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TAXATION AND ECONOMIC GROWTH: AN EVOLUTIONARY APPROACH

Taxes play an extremely important role in assuring of the activities of the state, financing the production of public goods and income redistribution. There is no doubt also that taxes have a significant impact on the economic growth of the country, and also on the development of industry. The last is the base of national economy for many developing and transitive countries of the world, including Ukraine.

To the investigation of this aspect of taxation, a wide range of academic resources is devoted, that reflects the results of both theoretical and empirical studies, the rationale of the recommendations for reforming tax systems of different countries. Among the most significant recent works on this issue, it can be mentioned, for example, the works of Engen E. and Skinner J. [1], Myles G. [2], Lee Y. and Gordon R.H. [3], Scully G.W. [4-5], Johansson A., Heady C., Arnold J., Brys B. and others [6-7], Bird R. [8], McBride W. [9], Mazerov M. [10]. At the same time, despite lots of research, great variety of approaches, based on the models of endogenous and exogenous economic growth, econometric modeling, analysis and subsequent aggregation of decisions made by economic agents about investments, savings, labor supply and capital at the micro level, the obtained results are contradictory enough. Various scientists claim and provide some empirical evidence that reduction of the tax burden leads to economic growth, or hinders economic growth or its effect is very weak. Such uncertainty prevents the justified establishment of fiscal policy, aimed on assuring of economic growth, also in the field of industry.

New horizons in the study on the impact of taxation on economic growth are opened by the evolutionary economics [11-13] and concept of tax population, originated on its base [14-16]. The main idea of this concept is that the formal and informal tax institutes of different levels, from the tax mentality and morality to, for example, tax planning routine in industry, formed during the prolonged socio-economic evolution,

not universal for all countries, but very similar for their individual groups. These groups are denoted as tax populations and tax subpopulations. According to the current understanding of tax populations, there can be expected that the impact of taxation on economic growth will vary to some extent in different countries belonging to different tax populations and subpopulations.

The purpose of this paper is to study the influence of the taxation level on economic growth within the boundaries of the various tax populations and subpopulations. Achievement of this goal is entirely connected with the construction and analysis of the specificity of econometric models for different tax populations and subpopulations, which include a sufficient number of countries, allowing provision of statistically adequate models.

Before turning to the direct analysis of the obtained models, it is necessary to make some preliminary observations on the variables used in them.

Using official economic growth (Growth$_{official}$) and tax ratio (TR$_{official}$) as models' variables can lead to misconceptions about the nature of the considered dependence, as it does not take into account the size of the shadow economy. Thus, at high tax ratio and a substantial scale of the shadow economy, the real tax ratio (TR$_{real}$) is moderate or even low. Official economic growth also comprise insufficient information for the purposes of this study. For instance, it is possible that the fall in official GDP occurs simultaneously with the growth of the informal (shadow) sector, then, at a certain scale of the latter, the real economy, including both formal and informal sector can grow.

It should be noted that, as usual, national state and international organizations show economic growth and tax ratios, calculated on the basis of official GDP. This also applies to the database Heritage Foundation [17-19], used in our research, so it is necessary first of all to provide the calculation of indicators of real economic growth and the real tax ratio. To take into

consideration the impact of the shadow economy, the results of Buehn A. and F. Schneider [20] have been used. Note that in their work it is presented estimates of the shadow economy as a share in official GDP for a substantial number of states, but at the same time, these figures are related to the period from 1999 to 2007, as well as average figures over the period. In order to calculate the real tax ration (TR_{real}) in a particular year (period), as follows from formula (1), official figures of tax ratio ($TR_{official}$) should be divided by (1 + SE), where SE - the share of the shadow economy in the relevant year. But since estimates of the shadow economy for the latest years are not available, the average figures for the following period are used in the calculations:

$$TR_{real} = \frac{Total\ Tax}{GDP_{real}} = \frac{Total\ Tax}{GDP_{official}(1+SE)} =$$
$$= \frac{TR_{official}}{(1+SE)} \approx \frac{TR_{official}}{(1+SE_{av})}. \qquad (1)$$

In this case, if the average share of shadow economy in Ukraine is 49.7% of the official GDP and the official tax ratios are equal to - 38.1% (according to the database – Heritage Foundation Index of Economic Freedom 2013 [19]), 36.9% (according to the database – Heritage Foundation Index of Economic Freedom 2012 [18]) and 37.7% (according to the database –Heritage Foundation Index of Economic Freedom [17]), then the corresponding real tax ratios are – 25.45%, 24.65 % and 25.18% respectively.

The most widely used measure of economic growth is the real GDP growth rate ($Growth_{real}$):

$$Growth_{real(t)} = \frac{GDP_{real(t)}}{GDP_{real(t-1)}} - 1 =$$
$$= \frac{GDP_{official(t)}(1+SE_t)}{GDP_{official(t-1)}(1+SE_{t-1})} - 1. \qquad (2)$$

The formula can be transformed as follows:

$$Growth_{real(t)} = \frac{GDP_{official(t)}(1+SE_t)}{GDP_{official(t-1)}(1+SE_{t-1})} - 1 =$$
$$= (\frac{GDP_{official(t)} - GDP_{official(t-1)}}{GDP_{official(t-1)}} + 1)\frac{(1+SE_t)}{(1+SE_{t-1})} - \quad (3)$$
$$-1 = (Growth_{official(t)} + 1)\frac{(1+SE_t)}{(1+SE_{t-1})} - 1.$$

Ssince, as was already noted, the calculations of the share of shadow economy A. Buehn and F. Schneider are limited by the period from 1999 to 2007, and our task is to determine the real economic growth of various countries in the later period, so the impact of the shadow economy is accounted using the ratio (k_{SE}), which describes the average dynamic of the shadow economy of the country according to the calculations of these scientists, that is:

$$k_{SE} = \frac{1}{8} \sum_{t=2000}^{2007} \frac{(1+SE_t)}{(1+SE_{t-1})}; \qquad (4)$$

$$Growth_{real(t)} = (Growth_{official(t)} + 1)k_{SE} - 1. \quad (5)$$

So, for example, based on estimates of the share of the shadow economy in Ukraine, we obtain:

$$k_{SE} = \frac{1}{8}\left[\begin{array}{c}\frac{(1+0.522)}{(1+0.527)} + \frac{(1+0.514)}{(1+0.522)} + \frac{(1+0.508)}{(1+0.514)} + \frac{(1+0.497)}{(1+0.508)} + \frac{(1+0.488)}{(1+0.497)} + \frac{(1+0.478)}{(1+0.488)} + \\ + \frac{(1+0.473)}{(1+0.478)} + \frac{(1+0.468)}{(1+0.473)}\end{array}\right] = 0.995088.$$

Then, taking into consideration the fact that the official economic growth in Ukraine is estimated at 5.205%, the real growth calculated by the formula (5) constitutes:

$$Growth_{real(t)} = (0.05205 + 1) \cdot 0.995088 - 1 =$$
$$= 0.046882 \approx 4.69\%.$$

Similar calculations of real economic growth and the real tax ratio were performed for the group, comprising 117 countries. It should

be noted that since the shadow economy remains enough inertial informal institute, the dynamics of its share in GDP, in a relatively short period (less than ten years), covered by paper of Buehn A. and F. Schneider, have been sufficiently slow. Following this discrepancy between the official and the real economic growth appears in a small range from -0.27 % to 0.72%. However, discrepancies of the official and the real tax ratios are really substantial.

As practice shows, the impact of taxation on economic growth usually occurs some period of time after certain changes held in the tax field, including those related to the level of taxation. Because of this, it is assumed that the greatest impact on real economic growth will have a variable that displays the level of taxation with a certain lag. Taking into account the fact that the level of taxation and the shadow economy is closely interrelated and can have a joint effect on real economic growth, the model of real economic growth in general is defined in a following way:

$$Growth_t = f(TC_{real(t-2)}, SE_{av}) \qquad (6)$$

To find the most statistically adequate models, the procedure of stepwise selection of variables was used, implemented in the program Statistica (version Statistica 10.0.1011.0 Trial Version Application). Wherein the set of possible variables has formed the average share of the shadow economy and tax ratio with a two-period lag, taking into account the various possible forms of interrelation (linear, quadratic, logarithmic, and other).

The most statistically adequate econometric model of real economic growth, based on data of the sample of 117 countries, has the form:

$$Growth_{real(t)\_all} = -92.2424 + 0.0006 SE_{av}^2 +$$
$$+0.0459 TR_{real(t-2)}^2 + 100.9237 \; \frac{1}{TR_{real(t-2)}} - \quad (7)$$
$$-7.2255 TR_{real(t-2)} + 48.5027 \sqrt{TR_{real(t-2)}}.$$

The coefficient of determination of this model is equal to 0.2177, and the adjusted coefficient of determination – 0.1825. Wherein most estimates of the model are statistically adequate at a significance level not exceeding 2%, estimates of variables $SE^2_{real(t-2)}$ and $1/TR_{real(t-2)}$ – at a significance level not exceeding 10%. The model includes the variables connected with the level of taxation, so as with the scale of the shadow economy. A positive coefficient of variable $SE^2_{real(t-2)}$ indicates the real economic growth caused by increase in the share of the shadow economy. At the same time, the insertion of this variable in the model allows increase of adjusted coefficient of determination only by 0.015 compared with a model that takes into account only the effect of the level of taxation ($R^2_{adjusted}=0.1673$):

$$Growth_{real(t)\_all} = -100.249 +$$
$$+0.050 TR_{real(t-2)}^2 + 112.343 \; \frac{1}{TR_{real(t-2)}} - \quad (8)$$
$$-7.913 TR_{real(t-2)} + 53.002 \sqrt{TR_{real(t-2)}}.$$

The model (8) reflects the non-linear relationship between the real economic growth and the real tax ratio. Insight about the nature of this correlation in the existing range of variation of the real tax ratio gives the curve in Fig. 1, built on the basis of the calculated values of the real growth according to the model (8). There can be distinguished three ranges of changes of the real tax ratio with different characteristics of its impact on real GDP growth. The model shows that with the growth of the real tax ratio ranging from 5.2% to 14% an increase in real GDP growth can be expected. The real tax rates of 48 countries of the original totality (41%) belong to the specified range of values.

The growth of the real tax ratio from 14% to 35.5%, on the contrary, is followed by a decrease in real GDP growth rates from 5.14% to 1.06 %. This range of variation of the real tax ratio comprises 59 countries, that constitutes 50.4 % of the original totality. And finally, the third range includes 8 countries and is determined by the variation of the effective tax ratio, fluctuating from 35.5% to 48.4 %. The growth of real tax burden in this range is connected with the expectation of increase in the rate of growth of real GDP.

Thus, analysis of the impact of taxation and the level of the shadow economy on the growth of real GDP according to the data of undivided sample of 117 countries, doesn't let us come to any unambiguous conclusions and makes it necessary to consider this issue in the context of individual tax populations and subpopulations.

In the static aspect, the tax population remains a group of countries in which tax systems operate in a similar way, equally responsive to variations of the same factors and characterized by a relatively close values of various indicators of institutional and socio-economic development. Cluster analysis allows to identify such groups of countries in a relatively independent clusters. Following the results of research of 117 countries in Gurnak A. (2013) [21], the most numerous are the European tax population, in-

cluding Western and Eastern European subpopulation, a subpopulation of post-colonial countries, and also mixed subpopulation, which includes a subpopulation of the Muslim countries. The detailed composition of these populations and subpopulations is shown in Table.
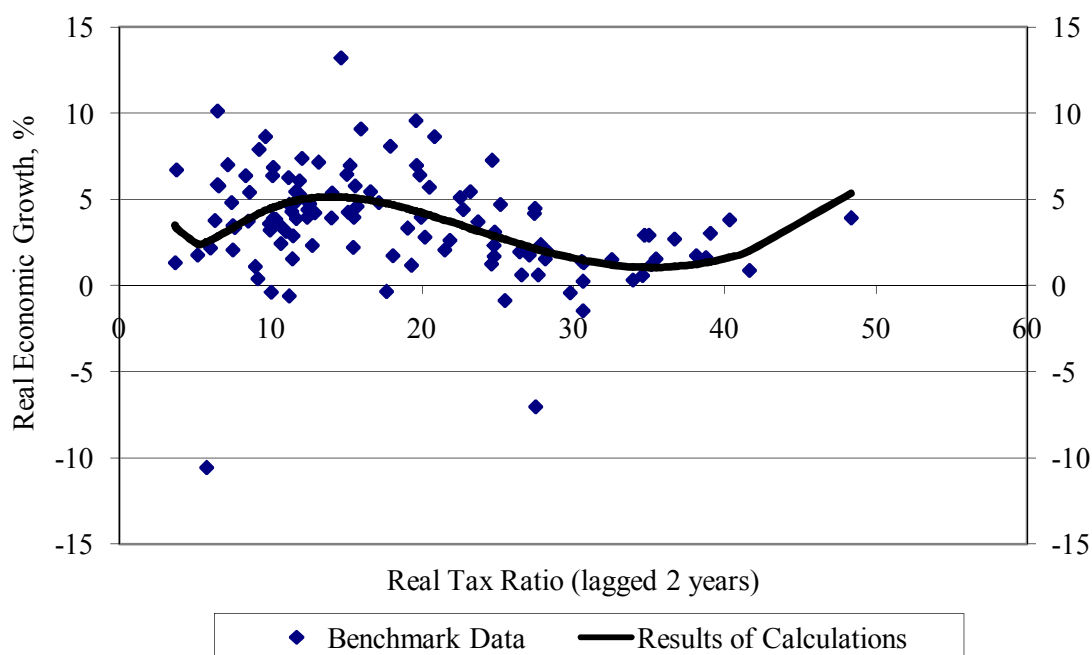

Fig. 1. Dependence of the real economic growth and the level of taxation according to the undivided sample of 117 countries

Table

The composition of the most numerous tax populations and subpopulations

European tax population			Mixed tax population	
Subpopulation of Western European countries	Subpopulation of Eastern European countries	Subpopulation of post-colonial countries	Subpopulation of Muslim countries	Other countries
1	2	3	4	5
Switzerland	Argentina	Botswana	Albania	Benin
United States	Armenia	Chile	Algeria	Bolivia
Austria	Bosnia and Herzegovina	Colombia	Azerbaijan	Bulgaria
New Zealand	Burundi	Costa_Rica	Bangladesh	Cameroon
United Kingdom	Croatia	Dominican Republic	Burkina Faso	Ecuador
Netherlands	Czech Republic	El Salvador	Chad	Ethiopia
Australia	Hungary	Ghana	Egypt	Georgia
France	Kyrgyz Republic	Guatemala	Guinea	Guyana
Iceland	Latvia	Haiti	Indonesia	Hong Kong
Canada	Lithuania	Honduras	Iran	Israel
Ireland	Montenegro	Kenya	Jordan	Mauritius
Germany	Poland	Lesoto	Kazakhstan	Nepal
Denmark	Romania	Liberia	Mali	Nicaragua
Finland	Russia	Madagascar	Mauritania	Norway
Sweden	Serbia	Malawi	Morocco	Paraguay

1	2	3	4	5
Belgium	Slovakia	Malaysia	Nigeria	Peru
Spain	Slovenia	Mexico	Pakistan	Singapore
Portugal	Tajikistan	Mozambique	Senegal	Sri Lanka
Malta	Ukraine	Namibia	Sierra Leone	Taiwan
Cyprus	Venezuela	Panama	Turkey	Thailand
Estonia		Philippines	Yemen	Vietnam
		Rwanda		
		South_Africa		
		Uganda		
		Uruguay		
		Zambia		
		Zimbabwe		

Econometric model of real economic growth for Western European countries tax subpopulation is characterized by adjusted coefficient of determination, which is equal to (on the level??) 0.2571. It is significantly higher than the value of this parameter for the model constructed on the basis of the undivided sample of countries. Besides this model shows that the real economic growth will be only affected by the scale of the shadow economy:

$$Growth_{real(t)\_West\_European} = -85.5515 +$$
$$+0.1180 SE_{av}^2 - 11.7294 SE_{av} + 61.4352\sqrt{SE_{av}}. \quad (9)$$

All estimates of the model's parameters are statistically significant at the 5% level. Model (9) and built on its basis graph in Fig. 2, show that the scale of the shadow economy in the borders of Western European tax subpopulations have nonlinear impact on real GDP growth. Wherein the majority of this tax subpopulations fall into such a range of relatively small values of the shadow economy in which its growth is not associated with an increase in the rate of growth of real GDP, as the model, built according to the data of the undivided sample of countries, and moreover it leads to reduction in growth of the real economy.
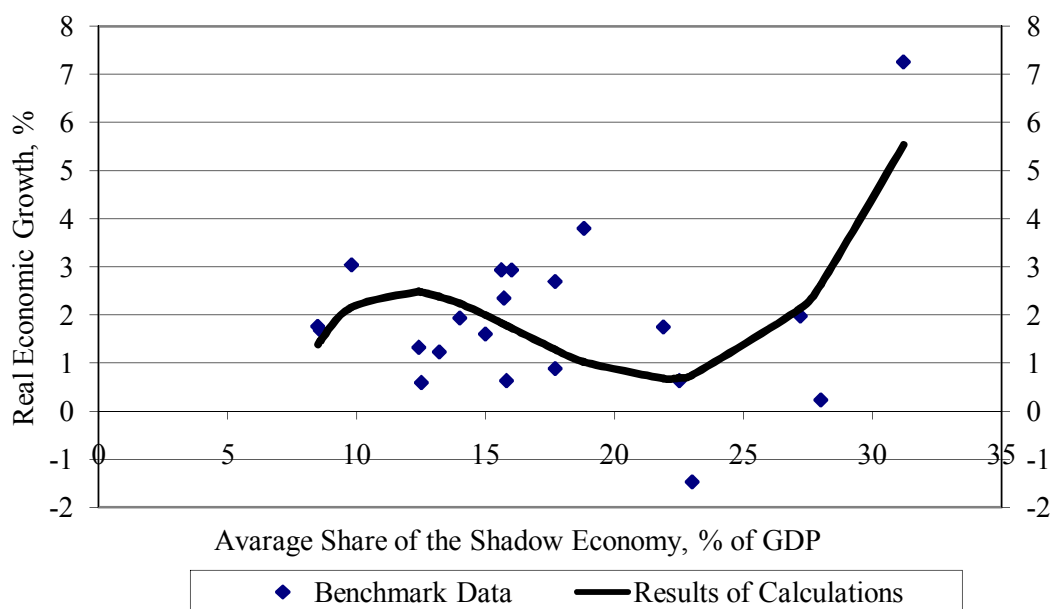

Fig. 2. Dependence of real economic growth on the shadow economy for
Western European tax subpopulation

So according to the constructed model (9), the level of taxation has no significant effect on real economic growth. The main reason of this virtually is the construction of the tax systems and tax policies in the countries of Western European tax subpopulation is based on the recommendations of the neoclassical theory of taxation in the aspect of its neutrality.

To the other results can be got through the analysis of the model, constructed according to the Eastern European tax subpopulations:

$$Growth_{real(t)\_East\_European} = 5.5571 -$$
$$-0.0039 TC^2_{real(t-2)}. \qquad (10)$$

Both estimates of model coefficients are statistically adequate at the 5% significance level. The coefficient of determination is 0.2242, and adjusted coefficient of determination - 0.1811.

Taking into account that analyzed models are used to study the impact on economic growth of only two factors (level of taxation and the size of the shadow economy) from a sufficiently large set, including technical progress, capital, labour, etc., the obtained coefficients of determination indicate an acceptable adequacy of the constructed models.

Model of the real economic growth of Eastern European tax population shows that at a sufficiently high level of the shadow economy for countries in this group, the variation of this parameter does not have a statistically significant effect on economic growth. Concerning, changes in the real tax ratio, its growth is associated with an expected slowdown in real GDP growth. Conversely, a decline in real tax burden increases the growth rate of real GDP. At the same time the maximum growth rate of real GDP is on average 5.56 %. Such character of the impact of taxation on economic development of Eastern European tax subpopulation is caused by their institutional features. These features are mainly interrelated with the fact that the government expends financial resources, that were accumulated through taxes, not in a proper way, carrying out increasingly social spending, rather than funding programs related to economic development. Moreover, in these countries there are cases of financial abuse and uncovered embezzlement of public funds.

The model of the real economic growth for tax subpopulation of post-colonial European countries comprises both size of the shadow economy and the level of taxation, and is described by the following equation:

$$Growth_{real(t)\_Postcolonial} = 4,2366 +$$
$$+0,0014 SE^2_{av} - 16,4748 \ 1/TC_{real(t-2)}. \qquad (11)$$

Statistical characteristics of the model are a bit worse in comparison to previous models. Thus, the coefficient of determination of the model is 0.1926, and adjusted coefficient of determination – 0.1253. Only estimates of the free variable and the coefficient of the variable $SE^2_{real(t-2)}$ are statistically significant at the 5% level. In this model, as well as in the model, constructed according to the undivided sample, the size of the shadow economy is positively correlated with economic growth. Nevertheless, the increase in the level of taxation (real tax ratio over the entire range of its values for this subpopulation) stimulates the growth in rates of real GDP in future that distinguishes a subpopulation of post-colonial countries from other subpopulations European tax population.

For the mixed tax population and, included in it, the tax subpopulation of Muslim countries, econometric models have the following form:

$$Growth_{real(t)\_Mixed} = 4,7271 -$$
$$-10,5508 \ 1/TC_{real(t-2)}; \qquad (12)$$
$$Growth_{real(t)\_Muslim} = 1,7063 +$$
$$0,0089 TC^2_{real(t-2)}. \qquad (13)$$

Both models reflect a positive correlation between the real tax ratio and economic growth across the entire range of the variation of tax ratio. The shadow economy factor has no significant influence on the variation of economic growth in these groups of countries. However, the two latest models both have very low values of the coefficients of determination and the adjusted coefficient of determination: for the model constructed according to mixed tax population – 0.0327 and 0.0085, and for the subpopulation of Muslim countries – 0.0826 and 0.0343, respectively.

It should be noted that outside of this study were such large in area and population,

rapidly developing countries as India and China. This is because of that India and China, in fact, are unique in the evolutionary-biological and civilizational-cultural aspects, and are regarded as those who form two separate tax populations: the Indian and the East Asian Asian respectively. Therefore, the study on the impact of the implemented their tax policy on the economic growth is impossible on the basis of cross-country analysis.

Thus, the results of the research show that the significance and nature of the impact of the level of taxation on the economic growth, considering the size of the shadow economy, differs substantially within the boundaries of the various tax populations and subpopulations. At the same time, for the countries of the mixed tax population, including subpopulations of Muslim countries, as well as a subpopulation of post-colonial countries of the European tax population, an increase in real tax ratio contributes the growth of real GDP. In countries of Western European tax subpopulation correlation between the level of taxation and variations in real economic growth is absent. This reflects the tendency of countries of Western European tax population to follow the principle of tax neutrality in the formation of the tax policy and providing tax systems reforms.

Unlike other tax populations and subpopulations, for Eastern European tax subpopulation, comprising Ukraine, the real growth of the level of taxation reduces the growth rate of real GDP that is explained by a clear priority of social spending and inadequate government funding programs for economic growth, and low efficiency of state institutions.

So it is clearly evident that the level of taxation influence in different ways on the economic growth of varios tax populations and tax subpopulations. However, a perspective direction for further research is to study the features of the impact of various taxes, such as direct and indirect, on economic growth in the context of different tax populations and subpopulations.

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