

# IMPACT OF FISCAL POLICY ON ECONOMIC DEVELOPMENT IN UKRAINE

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**Abstract.** *The paper aims on assessing the impact and efficiency of fiscal policy instruments for gaining macroeconomic goals in transition economies. For this reason the macroeconomic model of the Ukrainian budgetary sector is developed. The model represents interrelations between the budgetary sector and real economy reflecting the way financial resources are redistributed through the budgetary system. The model serves as a basis for scenario analysis of different types of fiscal policy and their effect on economic indicators. It also allows for forecasting budgetary revenues in order to compose an efficient budget estimates. The results of the research prove that in transition economy such as Ukrainian the channel of tax rate on personal income tax is more efficient from fiscal point of view than the one on enterprise profit tax, while reallocation of resources between budgetary transfers to population and R&D is more efficient than increasing budget expenditures. Since increase in expenditures influences higher increase in GDP, the model proves Keynesian effects in the economy of Ukraine.*

**Keywords:** *fiscal policy, macroeconomic model of budgetary sector, simultaneous equation modelling, economic development, transition economies, Ukraine.*

## 1. Introduction

The debates on a role of the government in economic development held during the recent century are permanently heated by the serial crises and the new challenges they send to the political and economic leaders of the world. The question they raise is what is more efficient for economic performance: government intervention in the market through implementing economic policy (fiscal in particular) or non-intervention. Government intervention is justified by market failures resulting from market imperfections – a concept developed by Henry Sidgwick [1] and Francis

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Bator [2], while non-intervention – by the principle called '*laissez-faire*' of Classical economics and by the concept of *government failure* of Public choice school.

Buchanan and Musgrave [3] responding to the position of public choice theory, argue that “defining the good fiscal system should be our primary task, not because there are no policy failures but because first things come first. If we do not know how to do it well, how do we know what failures to correct?” [3, p. 82]. At the same time Krugman, Stiglitz, and Sachs proclaim the entry of the modern economics into “a period in which orthodox views are openly questioned, creating an atmosphere characterized by a crisis of confidence” [4, p.160]. This stance of questioning makes the scientists opened for the discussion of any possible theories and results.

There are plenty of empirical studies validating Keynesian theory and criticizing it. The results are mostly diverse; many assumptions still need to be relaxed; and there is still no common position prevailing. As a result, policy implications are rather ambiguous. Moreover, there are few studies applying recently developed theories to the transition economies, Ukrainian in particular. There is scarcity within those researches explaining whether Keynesian theory is applicable to transition economies, such as Ukrainian one, which instruments of fiscal policy are significant and efficient for providing future sustainable economic development. The problem of specifying which economic theory is appropriate to explain recent economic processes and, thus, can be the basis of government decision making for the sake of economic development, nowadays has more empirical rather than theoretical character.

Various techniques of econometrics that have been developed during recent seventy years such as simultaneous equations (SEM), error-correction (ECM), structural vector autoregressive (SVAR), dynamic stochastic general equilibrium (DSGE) and computable general equilibrium (CGE) modelling give plenty of opportunities to model the behaviour and interrelations within the economy. For this aim the peculiarities of the economy under investigation should be explored thoroughly.

Carmignani [5], in his study of the impact of fiscal policy on private consumption and social outcomes in Europe and CIS with the focus on transition countries, employs simultaneous equations modelling. This technique allows for developing a long-term macroeconomic relationship between fiscal policy and economic growth, using real per-capita consumption growth as the dependent variable.

Carmignani, following Giavazzi and Pagano [6], separates the effects that fiscal policy has in normal times from those that it has during periods of large structural changes, using a dummy variable to pick episodes of sizeable fiscal adjustments or expansions. Thus, Carmignani [5] comes to the conclusion that fiscal policy has Keynesian effects in transition countries; non-significant effects in high-income OECD economies in normal fiscal times, and non-Keynesian effects outside normal times. For several developed countries this research partly correlates with previously held investigation of Alesina and Perotti [7], which comes to conclusion that fiscal adjustments mostly do not cause recessions. They address governments to cut expenditures, in particular transfers and government employment expenditures, rather than increase taxes. In addition, Carmignani [5] proves that government expenditures for public health and social protection are efficient in terms of social outcomes. The results suggest that fiscal adjustment in transition economies tend to be contractionary, while fiscal stimulus is expansionary. It also means that there is scope for a counter-cyclical usage of public spending, as long as fiscal policy is used symmetrically over the business cycle. On the contrary, for high-income OECD economies, the findings suggest that fiscal stabilizations might be expansionary, albeit the multiplier is likely to be small.

Lukianenko [8] develops a systematic model of Ukrainian economy decomposing it into sub-systems of real, monetary, external, budgetary sectors, and labour market. In the research she is employing SEM approach to model long-run relationships within the system. The model serves as the basis for scenario analysis, as well as provides analysis of multiplier effect of government expenditures and money supply. The findings of this study prove Keynesian effects in Ukrainian economy since decrease in tax pressure leads to increase in GDP.

Though the results stemming from the large volume of empirical investigations on the question about the contribution of fiscal policy to economic development are hard to summarize, as they are often incompatible and ambiguous, it is more common for transition and developing economies to bear Keynesian effects, while recent evidence from the developed economies in policy implications is mostly opposite and controversial. This, in turn, may be the evidence of higher efficacy of fiscal policies in transition countries.

Monetary policy is thought to have more rapid impact on the economy because of short inside lags. However, in transition economies it may appear less efficient than fiscal policy because of low level of

financial market development, which leads to longer outside lags in monetary policy and poor transmission effect. Thus, fiscal policy, because of its being built-in in the transition economies deeper than monetary one, needs to be investigated more thoroughly.

There are considerably more studies exploring the transmission of monetary policy shocks than of fiscal policy ones. In addition, applications of the theories and methodologies are mostly focused on the sample of high-income and/or developed countries rather than developing and transition economies in particular. As Carmignani [5] emphasizes, studies that are specifically focused on transition economies are “still in its infancy”. Since the history of transition is relatively short, time series are short and data quality is under question, which is constraining empirical analysis.

Ukrainian market along with other national markets in the world is thought to be efficient. However, this inefficiency has peculiarities that are to be discovered. Explanation of how the Ukrainian economy works, and in turn, how taxation system should be designed, which policy instruments should be used by governments to foster economic development in the transition economy based on the contemporary data of Ukrainian economy is the gap that this research strives to fill in.

The main purpose of the research is to discover interrelations between fiscal policy and macroeconomic state and development based on the way how financial resources of the economy are redistributed through the budgetary system. This paper aims to explore the case of the Ukrainian economy in order to contribute to the body of knowledge in the policy making process for the sake of economic development of transition economies.

To support the efficiency of public finance, relevant instruments of fiscal policy should be developed. Macroeconomic model of budgetary sector should serve as a basis for an efficient fiscal policy reflecting interactions between policy variables and target variables. The problem of development of macroeconomic model of budgetary sector of Ukraine is important nowadays because of the necessity of reforms in the budgetary sector of Ukraine and of the methodological framework for further efficient fiscal policy. Decision making process in the budgetary sector needs to be transparent, and the government should be provided with the instruments for efficient fiscal policy. Moving from *ad hoc* approach in decision making in budgetary allocation and taxation policy to coordinated budgetary policy is necessary for gaining public policy goals.

## 2. Experimental

This research is applying simultaneous equations modelling approach, which is useful for gaining its purpose. *Simultaneous equations modelling (SEM)* is a structural type of models containing multiple equations and variables. It is a system of a class of complete systems that have as many equations as there are endogenous variables. In these models it is chosen to regard variables as “simultaneous” or “jointly determined”, in the sense, that they are related but no causal ordering can be assigned [9, p. 72]. Thus, simultaneous equations framework requires an a priori division of the variables into endogenous and exogenous categories. This kind of distinctions between variables imposes restrictions on the short-run dynamics of the model in order to achieve identification [9, 10, 11]. SEM can be applied to efficiently investigate long-run relations within the system – budgetary sector and real economy in particular, thus it is chosen as a method for this research. Macroeconomic model developed within the framework of SEM allows for developing various scenarios of fiscal policy which may serve as a basis for choosing the most efficient policy and design of tax system.

Applying SEM to the data of Ukrainian economy serves to investigate interrelations between the budgetary and real sector of Ukraine that illustrate the structure of the economy. It is important for design of tax system and fiscal policy implications. The system of equations contains 6 regression equations and 3 identities. It can be presented as follows:

$$PIT = f\{SAL\_BUDG, P, (SAL\_BUDG(-1) - SAL(-1)) * TR\_PIT(-1), DUMMY\_CR\}; \quad (1)$$

$$EPT = f\{GDP(-1), d(INNOV\_GOV(-2)), P(-1) * TR\_EPT(-1), Q1 * PPI, DUMMY\_2010\_3\}; \quad (2)$$

$$VAT = f\{CONS - IMP, IMP, EX/GDP, TR\_POPUL/EXPEN, DUMMY\_CR1, DUMMY\_2010\_3\}; \quad (3)$$

$$EXCISE = f\{IMP, CONS - IMP, DUMMY\_09\}; \quad (4)$$

$$REV\_OTH = f\{GDP, DUMMY\_11\}; \quad (5)$$

$$GDP = f\{EXPEN, EX, VAT * (1 + TR\_VAT) / (TR\_VAT) * (1 - EXPEN / CONS), DUMMY\_08, DUMMY\_2010\_3\}; \quad (6)$$

$$REV = PIT + EPT + VAT + EXCISE + REV\_OTH; \quad (7)$$

$$EXPEN = \\ = INNOV\_GOV + TR\_POPUL + SAL\_BUDG + EXPEN\_OTH; \quad (8)$$

$$BD = REV - EXPEN, \quad (9)$$

where *PIT* – personal income tax (mln UAH); *EPT* – enterprise profit tax (mln UAH); *VAT* – value added tax (mln UAH); *EXCISE* – excise on import and export (mln UAH); *REV\_OTH* – other revenues of the consolidated budget (mln UAH); *REV* – revenues of the consolidated budget (mln UAH); *EXPEN* – expenditures of the consolidated budget (mln UAH); *BD* – deficit of the consolidated budget (mln UAH); *INNOV\_GOV* – expenditures of the consolidated budget on innovations (Expenditures on research-and-development and Expenditures of state and regional significance) (mln UAH); *TR\_POPUL* – transfers to population from the consolidated budget (mln UAH); *SAL\_BUDG* – salaries to employees of institutions financed from the budget (mln UAH); *EXPEN\_OTH* – other expenditures of the consolidated budget (mln UAH); *TR\_PIT* – tax rate of PIT (%); *TR\_EPT* – tax rate of EPT (%); *TR\_VAT* – tax rate of VAT (%); *SAL* – salaries fund (mln UAH); *P* – profits of enterprises before taxes (mln UAH); *GDP* – gross domestic product (mln UAH); *CONS* – consumption (mln UAH); *IMP* – import (mln UAH); *EXP* – export (mln UAH); *PPI* – index (%); *Q1* – dummy-variable for the first quarter; *Q4* – dummy-variable for the fourth quarter; *DUMMY\_CR* and *DUMMY\_CRI* – dummy-variables that indicate the impact of financial and economic crisis on budgetary and macroeconomic indicators during the period from 4<sup>th</sup> quarter of 2008 to 4<sup>th</sup> quarter of 2009, and 1<sup>st</sup> quarter of 2010 respectively; *DUMMY\_08* – dummy-variable that indicates the impact of financial and economic and debt crises on budgetary and macroeconomic indicators starting from 4<sup>th</sup> quarter of 2008; *DUMMY\_09* and *DUMMY\_11* – dummy-variables that indicate the impact of changes in the Ukrainian legislation concerning rates of excise taxes in 2009 and system of taxation in 2011 respectively.

In order to estimate the system of equations, it should be over identified or exactly identified. For this, there are sufficient condition for consistency (order condition) and necessary condition (rank condition for identification). After testing for both conditions, the system of equations proved to be over identified, so it can be assessed with the use of Two-stage least square (2SLS) or Three-stage least square (3SLS) Method.

This study was conducted in the framework of the official statistics published by the State Statistics Committee of Ukraine, State Treasury of

Ukraine, National Bank of Ukraine, and other state institutions [12, 13 and 14]. Data collection of the main budgetary and economic indicators of Ukraine is a hard procedure, as there is still lack of transparency in governmental institutions. The data on performance of consolidated budget from 2000 to 2011 derives from the state reports provided by the Institute of Economic Research and Political Consultancy. The budgetary data from 2004 to 2011 derives from the Treasury reports. The data of the real economy derives from public reports of the State Statistics Committee of Ukraine. All the time series explored in the model are quarterly data starting from 2000 to 2011.

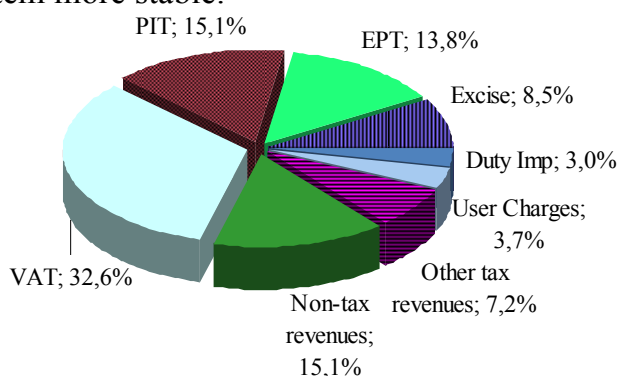
### 3. Results Section

#### 3.1. Statistic Analysis of the Data

The main components of budget system are revenues, expenditures, and budget deficit. They are interconnected through real economy and economic policy that is the reason for exploring these relations more thoroughly.

##### 3.1.1. Characteristics of the revenue side of consolidated budget

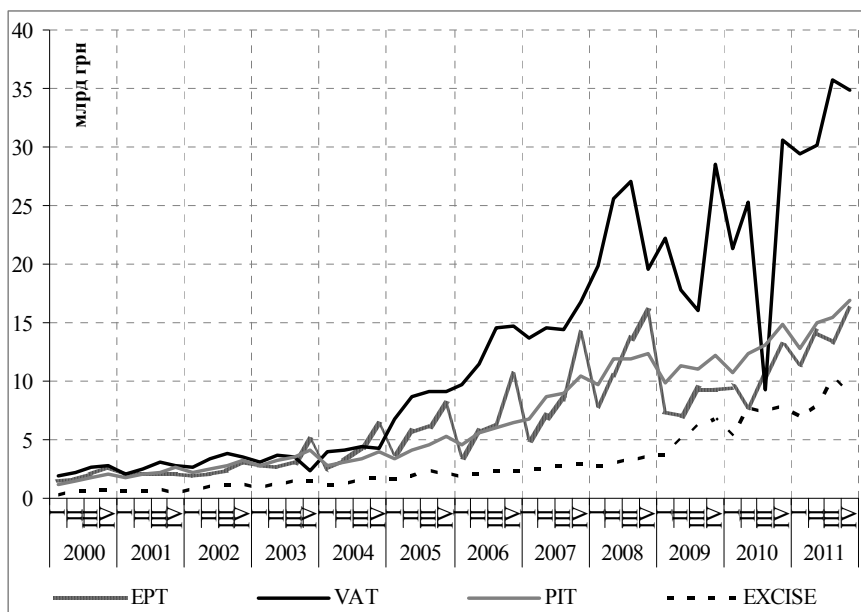
Budget revenues of Ukrainian budgetary system by 84% consist of tax revenues (2011). The main tax revenues of the consolidated budget are value added tax (VAT) (32,6% of revenues in 2011), personal income tax (PIT) (15,1%), enterprise profit tax (EPT) (13,8%), and excise (8,5%) (Graph 1). Since in transition economies indirect taxes, such as value added tax (VAT) and excise, are harder to evade, their comparatively high share in Ukraine (amounts to more than 40%) makes the revenue side of the budget system more stable.



**Graph 1.** Structure of the revenues of consolidated budget of Ukraine in 2011.

Since there are 4 taxes that comprise 70% of budget revenues of Ukraine, for the sake of modelling budget system, revenue side of the budget is divided into 5 components: VAT, PIT, EPT, excise, and the rest of the revenues (other revenues). Yearly and quarterly dynamics of the main revenue components of consolidated budget that are VAT, PIT, EPT and Excise during 2000-2011 is illustrated in Graph 2. Their shares constituted from 53,2% in 2000 to 66,7% in 2008, and 70,1% in 2011 in the total revenues of consolidated budget with an increasing tendency.

During 2000-2004 revenues from PIT, EPT and VAT were equal. Though being the hardest to administer, starting from 2005 VAT had constituted significantly higher share in the revenues of consolidated budget. VAT revenues started to dominate in budget revenues with an active government campaign against fake reimbursement of this tax from the budget (see Graph 2).



**Graph 2.** Quarterly dynamics of the main tax revenues during 2000-2011.

Redistribution of financial resources has followed a change in the system of taxation of incomes of individuals. Since the reform was aimed at stimulating legalization of incomes in 2004, the state proposes a new way of taxation – introduction of a flat rate of 13% instead of progressive scale. As a result of transition to the new system of taxation comparing to the previous dynamics of budget revenues to the budget in short term the budget under levied a lump sum of resources. This is demonstrated in the



dynamics of PIT in 2004 comparing to 2003 and comparing to the amount of the other taxes levied (Graph 2).

Also Graph 2 illustrates that in the past years until 2008 the amount of PIT and EPT overtook each other depending on the quarter. The reason for those changes in the dynamics are seasonality, that is inherent to both of the taxes, deriving from the specifics of the tax base, as well as of tax legislation that influences the dynamics of levying the taxes. Since recent financial and economic crisis caused decrease in the level of profits of enterprises, starting from 2009 the amount of PIT levied has predominated the amount of EPT.

### ***3.1.2. Characteristics of the expenditure side of consolidated budget***

Recently the expenditures on social protection, education, healthcare, and economic activities have constituted more than 70% of expenditures of the consolidated budget. The level of expenditures on economic activities of the state (11,6%-17,9% in 2007-2011) corresponds to the level of financing state functions (10,7%-12,0% in 2007-2011). About half of the latter expenditures finance administrative apparatus, and the other half is debt service. High share of those expenditures serves as an evidence for the necessity of increasing the efficiency of debt policy aimed at decreasing the level of interest rates and the scope of loans, as well as restructuring administrative apparatus.

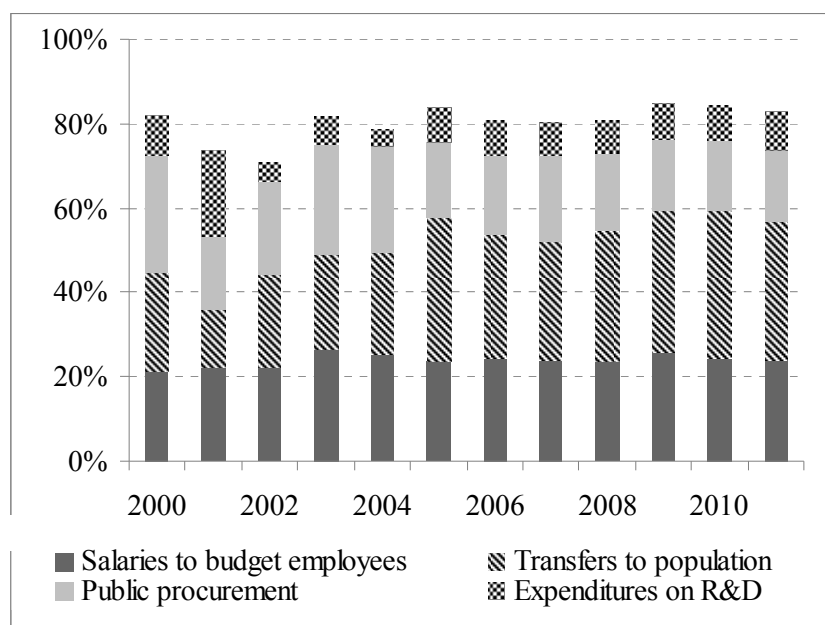
Growing expenditures on social protection and social service simultaneously with shortening expenditures on defence, even though national defence is strategic from the point of view of state integrity, are recent trends of the past decade. It serves as an evidence of non-proportional distribution of resources of the budgets of Ukraine and the necessity of increasing the efficiency of the budget process.

According to economic classification, expenditures of consolidated budget consist of current and capital expenditures, as well as unallocated expenditures and crediting excluding amortization. Growing share of current expenditures and shortening capital expenditures is a recent trend in Ukraine. Thus, in 2011 the share of capital expenditures amounted to 10,1%, ranging between 6,5% (in 2009) and 20,4% (in 2004) [State Treasury of Ukraine]. In the meanwhile it is worth to mention that in transition economy most of institutional changes may be provided with capital expenditures, including expenditures on innovations.

According to economic classification of the budget, the main components of expenditures of the consolidated budget are salaries of the employees of budget institutions, expenditures on investments in innovative programs (expenditures on R&D), transfers to the population and public consumption.

The first group representing salaries of the employees of budget institutions and pensions of former military forces employees (group «Salaries to budget employees» at Graph 3) in 2011 constituted 24,2% of the expenditures of consolidated budget of Ukraine.

Graphic analysis of Graph 3 demonstrates that the share of this group in the expenditures during 2000-2011 was the most constant and during this period ranged between 21,3% and 26,7%. From the point of view of fiscal policy efficiency this group of expenditures is a significant constituent of incomes of individuals, influencing the amount of PIT levied in the future periods. The second group of budget expenditures is expenditures on research and development (R&D) and expenditures of the state or regional significance (group «Expenditures on R&D» at Graph 3), since a part of those expenditures are long term, they influence innovative constituent of the state economy. In 2011 this group of expenditures amounted to 15,7% of budget expenditures. During 2000-2010 the share of this group in the expenditures of consolidated budget constituted from 3,7% (in 2004) to 9,7% (in 2000) (excluding 20,4% in 2001), being constant during 2005-2010 (around 8%), and increased almost twice in 2011. The second group of budget expenditures is expenditures on research and development (R&D) and expenditures of the state or regional significance (group «Expenditures on R&D» at Graph 3), since a part of those expenditures are long term, they influence innovative constituent of the state economy. In 2011 this group of expenditures amounted to 15,7% of budget expenditures. During 2000-2010 the share of this group in the expenditures of consolidated budget constituted from 3,7% (in 2004) to 9,7% (in 2000) (excluding 20,4% in 2001), being constant during 2005-2010 (around 8%), and increased almost twice in 2011. Expenditures on R&D stimulate innovative activities of the enterprises, which under the efficient allocation of the resources allow increasing incomes in the economy, and consequently, the amount of EPT levied in the future periods.



**Graph 3.** Dynamics of expenditure constituents of the consolidated budget in Ukraine during 2000-2011.

The third group of expenditures representing their influence on the VAT levied, consists of 2 parts: current and capital transfers to the population, charges on the salaries of the employees of budget institutions (subgroup «Transfers to population» at Graph 3); and the materials, inventory and services provided to the state (subgroup «Public procurement» at Graph 3). Current and capital transfers to the population are assigned in the form of targeted aid to some categories of population (e.g. low-income groups), charges on salaries are redistributed through Pension fund and funds of social insurance (assurance, unemployment et.al.), which afterwards is mostly used for consumption by the low-income group of population, influencing the amount of VAT. Subgroup of transfers to the population in 2011 amounted to 32,4% of the expenditures of consolidated budget, while expenditures on goods and services of the state – 17,3% (Graph 3). During 2000-2010 the share of transfers to the population in budget expenditures ranged between 13,5% (in 2001) and 32,4% (in 2011) with an increasing tendency, expenditures on goods and services of the state – between 17,3% (in 2011) and 28,2% (in 2000) with a decreasing tendency in the past years (Graph 3). Since expenditures on goods and services of the state are not that volatile, but also influences on the amount of VAT levied, for the sake of modelling they are joined to the transfers to

the population (in the model the third group is called transfers to the population).

*Regression Analysis  
Modelling and assessing regression equations  
of budget revenues and GDP*

Modelling of 6 separate regression equations of endogenous variables of the model of the budgetary sector (1)-(6) based on theoretical background employing least squares (LS) method to the real data of Ukrainian economy with E. Views packet has given the following results.

*1. Estimation of PIT equation*

Modelling budget revenues from personal income tax (PIT) as the regression (1) of the model in a whole with respect to the designations of the variables mentioned in the above gave the following results. Dependence of PIT on the exogenous variables can be presented in the following equation (t-statistics is shown in the brackets):

$$\begin{aligned}
 PIT = & -98,96 + 0,347 * (SAL(-1) - SAL\_BUDG(-1)) * \\
 & (-0,60) \qquad \qquad \qquad (5,27) \\
 & ) * TR\_PIT(-1)/100 + 0,356 * SAL\_BUDG + 0,023 * P + \\
 & \qquad \qquad \qquad (8,94) \qquad \qquad (3,32) \\
 & + 748,4 * DUMMY\_CR + \varepsilon, \\
 & \qquad \qquad \qquad (1,72)
 \end{aligned} \tag{10}$$

$$\hat{R}^2 = 0,982, dW = 1,962.$$

This regression explains PIT revenues of the consolidated budget with the factors of salary, tax rate, profit, salary of budget sector employees and crisis impact on the economy during the period from the 4<sup>th</sup> quarter of 2008 till the end of 2009 on the level of 98,2%. From the coefficients of the equation above, the following conclusions can be drawn. Under 1 mln UAH growth of tax burden on PIT on incomes of budget sector employees, other conditions being equal, PIT revenues grow by 347 ths UAH, which is 34,7% of anticipated revenues from the tax, while under 1 mln UAH growth of salary of budget sector employees, PIT revenues grow by 356

ths UAH, which is 35,6% of the tax base. However, since under increase of the tax burden and worsening of macroeconomic conditions propensity to shadowing incomes in transition economies is rather high, during the periods of economic crisis incomes are getting shadowed and IT is levied proportionally on the budget and non-budget sectors employees. Thus, tax rate is the most influential regulator for tax revenues.

Under 1 mln UAH growth of profits of enterprises, other conditions being equal, PIT revenues grow by 23 ths UAH. The scope of the profit is important for modelling PIT revenues, since enterprises are the tax agents of this tax. Thus, the level of legal incomes and the taxes paid accordingly versus shadow economy depends on the level of profits of the enterprises. Though profit cannot serve as a policy regulator for PIT, the latter is an important macroeconomic indicator for tax modelling.

## 2. Estimation of VAT equation

Modelling budget revenues from value added tax (VAT) as the regression (2) of the model in a whole with respect to the designations of the variables mentioned in the above gave the following results. Dependence of VAT on the exogenous variables can be presented in the following equation (t-statistics is shown in the brackets):

$$VAT = -2429,6 + 0,135 * (CONS - IMP) - 3178,9 * EX / GDP + 0,121 * IMP + \quad (11)$$

(-0,85)
(6,32)
(-0,55)
(11,46)

$$+ 6608,0 * TR\_POPUL / EXPEN - 2460,9 * DUMMY\_CRI - 19052,3 * DUMMY\_2010\_3,$$

$$\hat{R}^2 = 0,957, dW = 2,048.$$

This regression equation explains VAT revenues of the consolidated budget with the factors of internal consumption, export, import, transfers to the population from the budget, and impact of financial and economic crisis on the level of 95,7%.

From the coefficients of the equation above, the following conclusions can be drawn. Under 1 mln UAH growth of import of goods, other conditions being equal, VAT revenues grow by 121 ths UAH, which is equivalent to 12,1% of the tax base, which is lower than basic rate on VAT, which amounts to 20%. The reason is preferential taxation, which is widely used for export operations.

The coefficients of the equation demonstrate that increasing transfers to population makes positive impact on the rise of VAT revenues since

mostly they are transferred to sustain the level of low income groups who use this aid for consumption of the goods of first need.

### 3. Estimation of EPT equation

Modelling budget revenues from enterprise profit tax (EPT) as the regression (3) of the model in a whole with respect to the designations of the variables mentioned in the above gave the following results. Dependence of EPT on the exogenous variables can be presented in the following equation (t-statistics is shown in the brackets):

$$\begin{aligned}
 EPT = & 515,2 + 0,039 * GDP(-1) + 0,244 * P(-1) * TR\_EPT(-1)/100 + \\
 & (1,44) \qquad (15,0) \qquad (4,54) \\
 & + 0,141 * D(INNOV\_GOV(-2)) - \qquad (12) \\
 & (1,07) \\
 & - 571,6 * Q_1 * PPI + 1064,4 * DUMMY\_CRI, \\
 & (-3,12) \qquad (1,48) \\
 & \hat{R}^2 = 0,917, dW = 2,170.
 \end{aligned}$$

This regression equation explains EPT revenues of the consolidated budget with the factors of tax rate on EPT, enterprise profits, GDP, increase or decrease of expenses on research-and-development, and seasonal peculiarities of tax administration on the level of 91,7%.

The coefficients of the equation demonstrate that EPT tax burden is 3,9%. Under 1 mln UAH growth of tax burden on EPT, other conditions being equal, in the following quarter EPT revenues grow by 244 ths UAH, which is less than increase in PIT revenues under change of tax burden on the latter tax. This misfit of tax rates efficiency is caused by the differences in book-keeping accounting and tax accounting according to which taxes are levied. Another reason is the amount of non-justified rebates and tax exemptions on EPT. Thus, there is need to shorten their amount and to shorten the disparities.

Though state expenses on innovation which are common in transition economies for facilitating innovative processes and creating innovative economies are still low and statistically insignificant, they start to influence on EPT revenues with positive impact.

Seasonality of the first and fourth quarters is the result of the norms and order of paying EPT. It causes uneven tax burden on the enterprises that in its turn may cause shadowing of incomes.

#### 4. Estimation of Excise tax equation

Modelling budget revenues from excise tax (Excise) as the regression (4) of the model in a whole with respect to the designations of the variables mentioned in the above gave the following results. Dependence of excises on the exogenous variables can be presented in the following equation (t-statistics is shown in the brackets):

$$EXCISE = 147,0 + 0,018 * (CONS - IMP) + 0,019 * IMP + 2726,3 * DUMMY\_09, \quad (12)$$

(0,90)
(4,28)
(10,28)
(9,04)

$$\hat{R}^2 = 0,962, dW = 1,739.$$

This regression equation explains excise revenues of the consolidated budget with the factors of internal consumption, import and impact of increase in excise tax rates in 2009 on the level of 96,2%.

For modelling VAT and excise revenues that are indirect taxes consumption is the main factor of influence. That is why these taxes are sensitive to the phases of economic cycles. Excise consists of excise on import and on export. After accession of Ukraine to WTO in 2005 import started to prevail on export.

From the coefficients of the equation above, the following conclusions can be drawn. Under 1 mln UAH growth of consumption of the goods produced in the economy, other conditions being equal, excise revenues grow by 18 t hs UAH, or 1,8% of the tax base, which can be interpreted as an efficient (real) rate of excise levied on the goods of internal production. Under 1 mln UAH growth of import of the goods produced in the economy, other conditions being equal, excise revenues grow by 19 t hs UAH, or 1,9% of the tax base, which can be interpreted as an efficient (real) rate of excise levied on the imported goods.

Test diagnostics by LM-test confirms correct specification of the regression equation.

#### 5. Estimation of regressions for other revenues

Modelling other budget revenues as the regression (5) of the model in a whole with respect to the designations of the variables mentioned in the

above gave the following results. Dependence of other budget revenues on the exogenous variables can be presented in the following equation (*t*-statistics is shown in the brackets):

$$REV\_OTH = 1337,7 + 0,100 * GDP - 4748,7 * DUMMY\_11 \quad (13)$$

(2,23)                 (26,70)                 (-3,16)

$$\hat{R}^2 = 0,950, dW = 2,473.$$

This regression equation explains other revenues of the consolidated budget through the scope of production in the economy and impact of changes in the tax legislation on the level of 95,0%.

Most of other tax revenues that are of the higher share in other budget revenues depend on the level of production of the goods in the economy since mostly they depend on the peculiarities of economic activities. From the coefficients of the equation above it can be concluded that under 1 mln UAH growth of production of goods and services, other conditions being equal, other budget revenues grow by 100 ths UAH, or 10,0%. Also as a result of the changes in tax legislation and amendments of the Tax Code of Ukraine other revenues of the consolidated budget decreased.

#### *6. Estimation of GDP equation*

Modelling GDP as the regression (6) of the model in a whole with respect to the designations of the variables mentioned in the above gave the following results. Dependence of GDP on the exogenous variables can be presented in the following equation (*t*-statistics is shown in the brackets):

$$GDP = 17169,2 + 1,037 * VAT / (TR\_VAT / 100) * (1 + (TR\_VAT / 100)) * (1 - EXPEN / CONS) +$$

(4,23)   (7,70)

$$+ 1,587 * EXPEN - 0,126 * EX - 11029,6 * DUMMY\_08 + 102728,3 * DUMMY\_2010\_3, \quad (15)$$

(7,42)                 (0,83)                 (-1,37)                                 (-6,28)

$$\hat{R}^2 = 0,980, dW = 2,079.$$

This regression explains the amount GDP with the factors of the amount of budget expenditures, export, absorption of private sector



(consumption and investments), as well as crisis impact on the economy on the level of 98,0%.

From the coefficients of the equation above, the following conclusions can be drawn. Under 1 mln UAH growth of budget expenditures on consumption and investments the amount of GDP grows by 1,59 mln UAH. Thus, the multiplier of budget expenditures amounts to 1,59, which stands for increase of GDP with higher growth rate than budget expenditures. This is the justification for the Keynesian effects in the economy of Ukraine.

Under 1 mln UAH growth of the amount of the absorption of private sector, which includes consumption and investments within the state from the side of the private sector, the amount of GDP grows by 1,04 mln UAH. Less than 1 mln UAH growth of export of goods and services, the amount of GDP grows by 126 ths UAH. Thus, external sector holds an important role in the economy, however, with the disproportions in the trade balance it is not the basic regulator of the economic state of the country. There is also evidence for negative impact of economic crisis on GDP.

Test diagnostics, LM-test in particular, confirms correct specification of all regression equations.

The justification of the main assumptions of econometric modelling within which are absence of autocorrelation, heteroskedasticity, multicollinearity, and correct specification of the equations is done with the help of internal econometric tests. Validity and reliability of the modelled equations are justified with the tests of Durbin-Watson, Fisher's criteria, LM-test of Breusch-Godfrey, for some regression equations if needed adjustment for Heteroskedasticity White test was done. Conclusion on absence of multicollinearity can be gained from the analysis of separate regression equations, since most of economically forecasted interrelations are justified with the results of assessment of equations. Correlation between the factors of separate equations is less than 80%, and the number of statistically insignificant variables is small.

### *Assessing the system of equations and solving simultaneous model*

Comparison of the results of assessment of the parameters of the simultaneous equation model (1)-(6) as whole with two-stage least squares

(2SLS) and three-stage least squares (3SLS) showed that 3SLS gives more accurate results for more consistent parameters, since determinants of covariance matrices of errors of 3SLS (1,74E+38) are less than of 2SLS (2,16E+38). Thus, 3SLS is applied for further assessment of the model.

Estimated model with 3 additional identities can be presented in the following form:

$$PIT = 71,6 + 0,31*(SAL(-1)-SAL\_BUDG(-1))*TR\_PIT(-1)/100 + \\ + 0,39*SAL\_BUDG + 0,02*P + 191,7*DUMMY\_CR \quad (16)$$

$$VAT = -1289,9 + 0,13*(CONS-IMP) + 0,12*IMP - 5868,4*EX/GDP + \\ + 6311,0*TR\_POPUL/EXPEN - 2052,1*DUMMY\_CRI - \\ - 18353,7*DUMMY\_2010\_3 \quad (17)$$

$$EPT = 530,1 + 0,04*GDP(-1) + 0,24*(TR\_EPT(-1)*P(-1)/100) + \\ + 0,17*d(INNOV\_GOV(-2)) - 624,8*QI*PPI + 1135,9*DUMMY\_CRI \quad (18)$$

$$EXCISE = 200,1 + 0,020*IMP + 0,016*(CONS-IMP) + \\ + 2741,5*DUMMY\_09 \quad (19)$$

$$REV\_OTH = 1147,0 + 0,102*GDP - 5548,5*DUMMY\_11$$

$$GDP = 20270,8 + 1,54*EXPEN + 0,006*EX + \\ + 1,177*(VAT/(TR\_VAT/100)*(1+(TR\_VAT/100))*(1-EXPEN/CONS)) - \\ - 6281,2*DUMMY\_08 + 103377,5*DUMMY\_2010\_3 \quad (21)$$

$$REV = PIT + EPT + VAT + EXCISE + REV\_OTH \quad (22)$$

$$EXPEN = INNOV\_GOV + TR\_POPUL + \\ + SAL\_BUDG + EXPEN\_OTH \quad (23)$$

$$BD = REV - EXPEN .$$

The results of estimation demonstrate that the model defines PIT revenues with the factors of salary, tax rate, profit, salary of budget sector employees on the level of 98,1%. It explains VAT revenues of the consolidated budget with the factors of internal consumption, export, import, transfers to the population from the budget on the level of 95,5%. The model explains EPT revenues of the consolidated budget with the factors of tax rate on EPT, enterprise profits, GDP, increase or decrease of expenses on research-and-development, and seasonal peculiarities of tax

administration on the level of 91,6%. It explains excise revenues of the consolidated budget with the factors of internal consumption, import and impact of increase in excise tax rates in 2009 on the level of 96,1%. It also explains other budget revenues through the scope of production in the economy and impact of changes in the tax legislation on the level of 94,6%. The model explains GDP with the factors of the amount of budget expenditures, export, absorption of private sector (consumption and investments) on the level of 97,9%, as well as factor of financial and economic crisis that makes impact on each endogenous component of the model.

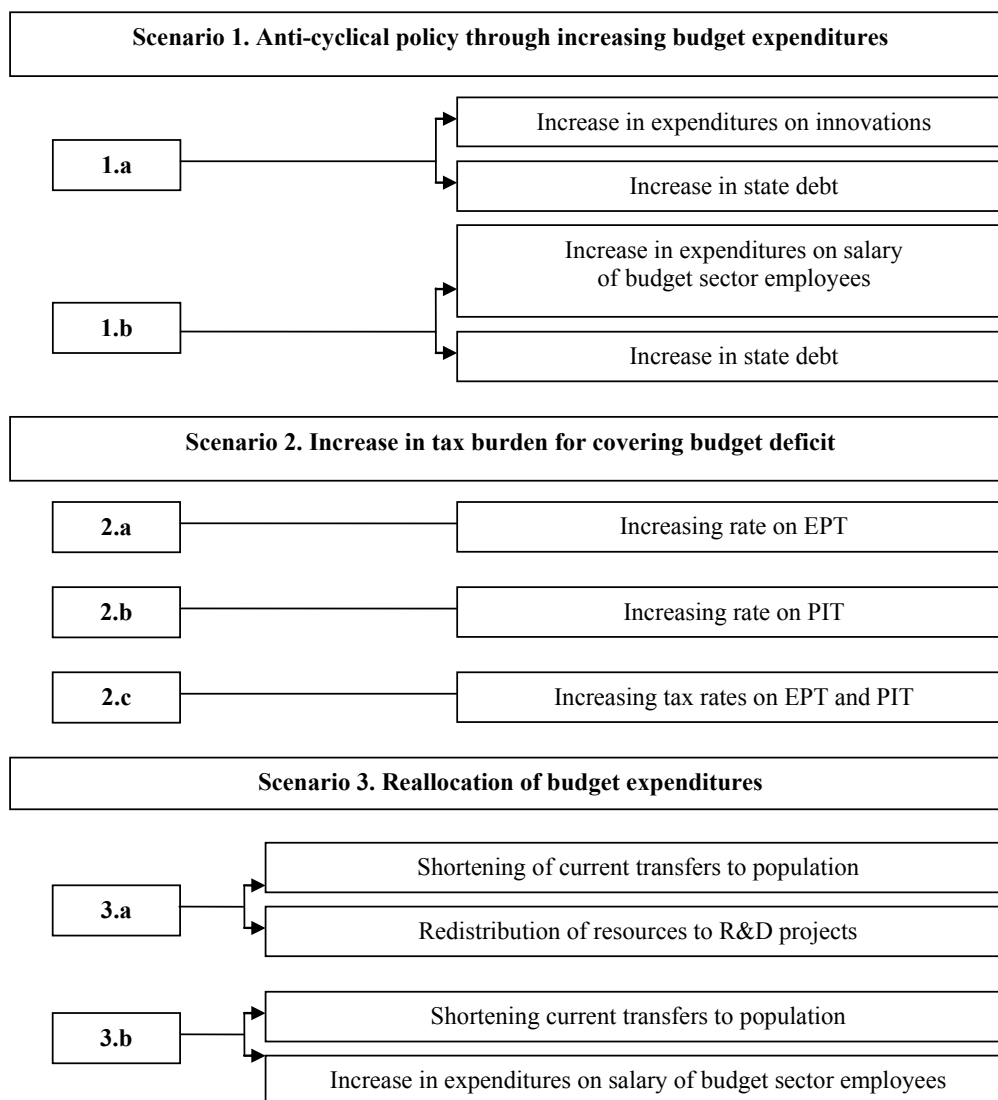
Assessment of the simultaneous model of 3 identities and 6 regressions applying Dynamic-Deterministic Simulation reflects that the series converge, which means that the model is steady and can be applied for forecasting, simulations, and developing scenarios of fiscal policy. The graphs also demonstrated that most of simulated data of endogenous variables accurately follow the real data.

The analysis of the forecasting capabilities of the model demonstrates that they are satisfactory for applying the model for forecasting. It is supported with the indicator of forecasting capability of the separate equations (MAPE), which is a relative indicator of accuracy of the model. According to it forecasting capability of PIT is good (the value of MAPE is 0,0897), and of EPT (0,1504), VAT (0,1754) and Excise (0,1541) taxes is satisfactory. Hence, forecasting capability of the model is satisfactory. The model is simulating all of the turning points of the data at a sufficient level and it is stable to insignificant changes in the parameters.

### *Scenario Analysis*

In order to compare the efficiency of certain instruments of fiscal policy in the economy of Ukraine, different scenarios of fiscal policy were simulated based on the model of the budget system. They are the scenarios that simulate anti-cyclical policy through increasing budget expenditures; the increase in tax burden for covering budget deficit, including changes in the tax rates of EPT and PIT; reallocation of budget expenditures through changing the proportions of budget expenditures, including shortening current transfers to the population; redistribution of the

resources to R&D projects or to salaries of the employees of budget institutions. (Graph 4)



**Graph 4.** Scenarios of fiscal policy in frames of macromodel of budgetary sector of Ukraine.

Graphic results of estimations of the scenarios have demonstrated that in the group of the scenarios implying the increase in the revenue side of the budget, scenario 1, which proposes to increase budget expenditures, is the most fiscally efficient. Increasing budget expenditures on salaries of the employees of budget institutions by 10% is the most efficient scenario out

of scenario groups 1, 2, and 3. The next efficient scenario is redistribution of budget resources from current transfers to the population (30% of the basic level) to salaries of the employees of budget institutions, and the next one is the alternative of applying the instrument of the tax rates. Under use of tax channels, changes of the tax rate of PIT allow gaining bigger changes in the budget revenues rather than changes of the rate of EPT. It is worth to mention that every scenario of the groups 1-3 is more efficient than the basic one.

Scenarios 1.b and 3.b that imply increase in budget expenditures and reallocation of budget expenditures from transfers to the population to salaries of the employees of budget institutions are equally efficient from the point of view of increase in revenues of PIT.

Scenarios 1.a and 2.a that imply increase in expenditures to R&D (1.a) in the first half of the forecasting period, and increase in tax rate of EPT (2.a) in the second half of the period respectively are more efficient from the point of view of increasing revenues of EPT. Overtaking temps of increase of revenues of EPT at the end of the forecasting period as a result of undertaking scenario 2 serves as an evidence that the instrument of tax rates on this tax is more efficient than increasing in budget expenditures on innovative projects absorbed in the economy.

Reallocation of expenditures of salaries of the employees of budget institutions (scenario 3.b) can be efficiently applied in order to decrease the difference in revenues and expenditures (comparing to the basic scenario); applying the instrument of tax rates, in particular rate of PIT (scenario 2.b) is also rather efficient.

From the analysis of scenario realizations the following conclusions can be drawn. Three alternative fiscal policy directions were proposed. Reallocation of budget expenditures from transfers to population to salaries of the employees of budget institutions, as well as changes in the tax rates are the most efficient instruments from the point of view of the resources mobilized. The highest fiscal efficiency of changing tax rate of PIT serves as evidence that PIT is the most sensitive in a sense of changing the scope of budget revenues. It is worth to mention that the comparison of the alternatives depends on the scope of resources redistributed and the size of changes in the tax rates.

The choice of combinations of fiscal policy instruments might have multiple options. Besides changing budgetary and tax components, scenarios might imply different macroeconomic conditions in the forecasted period. Constructing scenarios involves elaborating optimistic and pessimistic scenarios of economic conditions and the alternative

packages of macroeconomic indicators. Thus, scenario analysis allows assessing the efficiency of certain fiscal policy instruments under given economic conditions, as well as forecasting the variance of the future budget revenues which serves to assess possible risks related to under-levied revenues caused by slow recovery or worsening of economic conditions in the state.

#### **4. Discussion**

The results of the research, among other conclusions, confirmed Keynesian type of effects in the Ukrainian economy at its current transformational stage of development. Recently after financial and economic crisis, many researchers have confirmed the same effects in other economies, both in developed and transition economies, which make the conclusions of this research stand in line with international evidence and theoretical implications.

However, to apply fiscal policy instruments in order to attain economic effect, a number of reforms have to be undertaken to support economic system of Ukraine with better functioning of transmission mechanism.

It is worth mentioning, that this research is aimed at modelling budgetary sector of Ukraine. Thus, it is modelling interrelations exclusively between budgetary sector and real economy and among their components. The model does not take into consideration interrelations with other sectors, monetary and external in particular. Modelling the system of all interrelations within the economy could contribute to the accuracy of coefficients mentioned above. However, this model would be more complex, and not all the interrelations could be possible to model, which may worsen the accuracy of the impacts modelled.

Also the state of the world or local economy that influence budgetary sector, as well as the other exogenous variables that may be necessary for the model proposed in the research, are to be estimated and forecasted with the use of external models that are subject of another research.

With the use of the model proposed in the research, it is possible to replicate the research with the data of the other economies. Replication of quantitative estimation of the parameters of interrelations in the budgetary sector primarily would need conducting the analysis of qualitative

interrelations, based on the peculiarities of tax and budgetary system of a particular country.

## 5. Conclusions

Economic fluctuations in the developed and transition economies during the recent century, as well as recent sovereign debt crisis of the leading world economies has proved a necessity of continuous improvement and adjustment of fiscal policy to current macroeconomic conditions in the economy. Hence, it is highly topical to focus on investigating actual interrelations between fiscal policy and the state of the economic system of Ukraine, which is still being on the stage of transformation. Conducting efficient economic policy demands considering the features that are inherent to the economic system, as well as exploring the mechanisms involved in the economic processes of Ukraine. They should serve to explain the way tax and budgetary systems of the state should be arranged, as well as to suggest a justified choice of economic policy instruments applied that support economic development.

Providing further development of methodological principles of conducting fiscal policy is important for making balanced fiscal policy decisions. However, there is insufficient use of economic-mathematical tools among the researchers on the budgetary sector of Ukraine, which would allow estimating quantitative and qualitative characteristics of the budgetary sector and corresponding interrelations between budgetary and economic indicators that serve to estimate the efficiency of different instruments of fiscal policy. In order to achieve the aims of socio-economic development of the state, conducting effective fiscal policy has to involve complex and regular evaluation of interrelations in the budgetary and economic systems, including macroeconomic indicators. Methodology of macroeconomic modelling, in particular simultaneous equations modelling (SEM), allows providing the assessments.

Budget revenues as an instrument of fiscal policy accomplish important fiscal and regulative functions. They are measured with capability of the budgetary system to levy taxes and duties in order to provide accomplishment of the fiscal function by the state, and at the same time to regulate economic processes in the state by changing tax rates, tax base, tax preferences and the character of administering tax system. Thus, the character of the tax preferences employed may stimulate the

development of certain industries, which at the same time understate budget revenues. The choice of optimal rates for each tax is a key task in implementing fiscal function of the state, simultaneously serving as a regulator of the economic processes and redistribution of financial resources in the state. At the modern stage of development of the Ukrainian economic system, the efficiency of tax policy should include the expansion of the tax base, which is possible under conditions of decline of the level of shadow economy, as well as tax preferences should be economically grounded in order to encourage investments and innovations.

Investigation of interrelationships in the budgetary system of Ukraine suggested the following results. There are tight relationships inherent to budgetary sector and real economy of Ukraine. They were subject of analysis based on applying SEM approach. Results of assessment of interrelations reflected that Keynesian effects of fiscal policy on economic development are justified in the economy of Ukraine. Thus, in Ukraine with economy at transformation stage, fiscal adjustment tends to be contractionary. This result is coherent with Carmignani's [5] investigations.

Performance of personal income tax depends on the following macroeconomic factors: the amount of salaries in the economy, enterprise profits and the level of the tax rate. Macroeconomic factors that influence the performance of enterprise profit tax are the amount of enterprise profits, gross domestic product, expenditures on innovation activities that are absorbed in the economy, the level of the tax rate and the administrative issues of levying the tax. Performance of value added tax depends on the following macroeconomic factors: the amount of internal consumption, import, export, transfers to the population from the budget. Macroeconomic factors that determine the performance of excise are the amount of internal consumption and import, and of the other budget revenues — the amount of goods and services produced in the country. Financial and economic crisis has negatively influenced the amount of the taxes levied.

Scenario analysis has justified that tax rates are an efficient instrument in mobilizing financial resources. From fiscal point of view tax rate of personal income tax is more efficient than the rate of enterprise profit tax. Low level of real tax rate of the enterprise profit tax comparatively to the nominal one serves as an evidence of the necessity to reform the system of income taxation. Preferential tax treatment of enterprise income should be transparent and justified based on an objective



demand of support of certain industries and enterprises. Determining the tax base of income tax should be done based on the universal principles of taxation. Improving tax administration should serve to remove the schemes of avoiding income taxation and obtaining budgetary compensations of fake tax credit of VAT. Determining the level of tax rates and tax base of excise tax should be done based on the financial and regulatory rationale.

Budget revenues and expenditures are highly interrelated with macro-economic indicators. In the structure of GDP of Ukraine, consumption remains the main constituent of the economy. However, investments should be basic for providing economic development, which should be supported with different activities and stimulus, including fiscal ones. Negative dynamics of trade balance of Ukraine is caused by losing a part of target markets and recent decreasing prices on the basic export products of Ukraine on the world markets, combined with the lack of competitive import substitutive products produced in the economy. Growth of per capita incomes comparatively to the world indicators and the level of declared income of enterprises is still low, which stipulates low base of taxation on the majority of taxes. Thus, in order to achieve sustainable economic development, coherent tax system should serve to improve trade balance and stimulate investment activities (which constitute a tax base of excise tax and duty), as well as to raise incomes of population and enterprises, and thus, of product consumption (which constitute a tax base of taxes on incomes and consumption).

Under current economic conditions in Ukraine budget expenditures may stimulate economic activities, this being confirmed by the Keynesian effects in the economy of Ukraine at the present stage of economic development. In order to promote long-term economic development, a part of budget expenditures should be effectively allocated in research-and-development, which stimulates economic development. Changing the structure of budget expenditures implies reducing budget transfers to the population and enterprises. Hence, pension systems should be reformed in order to provide autonomous functioning of Pension Fund of Ukraine.

However, a huge scope for further research remains. The data used within the analysis of this paper does not give an answer on the impact of shadow economy within this model. Also, further research can be conducted to apply the approach suggested to modelling the interrelations in other transition economies and compare the results attained. Finally, further development of the study can be done through dynamic modelling combining SEM with ECM.

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