Fiscal Policy in a Decentralized Space of the Financial System of Ukraine

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Abstract: The article deals with fiscal policy in the decentralized space of the financial system of Ukraine. The methodology of complex, systematic assessment of fiscal policy in the decentralized space of the financial system of the state is grounded. It is proved that effective methodological approach to assessing fiscal policy in the decentralized space of the financial system of the state is a vector auto regression (VAR), which provides dynamic correlation of time series with simultaneous determination of each exogenous and endogenous variable in the system, in case of fiscal impulses (shocks) in economy. The production-institutional function is used which, when adapting to the relationship between GDP and tax burden with specific statistics, changes the type of trend of tax revenue. A method for evaluating the effectiveness of financing targeted programs for decentralized territory has been developed. The dynamics of direct and indirect taxes to the state and local budgets are analyzed and the fiscal significance of VAT in GDP, the state budget and tax revenues of Ukraine is determined. The amount of tax debt and the state budget deficit has been estimated and the structure of tax benefits in terms of taxes and fees in Ukraine is presented. The projected values of real tax revenues per capita are substantiated and the forecast parameters of the level of subsidization of local budgets of decentralized territories are given.

Keywords: Fiscal policy, tax revenues, value added tax, state budget, decentralized territory.

INTRODUCTION

Modernization transformations in the economies and financial systems of developing countries are complicated by ineffective fiscal policy mechanisms that, under the influence of financial and economic turmoil, exacerbate excessive financialisation and offshore capitalization. At the same time, based on the fiscal policy component, namely the tax sphere, it should be noted that it sets the vector of economic processes development, smoothes the effects of economic crises, increases the competitiveness of the economy, is the basis for governmental decisions on financing state programs, equalizing population income, performing social functions equality. However, successful implementation of tax functions is possible only if a well-established tax mechanism, the end results of which are to increase the volume and efficiency of the use of financial resources, even in conditions of financial instability and crisis.

Fiscal policy, which has a spatio-temporal gap between the rapidity of economic processes and policy decisions in the tax field, leads to asymmetry and deepening of divergence of regulatory levers in the decentralized space of the financial system of the state. Moreover, the increasing volatility and uncertainty of the economic environment leads to the accumulation of problems that exacerbate the crisis manifestations of structural imbalances and cyclical downturns in the financial system in regions that require additional budgetary expenditures and adequate (non-emission) financial security to maintain the stability of the economy of the state.

The following scientists have made significant contribution to the development of theoretical and practical foundations of fiscal policy: O. Blanchard and R. Perotti (2002), N. Chalk and R. Hemming (2000), C. Gunter *et al.* (2012), J. Von Hagen and I. Harden (1995), M. Horton and A. El-Ganainy (2009), E. Ilzetzki (2009), M. Jens (2011), A. Krysovatyy, A. Gospodarowicz and M. Slatvinska (2016), V. Muscatelli and P. Tirelli (2005), I. Sanz and F. Velasquez (2003), D. Swain (1987), V. Tanzi (2004, 2005, 2006), J. Wilson and D. Wildasin (2004) and others. Issues of

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modernization of economy, economic and financial systems were discussed in the works of the following scientists: R. Barro and X. Sala-i-Martin (1992), J. Buchanan (1967), S. Cacchetti (2002), J. Kilponen, H. Laakkonen and J. Vilmunen (2015), J.L. Lambertini and R. Rovelli (2004), A. Lerner (1943), I. Lukianenko and O. Faryna (2016), J. O Mierau, R. JongA-Pin and J. de Haan (2007), R. Musgrave and P. Musgrave (1989), E. Nell and M. Forstater (2003), W. Turbeville (2013), D. Vankovych (2014), M. Yermoshenko (2001) and others.

While paying due attention to the scientists on the issues of fiscal policy, it should be noted that the achievement of the goals of the socio-economic development of the state and the creation of appropriate conditions for this, necessitates the development of a comprehensive methodology for the effectiveness of fiscal policy and its adaptability to the realities of economic space. At the same time, the modernization of the financial system necessitates the objective need to develop a new concept of fiscal policy, specifying the principles of its formation and implementation, as well as the strategic priorities for the use of rational combination of state and market regulators of socio-economic development. Particular attention needs to be paid to identifying exogenous and endogenous factors that summarize and eliminate the internal and external contradictions of the fiscal space in the development of a new decentralized financial system of the state, the effectiveness of which is an indicator of the effectiveness and adaptability to fiscal policy. The priority of our research is to substantiate the methodology of a comprehensive, systematic assessment of fiscal policy in the decentralized space of the financial system of the state. It takes into account the cycles of transformation of the tax component, which is a dominant in the formation and redistribution of financial resources of the state and local budgets, which from the point of view of influence of financial policy on the macroeconomic process, creates the terms of effective funding of targeted programs for decentralized territories.

MATERIALS AND METHODS

The functioning of each of the structural components of fiscal policy and the identification of their impact on the socio-economic development of the state requires modernization in the context of decentralization of the financial system, since its stimulation through centralized management of financial resources is considered irrational (deficiencies in administration of taxes, inefficiency of budget expenditures and financial management of extra budgetary funds), which leads to a decrease in the potential value of fiscal multipliers. Accordingly, if the additional fiscal stimulus does not result in GDP growth, then it indicates that fiscal instruments are not able to smooth social conflicts, increase the competitiveness of the economy and overcome the effects of economic crises (Krysovatyi and Valihura 2004). To reflect the structural relationships between the components of fiscal policy, systemic dynamics methods are used which, through the construction of simulation models, allow determining the change of quantitative parameters of the decentralized financial system at the state and local level in order to solve socio-economic problems and stabilize economic development (Lukianenko and Faryna 2016).

One of the most effective methodological approaches to assessing fiscal policy in the decentralized space of the financial system of the state is vector auto regression (VAR), which provides a dynamic correlation of time series with the simultaneous determination of each exogenous and endogenous variable in the system, in the event of fiscal impulses (shocks) in economy. It is a system of equations with a linear combination of all variables. The vector autoregressive model (VAR) includes two variables with log 1. In this case, the number of equations is equal to the number of variables in system (1), providing a formalized interpretation of the results of the estimation (Bannikov 2006) (Eq. 1):

$$\begin{cases} x_{t1} = \alpha_{10} + \alpha_{11} x_{t-1.1} + \alpha_{12} x_{t-1.2} + \varepsilon_{t1} \\ x_{t2} = \alpha_{20} + \alpha_{21} x_{t-1.1} + \alpha_{22} x_{t-1.2} + \varepsilon_{t2} \end{cases}, \quad (1)$$

where, α_{10}, α_{20} – the free parameters; α_{ij} – autoregression parameters ($ij = 1, 2$); $\varepsilon_1, \varepsilon_2$ – mutually uncorrelated "white noise". Generally, for *k* variables and the number of lags *p*, the autoregressive model (VAR) has the form (Eq. 2) (Bannikov 2006):

$$\begin{cases} x_{t1} = \alpha_1 + \alpha_{11}^{[1]} x_{t-1.1} + ... + \alpha_{1k}^{[1]} x_{t-1.k} + \alpha_{11}^{[2]} x_{t-2.1} \\ + ... + \alpha_{1k}^{[2]} x_{t-2.k} + ... + \alpha_{11}^{[p]} x_{t-p.1} + ... + \alpha_{1k}^{[p]} x_{t-p.k} + \varepsilon_{t1} \\ x_{t2} = \alpha_2 + \alpha_{21}^{[1]} x_{t-1.1} + \alpha_{2k}^{[1]} x_{t-1.k} + \alpha_{21}^{[2]} x_{t-2.1} \\ + ... + \alpha_{2k}^{[2]} x_{t-2k} + ... + \alpha_{21}^{[p]} x_{t-p.1} + ... + \alpha_{2k}^{[p]} x_{t-p.k} + \varepsilon_{t2} \\ ... \\ x_{t2} = \alpha_k + \alpha_{k1}^{[1]} x_{t-1.1} + \alpha_{kk}^{[1]} x_{t-1.k} + \alpha_{k1}^{[2]} x_{t-2.1} \\ + ... + \alpha_{kk}^{[2]} x_{t-2k} + ... + \alpha_{k1}^{[p]} x_{t-p.1} + ... + \alpha_{kk}^{[p]} x_{t-p.k} + \varepsilon_{tk} \end{cases}, \quad (2)$$

or in a vector-matrix entry (Eq. 3):

$$\begin{pmatrix} x_{t1} \\ x_{t2} \\ \dots \\ x_{tk} \end{pmatrix} = \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \dots \\ \alpha_k \end{pmatrix} + \begin{pmatrix} \alpha_{11}^{[1]} \dots \alpha_{1k}^{[1]} \\ \alpha_{21}^{[1]} \dots \alpha_{2k}^{[1]} \\ \dots \\ \alpha_{k1}^{[1]} \dots \alpha_{kk}^{[1]} \end{pmatrix} \times \begin{pmatrix} x_{t-1.1} \\ x_{t-1.2} \\ \dots \\ x_{t-1.k} \end{pmatrix} + \dots + \begin{pmatrix} \alpha_{11}^{[p]} \dots \alpha_{1k}^{[p]} \\ \alpha_{21}^{[p]} \dots \alpha_{2k}^{[p]} \\ \dots \\ \alpha_{k1}^{[p]} \dots \alpha_{kk}^{[p]} \end{pmatrix} \times \begin{pmatrix} x_{t-p.1} \\ x_{t-p.2} \\ \dots \\ x_{t-p.k} \end{pmatrix} + \begin{pmatrix} \varepsilon_{t1} \\ \varepsilon_{t2} \\ \dots \\ \varepsilon_{tk} \end{pmatrix}, \quad (3)$$

For each matrix the quantities by which equation (4) (Bannikov 2006) is formed are determined:

$$X_t = \alpha + A^{[1]} \times X_{t-1} + \dots + A^{[p]} \times X_{t-p} + \vec{\varepsilon}, \quad (4)$$

It should be noted that VAR modeling allows estimating the critical parameters of fiscal impulses (shocks) in the financial system of the state and local budgets of the country, which have a decentralized vector of territorial development. The use of the "impulse response function" distinguishes the fiscal component of fiscal policy, which has an endogenous impact on the macroeconomic environment as a whole. At the same time, fiscal impulse is an indicator that measures the direction and intensity of fiscal policy and is calculated as (Eq. 5) (Heller, Haas and Mansur 1986, Konovalenko 2017):

$$FI = FI_0 - FS = \left[R_0 \left(\frac{Y_{po}}{Y_0} \right)^{Yr} - G_0 \left(\frac{Y_{po}}{Y_0} \right)^{Yq} \right] - \left[R \left(\frac{Y_p}{Y} \right)^{Yr} - G \left(\frac{Y_p}{Y} \right)^{Yq} \right], \quad (5)$$

where, FI – is the fiscal impulse; FS – fiscal position (cyclically-adjusted fiscal balance); R – state revenues; G – government expenditures; Y – actual GDP; Y_p – potential GDP; Y_r – elasticity of government revenues to GDP; Y_q – elasticity of government spending to GDP; 0 – base year index. It shows how the government's political decisions affect the economy (improving the economic situation, deepening the crisis). Its positive value indicates that the current policy is expansive, negative – restrictive. We propose to use VAR modeling to estimate the linear relationship of fiscal multipliers, with the additional use of the SVAR model (Eq. 6) (Blanchard and Perotti 2002, Buchanan 1967):

$$Y_t = \sum_{j=1}^{p} D_p Z_t + \sum_{i=1}^{k} C_i Y_{t-i} + U_t, \quad (6)$$

where, $Y_t = [T_t, G_t, X_t]^{"}$ – is a three-dimensional vector of observations of taxes, budget expenditures and GDP; $U_t = [t_t, g_t, x_t]^{"}$ – vector of distributed residues according to the standard without zero correlation; Z_t – vector of exogenous variables having deterministic components (seasonal variables, linear and quadratic trends, dummy variables describing excessive deviations or cyclical recessions in time series) and endogenous variables of economic development; C_t – coefficients of endogenous variables; D_p – coefficients of exogenous variables. After estimating the parameters of model (6), the fiscal impulses (shocks) of the decentralized financial system are estimated (Buchanan 1967) (Eq. 7):

$$\begin{aligned} t_t &= a_1 x_1 + a_2 e^q t + e_t^t \\ q_t &= b_1 x_t + b_2 e_t^t + e_t^q \\ x_t &= c_1 t_1 + c_2 q_t + e_t^x \end{aligned}, \quad (7)$$

where, e_t^t, e_t^q, e_t^x – mutually uncorrelated fiscal impulses (shocks), with a single variation.

The coefficients a_1, b_1, c_1 due to endogenous variables cannot be estimated without replacing them, since GDP, budget expenditures and taxes within one quarter interact. Identifying restrictions are used to overcome this situation. Accordingly, from the point of view of the function of budgetary losses from fiscal impulses (shocks), the state tries to develop such fiscal policy in the decentralized space of the financial system, in order to have a compromise choice between financial losses and inflation. The function of budgetary losses from fiscal impulses (shocks) in the state has the following form (Eq. 8) (Heller, Haas and Mansur 1986):

$$L_F = \frac{1}{2} \left[\pi_1^2 + \alpha_{xf} (x - \bar{x})^2 + \alpha_{yf} (y - \bar{y})^2 \right], \quad (8)$$

where, π_1^2 – the square of the deviation of the inflation level from the optimal value. In order to simplify the assessment, but without losing the overall size of the fiscal component in the fiscal policy structure, the optimal inflation rate is assumed to be zero. Expression $(x - \bar{x})^2$ – shows the square of deviation of the state of the strategic size of the state and local budgets from their optimal value in the decentralized financial system of the country, which should be equal to the value of 0. Indicator $(y - \bar{y})^2$ – the square of the deviation of the volume of budget revenues from fiscal impulses (shocks) in the state. The sensitivity coefficients α_{xf} and α_{xy} characterize the respective priorities of the state for the formation of strategic budget surplus and the volume of losses. The coefficient of sensitivity, taking into account the inflation rate, is normalized to one.

We believe that the assessment of the effectiveness of fiscal policy in the decentralized space of the financial system depends on the level of business activity of the state. Therefore, in the calculation it is necessary to take into account the production-institutional function of the following form (Eq. 9) (Balatskiy 2003):

$$Y = \gamma \times DK^{(a+bd)q} \times L^{(n+mq)q}, \quad (9)$$

where, Y – output (GDP of the country); κ – capital (volume of fixed assets); L – labor (number of people employed in the economy); q – tax burden (relative tax burden, calculated as a share of tax revenues T in GDP, $q = T / Y$); D – trend operator (time-dependent function *t*); γ, a, b, n, m – parameters that are estimated statistically based on retrospective time series. Variables Y, K, L and q are taken over the respective years *t*.

Function (Eq. 10) allows forming a production curve, which is displayed as a relation between GDP and tax burden and is described in this way (Balatskiy 2003):

$$T = \gamma \times q \times DK^{(a+bd)q} \times L^{(n+mq)q}, \quad (10)$$

Lafer fiscal point 1-th (cost-effectiveness point) corresponds to the maximum point of the production curve (10) when $dY / dq = 0$. For function (10), a Lafer point 1-th has the form (Eq. 11):

$$q^* = -\frac{1}{2} \times \frac{n \ln L + InK}{2m \ln K + b \ln K}, \quad (11)$$

Laferfiscal point 2-th (fiscal sufficiency point) is determined similarly and shows the maximum point of the fiscal curve (11) when $dY / dT = 0$. This formula has the form (Eq. 12):

$$q^{**} = -\frac{1}{2} \times \frac{\pm\sqrt{(n \ln L + \alpha \ln K)^2 - 8(m \ln L + b \ln K)} - n \ln K - \alpha \ln K}{m \ln L + b \ln K}, \quad (12)$$

Thus, when the tax burden is set at the optimum level, due to the effect of market incentives, the entrepreneurial initiative in the decentralized territories (regions) is activated, which provides the expected rates of economic growth at the level of maximum tax revenues. A positive aspect of production-institutional functions is the variability of the tax component in the fiscal cycle, which, when adapted to dependence (9) on specific statistics, changes the type of trend in the tax revenue trend (Balatskiy 2003). However, it should be noted that the sensitivity of the economic development trend to the tax burden in the country is dynamic, which changes from year to year. Raising the tax burden is only appropriate when the redistribution of GDP generates much more of the latter's growth. Otherwise, raising the tax burden is inappropriate. If there is a lack of tax and debt security in the state due to the lack of sources of financing expenditures, then it is necessary to review the size and structure of the latter.

Regarding the fiscal effect, it should be noted that the government's inconsistent policy regarding medium-term financial resources management – excessive discretion (and the temporary nature of impulses) threatens the long-term sustainability of the decentralized financial system (Petrakov 2016). At the same time, fiscal stability of the state is revealed in mechanisms based on the national interests of society and minimize the threats that occur in the destabilization of the financial system. At the same time, the stability of the fiscal system is conditioned by the ability to respond adequately to the influence of exogenous and endogenous factors that destroy the structure of the system over a long period. Therefore, when assessing the fiscal sustainability of the state, it is necessary to proceed from the level of adequacy of financial resources and the magnitude of their redistribution between decentralized territories, which are able to use tax revenues rationally and effectively.

In accordance with the recommendations of the International Monetary Fund (IMF), the fiscal stability of the country is assessed by the following indicators: the ratio of government debt to GDP; the ratio between the debt to GDP and the net present value of cash flow to the budget (*NPV*); debt-to-export ratio (*NPV*); the ratio of debt to the state budget; debt-to-export ratio; debt ratio to government revenue ratio (International Monetary Fund 2017, The IMF Databases 2019). At the same time, it is important to form a curve of aggregate demand and supply for monetary resources and to assess the impact on them of the fiscal components of fiscal policy in the short and long term, taking into account the pace of changes in commodity and money markets. This will combine the market rate of interest (*R*) and income (*Y*), which simultaneously ensure equilibrium in the above markets. A logarithmic-linear combination of expression (Eq. 13) is used to identify the fiscal effect that takes into account the functional dependence of aggregate supply and demand (Yermoshenko 2001):

$$\begin{aligned} & y_t = a_1(m_t - p_t) - a_2(e_t + p_t^* - p_t) + u_t \\ & y_t = b_1(m_t - p_t) - b_2(e_t + p_t^* - p_t) - b_3 r_3 + b_4 q_t - b_5 y_t + \varepsilon_t; \\ & m_t - p_t = c_1 y_t - c_2 r_t; \\ & b_2(e_t + p_t^* - p_t) - b_5 y_t + k(r_t - r_t^*) = 0 \end{aligned}, \quad (13)$$

where, y_t – income; m_t – money supply; r_t, r_t^*, p_t, p_t^* – respectively interest rate and price level in the

country and abroad; e_t – nominal exchange rate; q_t – budget deficit; u_t, ε_t – macroeconomic shocks of aggregate supply and demand.

The interim fiscal effect is described in general terms by the optimization function of private consumption (Eq. 14) (Martyniuk 2010):

$$V(G_0, G_1, T_0, T_1) = \max U(C_0, G_0) + \delta U(C_1, G_1), \quad (14)$$

according to restrictions (Eq. 15):

$$C_0 + \alpha_1^p C_1 = (\overline{Y}_0 - T_0) + \alpha_1^p (\overline{Y}_1 - T_1) + (1 + r_{t-1}^p) \times B_{t-1}^p = W_0, \quad (15)$$

where, α_1^p is the discount factor for consumption in the private sector; $T_0, G_0, C_0, T_1, G_1, C_1$ – taxes, government expenditures for consumption in the current and future time periods; $\overline{Y}_0, \overline{Y}_1$ – current and future value of income equilibrium; r^p – interest rate; B^p – private sector debt; W – total consumption (for the sum of two periods).

Private consumers maximize the utility function by choosing such a trajectory of consumption in the current and future periods, which takes into account changes in the levels of spending and the formation of state and local budget revenues. Unlike the traditional Mandell-Fleming model, where budget deficits directly affect the exchange rate (through capital inflows), private consumption stands in the interim models. At the same time, the budget deficit is complementary to private investment, which provides the potential for GDP growth in the longer term (Martyniuk 2010). Therefore, in exploring the impact of the fiscal effect on macroeconomic indicators, it is necessary to use two functional models: with investment and interest rate, because the inflow of capital not only balances the difference between savings and investment, but also ensures the sustainability of the economy of the state as a whole, thus forming independence donor countries in the capital market. It is proposed to calculate the consolidated indicator of estimation of the level of achieved fiscal results by the formula (Eq. 16):

$$R_{ef} = \sum R_i \times PT_i + R_i \times E_i, \quad (16)$$

where: E – government expenditures; R – indicator of the result of budget revenues; PT – tax potential.

It should be noted that the fiscal effect cannot be achieved without the coordination of actions of public authorities at all levels, as well as without the introduction of innovations and modern digital technologies, which allow to regulate the movement of financial resources for raising taxes, reducing non-priority expenditures, obtaining external grants and loans. However, such measures should take place without prejudice to the macroeconomic stability and stability of the financial system of both the state and decentralized territories. This proves that in the short and long term there is an objective need to financially support targeted spending programs, cover the state budget deficit, the Pension Fund of Ukraine (PFU) budget deficit and debt service.

From the point of view of asymmetry of socio-economic development and the level of social tensions that may arise in the country, there is a need to introduce a program-targeted method and methodology for evaluating the effectiveness of financing targeted programs of decentralized territories, by using a system of coefficients that determine: the amount of use of financial resources formed at the expense of tax revenues and involved in the implementation of the program; efficiency of use of financial resources for program implementation (Figure **1**). To quantify the lagged fiscal effect on per capita tax revenues that affect the predicted level of subsidization of local budgets in decentralized territories, we propose to use a distributional lag model (distributed lag model), which is an econometric model, the right part of which contains not only the current but also the previous (lag) values of the independent variables (Eq. 17):

$$y_i = \alpha + \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + ... + \beta_k x_{t-k} + \varepsilon_t, \quad (17)$$

where, y_i – the level of fiscal effect on the volume of tax revenues per capita (subsidy level) of decentralized territory in the t reporting period (quarter); $x_t, x_{t-1}, x_{t-2}, x_{t-3}$ – the volume of tax burden per capita of decentralized territory, respectively, in the period $t, t-1, t-2, t-3$. In the general case, the distribution-lag model (distributed lag model) can be represented as follows (Eq. 18):

$$y_i = \alpha + \sum_{y=0}^{k} \beta_k x_{t-k} + \varepsilon_t, \quad (18)$$

Moreover, the value β_0 is a short-term or influential multiplier that characterizes the effect of a factor trait on the resultant indicator at time t. Accordingly, the magnitude $\beta_0 + \beta_1$ characterizes the influence of x on y in the period $t+1$; $\beta_0 + \beta_1 + \beta_2$ – in the period $t+1$ and so on.

The aggregate parameter is a long-term distributive-lag multiplier (Eq. 19):

$$\beta = \sum_{r=0}^{k} \beta_r \quad (19)$$

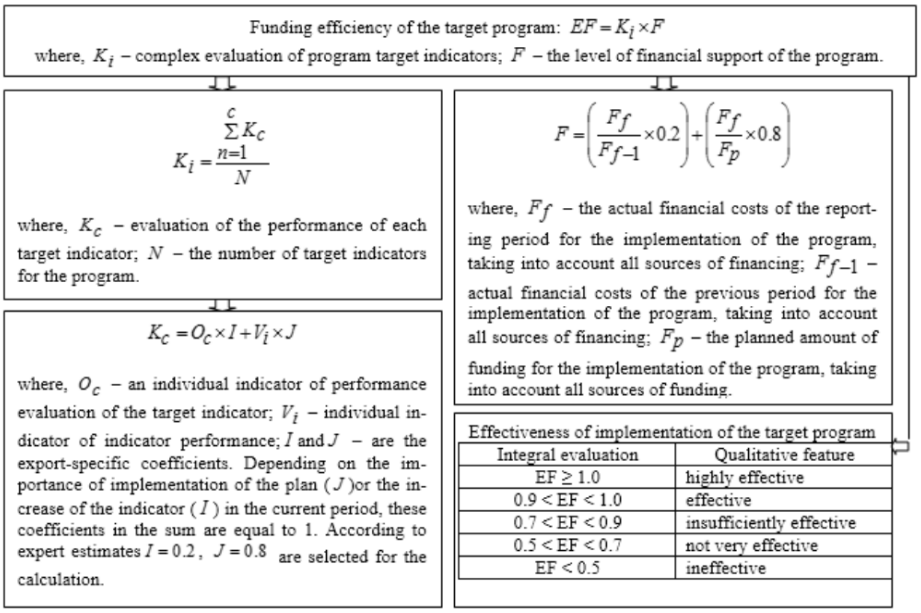

Figure 1: Methodology for evaluating the effectiveness of financing the targeted program of decentralized territory.
Source: developed by the authors

Any sum of the coefficients (19), $x \le k$ is an intermediate multiplier. To determine the factor changes in the duration of the fiscal effect (tax revenues per capita in the local budgets of decentralized territories) to the resultant indicator (predictive level of subsidization), the Alta-Tinberger method (method of consistent estimates of distribution-lag models) is used, with an indefinite number of lags. That is, in the first stage, the model is evaluated and so on until: you include in the model a new lag variable, one of the coefficients β_k will not change to the opposite sign. In this case it is advisable to include the variables: $x_t, x_{t-1}, x_{t-2}, x_{t-k+1}$; the following lag variable is included in the model, the parameters β_k cease to be statistically significant (Eqs. 20-21):

$$y_t = f(x_t, x_{t-1}, \varepsilon_t), \quad (20)$$

$$y_t = f(x_t, x_{t-1}, x_{t-2}, \varepsilon_t) \quad (21)$$

That is, only lag variables, the coefficients of which are significant should remain in the model, namely: $x_t, x_{t-1}, x_{t-2}, x_{t-k+1}$. If the value of the lag variable for 2-3 periods from the moment of observation has a greater influence on the result than the current or previous value of the variable (i.e. $\beta_2, \beta_3 \ge \beta_0, \beta_1$), then the parameters β, can be represented by the function of the duration of the lag. Curves reflecting this functional dependence for the distribution-lag model (Eq. 22):

$$y_i = \alpha + \sum_{y=0}^{k} \beta_k x_{t-k} + \varepsilon_t \quad (22)$$

will be estimated using models of type (Eq. 23):

$$y_t = f(x_t, x_{t-1}, x_{t-2}, x_{t-3}, \varepsilon_t). \quad (23)$$

We assume that β_0 can be approximated by a polynomial of *m*-degree from *r* (Eq. 24):

$$\beta_r = \alpha_0 + \alpha_1 r + \alpha_2 r^2 + ... + \alpha_m r^m, \ m \le r. \quad (24)$$

Then, at $m = 2$ (Eqs. 25-26):

$$\beta_r = \alpha_0 + \alpha_1 r + \alpha_2 r^2, \quad (25)$$

$$y_i = \alpha + \sum_{y=0}^{k} (\alpha_0 + \alpha_1 r + \alpha_2 r^2) \times x_{t-r} + \varepsilon_t$$
$$= \alpha + \alpha_0 \sum_{y=0}^{k} x_{t-r} + \alpha_1 y = 0 \sum_{y=0}^{k} r x_{t-r} + \alpha_2 \sum_{y=0}^{k} r^2 x_{t-r} + \varepsilon_t. \quad (26)$$

Marking (Eq. 27):

$$Z_{0t} = \sum_{r=0}^{k} x_{t-r}, \ Z_{1t} = \sum_{r=0}^{k} r x_{t-r}, \ Z_{2t} = \sum_{r=0}^{k} r^2 x_{t-r}, \quad (27)$$

we write the multifactor model (Eq. 28):

$$y_i = \alpha + \alpha_0 Z_{0t} + \alpha_1 Z_{1t} + \alpha_2 Z_{2t} + \varepsilon_t. \quad (28)$$

It is possible to determine the estimated level of subsidization of local budgets of decentralized territories, taking into account the calculations of the estimated values of tax revenues per capita in the

developed distribution and lag models. This will create an information platform to evaluate the effectiveness of financial management in the regions of the state.

RESULTS AND DISCUSSION

It should be noted that the choice of fiscal policy instruments in the country is determined by the peculiarities of the institutional environment, therefore, for the Ukrainian economy, the predominance of indirect taxes in the budget revenues is a well-established practice, since they perform the fiscal function, affect the macroeconomic indicators and act as a deflator, capable of reducing consumption (Krysovatyi and Valihura 2004, Zamaslo 2017). It should be noted that in EU countries the share of VAT in GDP varies from 3.4% to 9.2% (Figure **2**).

The share of VAT in Ukraine's GDP is close to that of Denmark, Estonia, Finland and Sweden, with the highest levels of this type of tax revenue in GDP. Fiscal policy implementation in the Czech Republic, Estonia, Finland, France, Greece, Poland, Slovakia for the period 2011-2018 has led to an increase in the VAT rate through fiscal consolidation caused by the economic and financial crises. However, it is more efficient and less damaging to the economic growth of countries than changes in other taxes. According to the EU Directive (VAT 2006/112/EC) for EU Member States, the minimum standard VAT rate should be at least 15%, with a probability of lowering it at least 5% (Consumption Tax Trends 2018, Council Directive 2006/112/EC… 2006). The Ukrainian practice of setting the VAT rate is more conservative – 20%, 7% and 0% (Trusova *et al.* 2018). Ukrainian realities show that VAT, as the dominant budget-forming element of the tax component in 2017, equaled 72% in 2018 – 71.2% from the total amount of taxes charged on consumption. This is explained by its low sensitivity to economic fluctuations and the lack of effective alternatives to cover the losses of the state budget in the abolition of this tax (Figure **3**).

In the period 2011-2018, the share of VAT revenues in GDP, state budget revenues and tax revenues as a whole had a wavy dynamic (Figure **4**).

At the same time, 77-78% net VAT revenues to the consolidated budget of Ukraine amounted to a share of

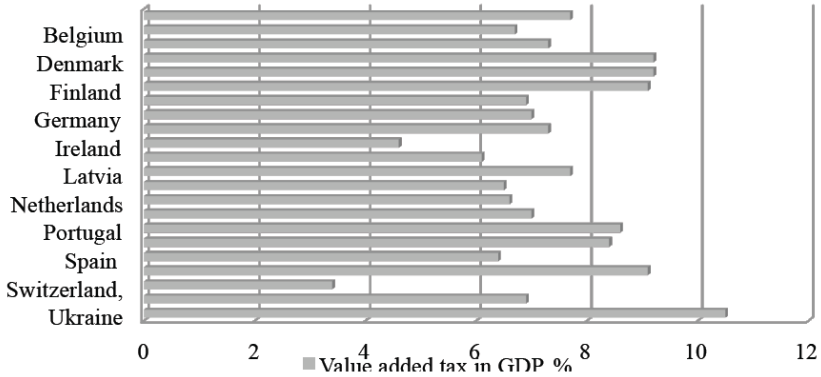

Figure 2: VAT share in GDP of the world in 2018, %.

Source: built by the author (Numerical Fiscal Rules 2019, Consumption Tax Trends 2018, Reporting of the State… 2019, Sala-i-Martin and Geneva 2017, Statistical Information of the State… 2019).

Figure 3: Receipts of indirect taxes to the State Budget of Ukraine, %.

Source: calculated by the authors according to data (Reporting of the State… 2019, Budget Monitoring: Analysis… 2019, Budget of Ukraine… 2019).

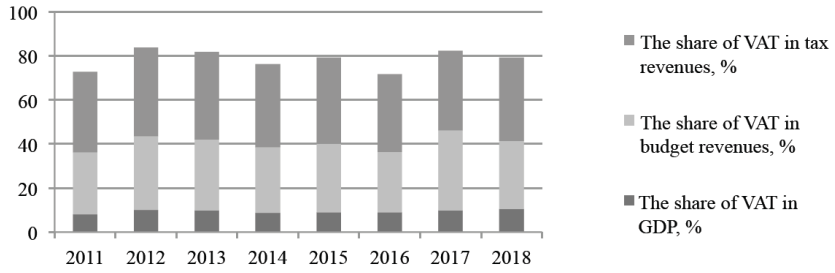

Figure 4: Fiscal value of VAT in GDP, state budget and tax revenues of Ukraine, %.

Source: calculated by the authors according to data (Reporting of the State… 2019, Statistical Information of the State… 2019).

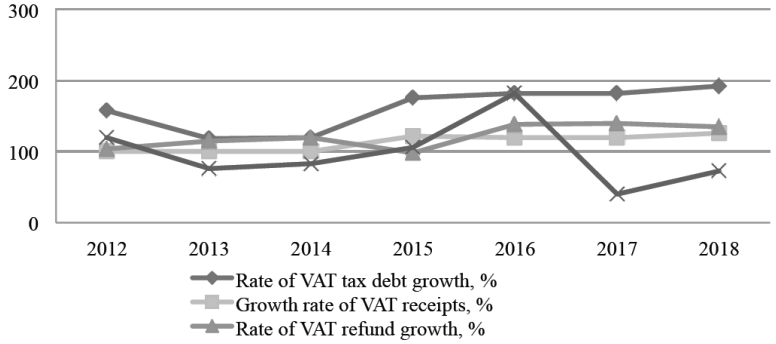

Figure 5: Growth rates of VAT receipts, refunds, tax debt and losses in Ukraine, 2012-2018, %.

Source: built by the authors according to data (Reporting of the State… 2019; Statistical Information of the State… 2019).

the tax on imported goods into the territory of the country. This is an evidence of significant import dependence, both on the economy of the country as a whole and on the revenue side of the budget. At the same time, 75% of Ukrainian exports are raw materials and they have low benefit. In addition, the lack of efficiency in combating goods smuggling reduces the fiscal efficiency of VAT. Thus, in 2016, with 15% of foreign trade of Ukraine with countries such as Poland, Hungary, Romania, Belarus, Slovakia, the amount of smuggling was more than 2 billion USD, (this is equivalent to 5% aggregate imports of goods in 2016) (Maziarchuk, Sybirianska and Paskalova 2017). However, a negative phenomenon in the country is that with the growth of imported goods, which are directed to a large proportion of budgetary financial resources, do not stimulate the potential for the development of home production and creating new jobs. In 2017-2018, the ratio between the growth rate of VAT receipts and the growth rate of compensation and tax debt under this tax does not correspond to the real volume of proportionality of its distribution (Figure **5**).

The tax dominant of the state budget among the direct taxes is income tax (IT) and personal income tax (PIT) (Figure **6**).

It should be noted that within the limits of fiscal decentralization of 2016-2018 the share of the tax burden on the private sector (more than 10%), which forms the main financial component of local budgets, has increased. Moreover, 63% of economic entities are payers of income tax, which forms the tax revenue of the State budget. We should note that one of the factors behind the decline in the income from the IT is the increase in tax debt, the dynamics of which has a general tendency for all payments, but in terms of volume, it is inferior to VAT debt (Figure **7**). Over the period 2014-2018, PIT increased more than 2.5 times (see Figure **6**). Among the factors behind this increase is the distribution of tax between budgets of different levels within the framework of financial decentralization. However, manipulation of tax instruments for purposes that take into account exclusively the fiscal interests of the state, provided that their regulatory potential is offset, negatively affects the processes of social reproduction (Trusova *et al.* 2017). In the total amount of tax benefits, their share that leads to loss of budget revenues decreased from 61.2% in 2011 to 31.3% in 2018.

Significant level of budget losses in the structure of preferential taxation (more than 50%) forms VAT, including, from the operation of a special regime of

Figure 6: Receipts of direct taxes to the State Budget of Ukraine, %.

Source: calculated by the authors according to data (Reporting of the State… 2019, Budget Monitoring: Analysis… 2019, Budget of Ukraine… 2019, Benefits Directories of the State… 2019).

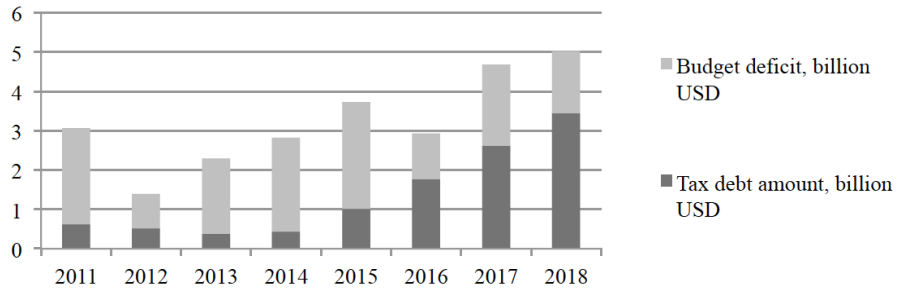

Figure 7: Amounts of tax debt and budget deficit of Ukraine, billion USD.

Source: calculated by the authors according to data (Databases the Ministry of Finance… 2017, Information on Tax Debt… 2019, Report of the State Fiscal… 2019).

VAT taxation for agricultural enterprises – 1.5 billion USD or 79% from the amount of VAT benefits (Figure **8**).

The dominance of VAT exemptions is an evidence that fiscal policy has a significant impact on the economic structure of economic entities and makes it exogenous to economic development strategies. In 2018, consolidated fiscal losses (state and local budgets) through legal tax benefits were 0.95 billion USD and has been at its lowest level in eight years because of measures to change the special VAT regime. However, under the influence of internal and external "shocks", political and economic instability, the problem of generating local budget revenues, the most important part of which is transfers, is compounded (the share in 2018 was 54.3%). With the increase of local taxes and levies in the regions of the state since 2016, there is a trend of increasing local budget revenues from 2% to 11% and in GDP from 0.2% to 24.8%. The basic income structure is formed by 96% of tax revenues. However, they do not sufficiently affect the financial status of decentralized territories (Figure **9**). To improve the effectiveness of financing targeted

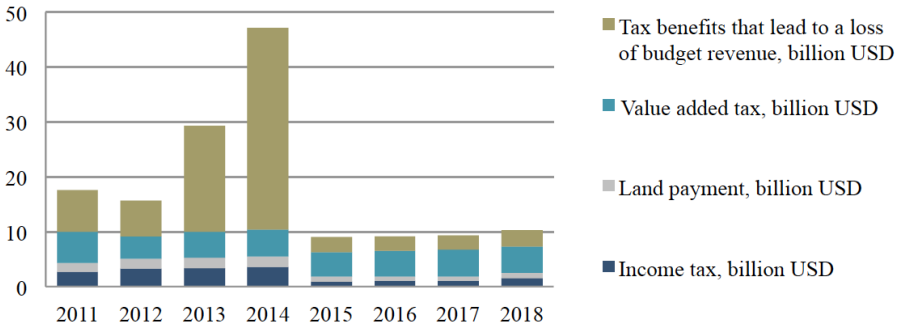

Figure 8: Tax benefits in taxes and fees in Ukraine, billion USD.

Source: calculated by the authors according to data (Benefits Directories of the State… 2019, Information on Tax Debt… 2019, Report of the State Fiscal… 2019).

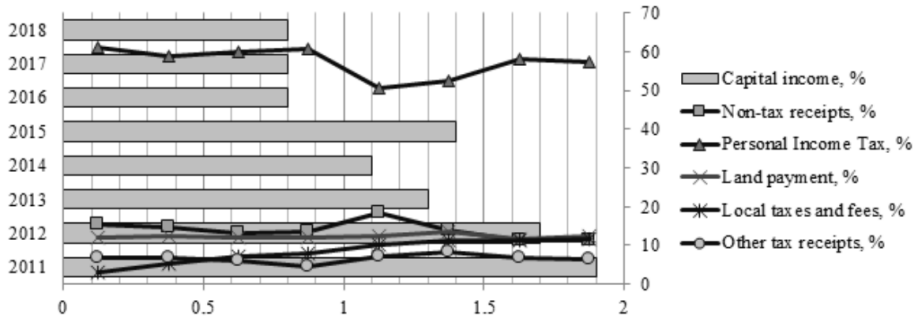

Figure 9: Structure of local budget revenues of decentralized territories of Ukraine, 2011-2018 (excluding intergovernmental transfers), %.

Source: calculated by the authors according to data (Reporting of the State… 2019, Budget Monitoring: Analysis… 2019, Budget of Ukraine… 2019, Benefits Directories of the State… 2019).

programs and managing the financial resources of local budgets in terms of forming local tax revenues, it is of great importance to estimate the lagged fiscal effect, which is due to the need to determine the forecast level of subsidization of decentralized territories.

The coefficients of determination calculated for 6 models of the projected dynamics of fiscal effect in terms of per capita tax revenues and subsidization levels of decentralized territories (27%), indicate the parameters of their fluctuations within 0.7-0.8, for 7 models (32%) – within 0.8-0.9 and for 9 models (41%) – more than 0.9. Verification of the Student's test parameters showed that more than 70% parameter estimates are statistically significant. We calculated the values of intermediate and long-term distributive-lag multipliers, which allow us to predict the level of sensitivity of fiscal effect indicators to the level of subsidization of decentralized territories in Ukraine in time with a single increase in the size of real tax revenues per capita (Table **1**).

The presence of calculations of the relative coefficients of regression allows to estimate the level of effectiveness of both endogenous and exogenous factors on the above indicators. To solve this problem, in the context of local budgets of decentralized territories, it is proposed to use trend models based on the idea of extrapolation (that is, warning about the future trends of changes in the values of the studied indicators observed in the past prior to the calculation of the forecast). However, it must be assumed that the factors that influenced the performance indicator in the past will not significantly change the nature of its impact on the forecasting period. The variable values of the tax revenue per capita of decentralized territories are due to the presence of their discrete values over time. Therefore, trend models have been used to develop the fiscal effect forecast for the fiscal component of the local budgets, using the time series smoothing method, namely, the trend models, and based on them, forecasts for the next 4 quarters have been calculated. The insignificant period of the forecast is caused by the insignificant existence of decentralized territories (2-3 years, i.e. 8-12 quarters), (Table **2**).

Taking into account the developed and estimated distribution and lag models and the forecast of the dynamics of fiscal effect on the volume of tax revenue per capita on indicators of the level of subsidization of local budgets of decentralized territories, the forecast parameters of indicators are presented (Table **3**).

It should be noted that decentralized territories should approve their own list of strategic guidelines for managing tax receipts to local government revenue, taking into account the factor variables (endogenous and exogenous) that determine alternatives to improve the financial support of regional development, the accumulation, distribution, redistribution and spending of grant funds. In this case, the financial system, both in the country as a whole and in decentralized territories, will become indicative of systemic orderliness, and the tax sphere of its influence will expand all the real financial processes occurring in the country.

CONCLUSIONS

The process of decentralization of state power must be viewed in indissoluble unity as a set of mutually agreed measures aimed at extending the powers of local authorities (political decentralization) towards solving the issue of territorial development (administrative decentralization) to increase the effect of the tax component and the form of financial capacity of fiscal decentralization at the local level. At the same

Table 1: Values of Intermediate and Long-Term Distributor-Lag Multipliers in Fiscal Effect Models by Volume Tax Revenue Per Person that Affect the Level of Subsidization of Local Budgets of Decentralized Territories for 2020

Decentralized territories	Indicators	Model	1st quarter (effect at time *t*)	2st quarter (effect at time *t+1*)	3st quarter (effect at time *t+2*)	4st quarter (effect at time *t+3*)
Local budget of decentralized territory No. 1	Tax revenue per person	$y_t = 1.941 – 0.003x_t – 0.002x_{t-1} – 0.002x_{t-2} + 0.0001x_{t-3}$, $R^2 = 0.869$	-0.003	-0.005	-0.007	-0.007
	Subsidization	$y_t = 0.14 + 0.0002x_t + 0.0002x_{t-1} + 0.0003x_{t-2} + 0.0003x_{t-3}$, $R^2 = 0.855$	0.0002	0.0004	0.0007	0.001
Local budget of decentralized territory No. 2	Tax revenue per person	$y_t = 0.461 + 0.001x_t + 0.002x_{t-1} + 0.001x_{t-2} – 0.004x_{t-3}$, $R^2 = 0.822$	0.001	0.003	0.004	0
	Subsidization	$y_t = 0.459 – 0.0002x_t – 0.00006x_{t-1} + 0.0003x_{t-2} + 0.0007x_{t-3}$, $R^2 = 0.78$	-0.0002	-0.0008	-0.0011	-0.0004
Local budget of decentralized territory No. 3	Tax revenue per person	$y_t = 0.633 + 0.001x_t – 0.01x_{t-1} + 0.002x_{t-2} + 0.008x_{t-3}$, $R^2 = 0.816$	-0.001	0	0.002	0.01
	Subsidization	$y_t = 0.435 – 0.001x_t + 0.003x_{t-1} – 0.0001x_{t-2} – 0.002x_{t-3}$, $R^2 = 0.74$	-0.001	0.002	0.0019	-0.0001
Local budget of decentralized territory No. 4	Tax revenue per person	$y_t = 3.628 – 0.009x_t – 0.006x_{t-1} + 0.004x_{t-2} + 0.002x_{t-3}$, $R^2 = 0.915$	-0.009	-0.015	-0.011	-0.009
	Subsidization	$y_t = –0.071 + 0.001x_t + 0.001x_{t-1} + 0.001x_{t-2} – 0.0002x_{t-3}$, $R^2 = 0.828$	0.001	0.002	0.003	0.0028
Local budget of decentralized territory No. 5	Tax revenue per person	$y_t = 6.352 – 0.004x_t + 0.005x_{t-1} – 0.008x_{t-2} + 0.02x_{t-3}$, $R^2 = 0.995$	-0.004	-0.009	-0.017	-0.015
	Subsidization	$y_t = –0.409 – 0.001x_t + 0.001x_{t-1} + 0.001x_{t-2} + 0.001x_{t-3}$, $R^2 = 0.994$	-0.001	0	0.001	0.002
Local budget of decentralized territory No. 6	Tax revenue per person	$y_t = 3.936 + 0.011x_t + 0.016x_{t-1} – 0.009x_{t-2} – 0.035x_{t-3}$, $R^2 = 0.725$	0.011	0.027	0.018	-0.017
	Subsidization	$y_t = 0.259 + 0.001x_t – 0.0004x_{t-1} – 0.0002x_{t-2} + 0.002x_{t-3}$, $R^2 = 0.719$	0.001	0.0006	0.0004	0.0024
Local budget of decentralized territory No. 7	Tax revenue per person	$y_t = 0.413 + 0.007x_t – 0.002x_{t-1} + 0.002x_{t-2} + 0.005x_{t-3}$, $R^2 = 0.862$	0.007	0.009	0.011	0.016
	Subsidization	$y_t = 0.089 – 0.0004x_t – 0.00002x_{t-1} + 0.0002x_{t-2} + 0.0007x_{t-3}$, $R^2 = 0.752$	-0.0004	0.0004	0.0002	0.0005
Local budget of decentralized territory No. 8	Tax revenue per person	$y_t = 2.527 + 0.003x_t + 0.006x_{t-1} – 0.012x_{t-2} – 0.006x_{t-3}$, $R^2 = 0.964$	0.003	0.009	-0.003	-0.009
	Subsidization	$y_t = 0.144 – 0.004x_t + 0.0005x_{t-1} + 0.001x_{t-2} + 0.001x_{t-3}$, $R^2 = 0.9645$	-0.004	-0.005	-0.004	-0.003
Local budget of decentralized territory No. 9	Tax revenue per person	$y_t = –14.3 + 0.057x_t + 0.014x_{t-1} – 0.003x_{t-2} – 0.002x_{t-3}$, $R^2 = 0.998$	0.057	0.071	0.068	0.073
	Subsidization	$y_t = 1.291 – 0.012x_t – 0.003x_{t-1} + 0.0003x_{t-2} – 0.002x_{t-3}$, $R^2 = 0.995$	-0.012	-0.015	-0.015	-0.013
Local budget of decentralized territory No. 10	Tax revenue per person	$y_t = 0.368 – 0.037x_t – 0.011x_{t-1} – 0.004x_{t-2} – 0.016x_{t-3}$, $R^2 = 0.793$	-0.037	-0.048	-0.052	-0.068
	Subsidization	$y_t = 0.279 + 0.003x_t + 0.001x_{t-1} + 0.0001x_{t-2} + 0.0001x_{t-3}$, $R^2 = 0.916$	0.003	0.004	0.004	0.005
Local budget of decentralized territory No. 11	Tax revenue per person	$y_t = 3.429 – 0.013x_t – 0.006x_{t-1} + 0.007x_{t-2} – 0.001x_{t-3}$, $R^2 = 0.835$	-0.013	-0.019	-0.012	-0.013
	Subsidization	$y_t = –0.065 + 0.001x_t + 0.001x_{t-1} + 0.0002x_{t-2} – 0.0015x_{t-3}$, $R^2 = 0.921$	0.001	0.002	0.002	0.001

Source: authors' calculations.

Table 2: Estimates of Real per Capita Tax Revenues of Decentralized Territories of Ukraine for 2020

Decentralized territories	Trend model	1st quarter	2st quarter	3st quarter	4st quarter
Local budget of decentralized territory No. 1	$y_t = -2.1216t^2 + 24.487t + 229.51$, $R^2 = 0.866$	189.29	156.49	119.46	78.17
Local budget of decentralized territory No. 2	$y_t = 127.876t^{0.2976}$, $R^2 = 0.901$	274.33	280.45	286.27	291.82
Local budget of decentralized territory No. 3	$y_t = 101.2t^{0.2906}$, $R^2 = 0.867$	213.31	217.95	222.37	226.58
Local budget of decentralized territory No. 4	$y_t = 101.2t^{0.2906}$, $R^2 = 0.867$	279.39	289.62	298.09	303.68
Local budget of decentralized territory No. 5	$y_t = 229.35t^{0.0517}$, $R^2 = 0.841$	364.09	383.28	403.47	424.73
Local budget of decentralized territory No. 6	$y_t = -0.104t^3 + 2.189t^2 - 5.347t + 164.35$, $R^2 = 0.964$	217.72	225.78	231.98	235.69
Local budget of decentralized territory No. 7	$y_t = 149.99t^{0.1557}$, $R^2 = 0.9645$	383.27	401.42	420.44	440.36
Local budget of decentralized territory No. 8	$y_t = 252.69t^{0.0466}$, $R^2 = 0.805$	208.46	205.23	207.77	210.12
Local budget of decentralized territory No. 9	$y_t = 152.42t^{0.1292}$, $R^2 = 0.8978$	202.46	205.23	207.77	210.12
Local budget of decentralized territory No. 10	$y_t = -0.171t^2 + 1.187t + 130.64$, $R^2 = 0.889$	127.47	125.41	123.01	120.26
Local budget of decentralized territory No. 11	$y_t = -0.8273t^2 + 19.842t + 330.51$, $R^2 = 0.9074$	442.08	446.20	448.67	449.48

Source: authors' calculations.

Table 3: Fiscal Impact Estimates and Subsidy Levels of Local Budgets of the Decentralized Territories of Ukraine for 2020

Decentralized territories	Indicators	1st quarter	2st quarter	3st quarter	4st quarter
Local budget of decentralized territory No. 1	Tax revenue per person	0.615	0.749	0.967	1.223
	Subsidization	0.379	0.339	0.316	0.283
Local budget of decentralized territory No. 2	Tax revenue per person	0.434	0.553	0.452	0.508
	Subsidization	0.354	0.332	0.394	0.337
Local budget of decentralized territory No. 3	Tax revenue per person	0.890	0.653	0.783	0.778
	Subsidization	0.408	0.475	0.443	0.446
Local budget of decentralized territory No. 4	Tax revenue per person	0.726	0.937	0.902	0.824
	Subsidization	0.622	0.669	0.742	0.738
Local budget of decentralized territory No. 5	Tax revenue per person	0.973	0.572	0.674	0.298
	Subsidization	0.183	0.269	0.317	0.317
Local budget of decentralized territory No. 6	Tax revenue per person	0.928	1.434	0.619	0.588
	Subsidization	0.763	0.728	0.787	0.792
Local budget of decentralized territory No. 7	Tax revenue per person	0.412	0.816	0.870	1.002
	Subsidization	0.221	0.238	0.263	0.251
Local budget of decentralized territory No. 8	Tax revenue per person	0.547	0.656	0.732	0.674
	Subsidization	0.619	0.616	0.587	0.584
Local budget of decentralized territory No. 9	Tax revenue per person	0.433	0.626	0.836	0.982
	Subsidization	0.536	0.479	0.432	0.403
Local budget of decentralized territory No. 10	Tax revenue per person	0.150	0.969	0.723	1.024
	Subsidization	0.969	0.909	0.924	0.903
Local budget of decentralized territory No. 11	Tax revenue per person	0.531	0.714	0.659	0.659
	Subsidization	0.277	0.289	0.249	0.259

Source: authors' calculations.

time, the structure of the fiscal space of the state in the local system of decentralized territories should ensure the interrelation of tax and budgetary mechanisms with the definition of active fiscal policy, which in the range of socio-economic development determines the financial orientation of the target direction of the redistributed financial resources, while ensuring compliance with requirements for tax filling options and increasing the sustainability of local budgets. In the framework of comparing the characteristics of the local budget with revenue (the structure of sources of revenue, considered from the standpoint of the level of autonomy, for the assessment of which the indicator of assessing local budget subsidy as a share of transfer revenues from the state budget is used) and expenditures (determined based on the distribution of budget expenditures on mandatory and optional to maintain the proper quality of life of the population) parameters, it is necessary to consistently implement the targeted projects and programs of the regional socio-economic development, which are based on the integration of the provisions of the program-based approach and the concept of fiscal space.

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