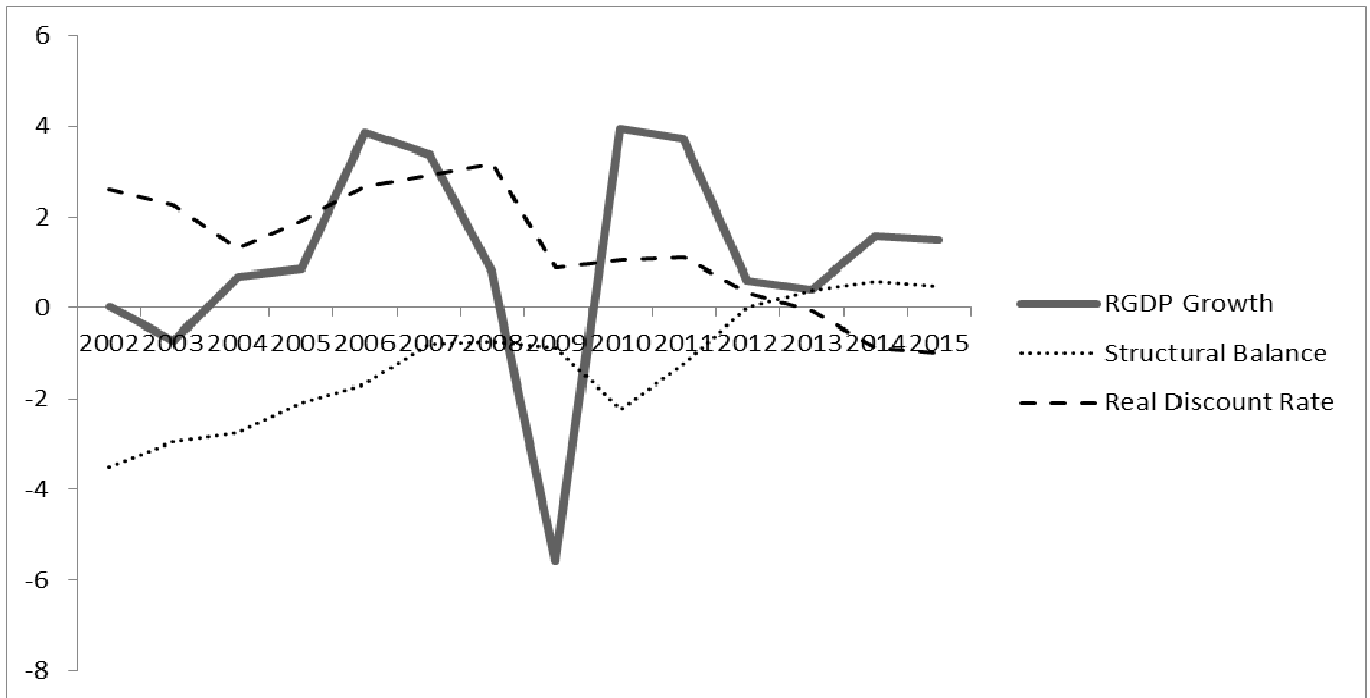
Picture 1. Fiscal and monetary policy indicators and the economic growth in Ukraine in 2002-2015.
 Data sources: authors calculations on the base of [22,23].



Picture 2. Inflation and fiscal-monetary policy mix in Ukraine in 2002-2015.
 Data sources: authors calculations on the base of [22,23].

The same problem holds true for monetary policy, almost during the same time frame. However, the National Bank of Ukraine employed more counter-cyclical policy in 2014-2015 using expansionary monetary policy in an attempt to stop the economy from going into a depression. This is, however, quite contradictory policy due to the fact that the main responsibility of the NBU is to keep inflation low, and in 2014-2015 Ukraine experienced a typical stagflation – recession combined with inflation, as illustrated on the pictures 1 and 2. As we have already observed, the best coordination between fiscal and monetary authorities was achieved in 2003, 2006, 2008, and 2010-2013, and to some extent in 2005 and 2007. These years generally correspond to the much higher levels of real GDP growth with relatively mild inflation. Consequently, it can be concluded that coordination of fiscal and monetary policies may be a very important factor for the achievement of non-inflationary economic growth in Ukraine.

Comparative to Ukraine, for example, in Germany, fiscal and monetary policies generally were rather counter-cyclical, with lower structural deficits and higher real discount rates during the periods of relatively high real GDP growth, such as 2005-2007, and 2010-2012.

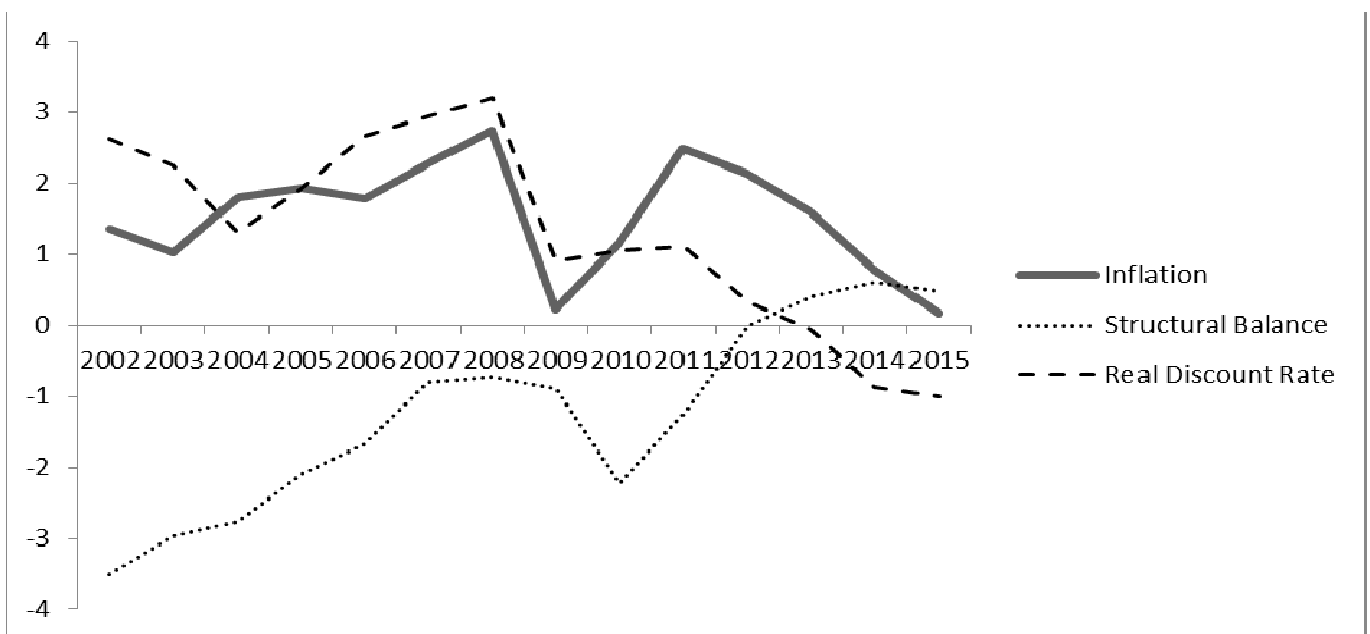


Picture 3. Fiscal-monetary policy mix and real GDP growth in Germany in the years 2002-2015.

Data sources: authors calculations on the base of [22].

In the last two years, however, real GDP growth was relatively high, at least by the standards of developed countries, and the government of Germany rightfully pursued more contractionary fiscal policy. But the European Central Bank set up monetary stimulus, so-called Quantitative Easing Program, mainly to boost inflation, which was extremely low and declining during the said years (see picture 4).

The coordination of fiscal and monetary policies seems to be as important for Germany as for Ukraine. The highest rates of real GDP growth with moderate inflation were achieved in 2004-2007 and 2010-2011, which generally correspond with the years of the highest degree of coordination between German government and the ECB, with a notable exception of the years 2007 and 2008, suggesting that this relationship is far from being perfect or the only explanatory factor in the determination of economic growth.



Picture 4. Inflation, and fiscal and monetary policy indicators in Germany, 2002-2015.

Data sources: authors calculations on the base of [22].

The similar statistical analysis made for the other countries show that, for example, for Greece it seems that coordinated policies are associated with higher economic growth with moderate rates of inflation. For the United States, the relationship between the degree of coordination of fiscal and monetary policies and economic growth is rather unclear. It seems, contrary to the conventional wisdom, that monetary policy moves are more closely related to the movements in real GDP, while fiscal policy influences more on inflation.

In general, as statistical analysis has shown, evidence is mixed, so further quantitative investigation on the based of econometric tools is desirable. In this context the panel data empirical model of economic growth and some of it modification incorporating separate and joint effects of fiscal and monetary policy has been build. The purpose of it is to verify from the estimated models the hypothesis that fiscal-monetary interactions do matter for economic development of Ukrainian and the other countries and estimate the separate and joint influence of the main instruments of fiscal-monetary policy on economic growth in short and long run.. The proposed econometric panel data model based on the framework of neoclassical growth theory, primary the one developed by Mankiw, Romer and Weil [12] and has such general form:

$$[\ln(RGDP_{it}) - \ln(RGDP_{i,t-1})] = \beta_0 + \beta_1 \ln(GDP04i) + \beta_2 \ln(GCF_{it}) + \beta_3 \ln(n_{it} + g + \delta) + \beta_4 EDUC_{it} + \beta_5 PRI_{it} + \beta_6 IFI_{it} + \beta_7 TFI_{it} + \beta_8 OIL_t + \beta_9 CRISIS_t + \beta_{10} SURP_{it} + \beta_{11} INFL_{it} + \beta_{12} (SURP_{it} \times INFL_{it}) + \varepsilon_{it}, \quad (7)$$

where $RGDP_{it}$ - real gross domestic product per capita of a country i in time t (measured in local currency units); $GDP04_i$ - initial GDP per capita of a country i in the year 2004 (in US dollars); GCF_{it} - gross capital formation as a fraction of GDP of a country i in time t (percent of GDP); n_{it} - population growth of a country i in time t (measured in fraction, e.g. 0.01, which means 1 percent growth); $(g + \delta)$ - the rate of technology development plus the rate of depreciation, taken as the same for all countries, $(g + \delta) = 0.05$, as was estimated to be the common rate of technology growth and depreciation by Mankiw, Romer and Weil [12]; $EDUC_{it}$ - education index of a country i in time t (a part of the United Nation's Human Development Index) (measured in fraction units from 0 - the worst education, to 1 - the best education); PRI_{it} - Property Rights Index of a country i in time t (in units, from 0 - private property is banned to 100 - private property is fully protected by law); IFI_{it} - Investment Freedom Index of a country i in time t (in units, from 0 - least free, to 100 - most free investment activities); TFI_{it} - Trade Freedom Index of a country i in time t (in units, from 0 - least free, to 100 - most free trade), OIL_{it} - a dummy variable where 1 indicates that a country i is rich in mineral fuels (mineral fuels constitute more than 50 percent of merchandise exports) and 0 otherwise; $SURP_{it}$ - fiscal surplus of a country i in time t (in order to eliminate effects of debt service on government expenditures, the variable $PRSURP_{it}$ - primary surplus has been also used instead of $SURP_{it}$) (measured in percent of GDP); $INFL_{it}$ - inflation rate of a country i in time t measured by GDP deflator index (in percent); $(SURP_{it} \times INFL_{it})$ - interaction term of surplus and inflation, aimed at measuring their joint effects; $CRISIS_t$ - a dummy variable indicating years of the Great Recession, this dummy variable has been included to account for a general decline in economic conditions during the Great Recession of 2008-2009 where 1 appears for every country in the years 2008 and 2009, and 0 otherwise; $i = \overline{1,130}$; $t = \overline{1,10}$; γ_i - the unknown specific effects parameters for the country i ; $\beta_j, j = \overline{0,12}$ - unknown parameters of the model; ε_{it} - error term of a country i in time t (residual in an estimated model).

We should stress that in order to measure whether coordination of fiscal and monetary policies influence on economic growth, we include the interaction term, that is, a product of two policy variables - either surplus and inflation or primary surplus and inflation.

The estimation of the model (7) has been done on the real data set obtained from two major international sources - World Bank's World Development Indicators International Monetary Fund's World Economic Outlook. Additionally, we got Education Index from the United Nation's website, and Property Rights, Investment Freedom and Trade Freedom Indices from the Heritage Foundation's website. In total, we were able to gather information on all variables for 130 countries and the years 2004-2014, organized as panel data. In order to estimate the model (7) accurately, the first thing to do is to decide what type of panel data model is appropriate for the data used. There are 3 main options: pooled ordinary least squares estimation, random effects and fixed effects models. Using a set of the diagnostic tests such as Breusch-Pagan Lagrangian Multiplier test for pooled vs. random effects estimation, and Hausman test for random vs. fixed effects model it was found that in our case the appropriate type of the model is the fixed effects panel data model.

So, the model (7) has been estimate as the panel data fixed effects model in two modifications. Using notation given above the first from the estimated models has such view (t-statistic value in the parenthesis):

$$\begin{aligned}
 [\ln(RGDP_{it}) - \ln(RGDP_{i,t-1})] = & -0.394 + 0.0638 \ln(GCF)_{it} - 0.0847 \ln(n_{it} + g + \delta) - \\
 & (-5.2) \quad (7.29) \quad (-3.64) \\
 - & 0.046 \ln(EDUC_{it}) + 0.0001 PRI_{it} - 0.0002 IFI_{it} - 0.0003 TFI_{it} - 0.0261 CRISIS_t + \\
 & (-1.08) \quad (0.16) \quad (-1.19) \quad (-1.69) \quad (-9.81) \\
 & + 0.0015 SURP_{it} + 0.0002 INFL_{it} + 0.0001(SURP_{it} \times INFL_{it}) + e_{it} \\
 & (3.52) \quad (1.6) \quad (3.34)
 \end{aligned} \tag{8}$$

The second, from the estimated models is (t-statistic value in the parenthesis):

$$\begin{aligned}
 [\ln(RGDP_{it}) - \ln(RGDP_{i,t-1})] = & -0.3964 + 0.0646 \ln(GCF)_{it} - 0.084 \ln(n_{it} + g + \delta) - \\
 & (-5.2) \quad (7.29) \quad (-3.64) \\
 - & 0.0486 \ln(EDUC_{it}) + 0.00001 PRI_{it} - 0.0003 IFI_{it} - 0.0003 TFI_{it} - 0.0261 CRISIS_t + \\
 & (-1.12) \quad (0.04) \quad (-1.23) \quad (-1.63) \quad (-9.77) \\
 & + 0.0014 PRSURP_{it} + 0.0002 INFL_{it} + 0.0001(SURP_{it} \times INFL_{it}) + e_{it} \\
 & (3.25) \quad (1.38) \quad (2.70)
 \end{aligned} \tag{9}$$

Overall, the fit of the models is sufficiently good as for macroeconomic, cross-country studies. Each model has highly (at the level of 0.01) significant non-policy variables: natural logarithm of gross capital formation (*GCF*); natural logarithm of the sum of population growth, technology development and depreciation rate $\ln(n_{it} + g + \delta)$. Since technology and depreciation rates are fixed over time and across countries, we should interpret this parameter only with respect to population growth. The dummy *CRISIS* - on average, all countries grew by 2.6 p.p. less during the financial crisis of 2008-2009, other things equal.

The interpretation of fiscal and monetary policy variables is a bit more complicated because of their interaction term. Let us differentiate the equations (8-9) with respect to $SURP_{it}$, $PRSURP_{it}$ та $INFL_{it}$:

$$\frac{\partial [\ln(RGDP_{it}) - \ln(RGDP_{i,t-1})]}{\partial SURP_{it}} = 0.0015 + 0.0001 INFL_{it}, \tag{10}$$

$$\frac{\partial [\ln(RGDP_{it}) - \ln(RGDP_{i,t-1})]}{\partial PRSURP_{it}} = 0.0014 + 0.0001 INFL_{it}, \tag{11}$$

$$\frac{\partial [\ln(RGDP_{it}) - \ln(RGDP_{i,t-1})]}{\partial INFL_{it}} = 0.0002 + 0.0001(PR)SURP_{it} \tag{12}$$

The impact of surplus depends not only on its own influence, but on inflation as well, and vice versa. The estimation results of the model equations (8) and (9) reveal that fiscal policy measured either by fiscal or by primary surplus is significant at the level 0.01, monetary policy, as measured by inflation rate, is insignificant, and their interaction term is statistically significant at the level of 0.01.

An increase in fiscal surplus of a country by 1 percentage point is associated with 0.15 p.p. rise in the rate of real GDP growth, an increase in primary surplus by 1 p.p. – with 0.14 p.p. rise in the growth rate. This means that balanced and to some degree tough fiscal policy is conducive for economic growth in a country.

Monetary policy can actually enhance the effectiveness of fiscal policy, despite the fact of being statistically insignificant on its own. For instance, 1 p.p. increase in surplus with inflation being equal to 2 percent is likely to lead, on average, to a rise in the rate of growth by 0.17 p.p., while in case of inflation being 5 percent – to a 0.2 p.p. rise in the rate of real GDP growth. We should mention some reservations here. This relationship, of course, cannot hold forever. Nevertheless, we can conclude here that reasonable movements in fiscal policy should be counteracted by opposite monetary policy: fiscal consolidation (decreasing fiscal and/or primary deficit or increasing surplus) should be accompanied with monetary expansion (higher inflation rate), and vice versa, in order to enhance the rate of economic growth in the short and medium run.

Conclusion. Fiscal and monetary policies jointly influence on economic growth through the key macroeconomic indicators such as inflation, interest rates, *exchange rate* etc. The joint inspection of fiscal and monetary policies with real GDP growth and the main macroeconomic indicators in the developed and emerging countries revealed that, on average, coordinated policies (expansionary-contractary or neutral-neutral mixes) are more supportive for non-inflationary economic growth than uncoordinated. However, the results from preliminary data analysis are somewhat ambiguous, since the United States, having largely uncoordinated policies, managed to achieve higher rate of real GDP growth than Germany, while Ukraine, experiencing relatively coordinated fiscal and monetary policies, lagged behind. These findings suggest that there is much more to the story of economic growth than economic policies and their coordination.

Quantitative econometric analysis of economic growth and coordination of fiscal and monetary policies, undertaken on the basis of neoclassical model of growth and panel data methodology, revealed that there is an impact of coordination of fiscal and monetary policies on the short- and medium-term economic growth. The fixed effects panel data model was employed in order to explore the effects of fiscal-monetary coordination on economic

growth taken into account the unobservable, country-specific characteristic (e.g., richer countries has better education, more open trade policies and better protected property rights), thus being able to explore mainly time series effects of different factors, such as education, gross capital formation rate, property rights, investment and trade freedom, population growth, and, of course, surplus (fiscal variable) and inflation (monetary variable).

The analysis of the results after panel data model estimation on real data reveals that coordination of fiscal and monetary policies do matter in the short to medium run. More specifically, it has been found that the «ideal» policy mix for economic growth is one of contractionary fiscal and expansionary monetary policy. The received results also lead to a conclusion that reasonably higher inflation rate is likely to boost the effectiveness of fiscal policy. This conclusion has some similarity to the one reached by Ahrend et al. [1], that expansionary monetary policy helps to accommodate fiscal consolidation.

However, in the long run it is fundamental factors (initial GDP, capital formation, human capital, and trade freedom) that matter. As for Ukraine thus, given the empirical findings several recommendations for fiscal and monetary policy-making in the short to medium run can be made. For example, for economic policies in Ukraine and elsewhere it is desirable to pursue reasonably tight fiscal and reasonably expansionary monetary policies to achieve higher rates of economic growth in the short and medium run, while improving the economy's institutional framework, physical and human capital to sustain higher rates of growth in the long run.

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