

Econometric Analysis of Regional Tax Capacity for Uzbekistan

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Introduction

Development prospects of any region in the country, solution of its most important social problems to large extent depends on disposable fiscal resources, the main source of which is tax revenue. Estimation of potential tax revenue could help determine reserves of tax revenue growth. Therefore, the rationale for evaluation and reliable forecasting of taxable capacity is the primary and most crucial step in development of socio-economic program of any region.

In 2010-2012, average budget revenues from local resources (regional tax revenues including social contributions) amounted to 58.5% of total government revenue in Uzbekistan. This represents an increase of 6.5 p.p., from 52% in 2000, of 4.5 p.p. from 54% in 2005. In absolute terms, local tax revenues surpassed pre-crisis levels already in 2009 (57.2% of total revenues).

Considering further fiscal decentralization local governments will have to seek additional revenues coming from their own resources. As common rule, tax capacity on the accumulation of tax revenues is defined by two factors:

- The size of the tax base, which depends on the efficiency of regional production factors (labor, capital, land);
- Levels of tax rates and the amount of tax benefits.

That implies that local governments should exploit their tax revenue capacity primarily from existing set of taxes before specifying and implementing any new taxes.

Our assessment of tax capacity is based on 8 individual types of taxes, which add up to more than two thirds of the total amount of regional tax revenues. The sectorial specialization of region is determined by existence of industries and enterprises that are "budget-filling" in terms of collected tax revenues to regional and state budgets. Determination of tax capacity is contingent on prevailing rules and conditions of taxation, as well as the level of tax collection (as a ratio of declared and actually collected tax revenues).

Taking into account identified factors that are consistently included in the calculation we developed a clear algorithm to determine the magnitude of the tax capacity.

Tax Capacity: Definition and Methods

An overview of international practices of tax capacity assessment techniques reveals that there is no single approach to identification and assessment methods of tax capacity.

The starting point in designing appropriate methodologies for assessing tax capacity is to identify and specify term "tax capacity". Complexity of determining tax capacity largely characterized by the fact that there are several points of view on this concept in the literature, and the same term refers to various indicators used in practice.

Next point in designing tax capacity estimation methodology is to identify major impact channels of economic activity on its tax potential (ultimately, tax base on tax revenues).

In most traditional literature for developing countries [1-4] taxable capacity measure usually reflects average tax ratio (ratio of tax revenues to produced output) for any kind of tax collected by any level of government with average degree of tax "effort" (which is simply the ratio between actually collected tax revenues and taxable capacity). More exactly, *taxable capacity* (for individual tax) usually refers to average possible tax revenue that could be collected subject to the application of uniform conditions of collection of tax (the tax rate, tax base, tax benefits, etc.) and common (average or maximum) tax administration efforts. Mathematically, taxable capacity measure is usually derived from the OLS regression analysis just as estimated tax revenue collections from existing tax base.

Moreover, *tax potential* is defined as budget revenue that would result if all available resources and ability is used by the authorities to collect obtainable tax revenues for a certain period. Most often, it is considered as "maximum possible amount of taxes and levies on all economic entities located in the region".

Interpretation of the tax capacity in the region is more specified. Tax capacity (potential) in the region represents the average (or maximum) possible amount of taxes and charges, which can be collected within the territory for a certain period of time under the existing legislation with the optimal use of available (financial, economic, labor, natural, etc.) resources in specific region (for example, share of non-agricultural activities in GDP, resources of oil & gaz sector). Hence the organization of the management of budget resources in the form of estimation of regional taxable capacity should account existing regional economic capacity.

In the World Bank publication "Russia and the problems of fiscal federalism" emphasis also shifts to economic potential of the region: "Tax capacity is the ability of the tax base within an administrative unit to generate revenue in the form of tax proceeds (but not the actual amount of tax collections)".

For interregional comparisons the magnitude of tax capacity is calculated per capita, per area unit and per other indicators. Also it is pointed out that tax exemptions and tax credits (deferments or payments by installment) granted by government and local authorities reduce the amount of potential tax revenues and other compulsory fees and payments, reduce their collection as compared with budget assumptions.

Finally, the level of tax collection is affected by the absence or lack

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of monetary funds at taxpayers needed for full and timely payment of taxes and charges, which results information of tax arrears and (or) non-cash termination of tax obligations by offsetting.

Empirical studies reveal that a common methodological approach is still missing in the *methods of assessment of tax capacity*. In the practice of tax policy and administration there have been developed a number of methods for estimating tax capacity. Existing techniques differ depending on the tasks and possibilities of the available statistical database. In some countries, for example, in USA, 2-3 methods are used simultaneously for evaluation and prediction of tax potential.

If the number of economic entities in the municipality is not high, then most commonly used one is a *standard-index evaluation method*: the projected tax base for every tax type and entity type is multiplied by the current maximum tax rate.

However, despite apparent simplicity of this method, its practical implementation involves a number of difficulties. First, this method requires data on actually collect taxes and tax bases for all taxes and regions. Even if such information is represented, firms and entrepreneurs are generally not required to provide it to local municipality authorities. Second, not all entities, especially small and medium enterprises, have business plans for the short and medium term perspective covering indicators needed for the assessment of the future tax base.

The basic idea of a *representative tax system method* is to calculate the amount of tax payments, which would be collected in the region if all regions make their collection with the average tax effort and use identical composition of taxes and tax rates [5,6]. The tax base should use a reasonable measure economic capacity, thus this method avoids the direct use of a tax base indicator as defined in the tax laws.

There are a number of constraints of such approach, which significantly limit the scope of its application in practice. First, there is a subjective selection of variables describing the tax base. Second, the data often have insufficient disaggregation in order to be able to account for all differences in tax opportunities of regions. Third, this approach does not take into account differences in income per capita in the region.

The above approach is very common in the developing world. About 85% of countries use *standard-index evaluation* techniques to forecast potential amount of budget tax revenue [7].

An alternative to the index method at the medium level and representative tax system method is *econometric techniques*, which use forecasts of key economic indicators at regional level (and first of all, GDP, growth rates of expected private incomes, share of small business, retail trade and etc.).

Econometric techniques applied in a less number of developing countries, for the year 2005 it was used in about 13% of countries. But regression method using the OLS for taxable capacity estimates is the most common method in developed countries. In this case, in regression the dependent variable is tax revenue and explanatory variables are selected indicators of tax base, the structure of the economy, level of development of institutions, etc. Particular attention is paid to the correct specification of regression model that is choice of explanatory variables and their economic interpretation. In some works for developing countries analysis of potential determinants of tax performance is based on panel data [8-11]. Other works estimate regressions for each year separately for cross section data [12].

As highlighted by the above analyses of recent econometric studies on taxable capacity, there is no clear pattern of the significance of all the various factors of economic potential of the region, because results vary according to the period analyzed and the sample of countries chosen. However, in general, significant influence on tax revenue have such indicators which may be interpreted as proxies of a country's stage of development - like GDP per capita, share of non-agricultural activities in GDP.

However, main condition for the application of this method is the stability of the tax system, which is mainly characteristic of developed countries and only within stable world economy. Moreover, often regression method using the OLS only reflects the current trends and does not assess the reserves of tax revenue expansion under activation of different sectors and spheres of activity [13-15].

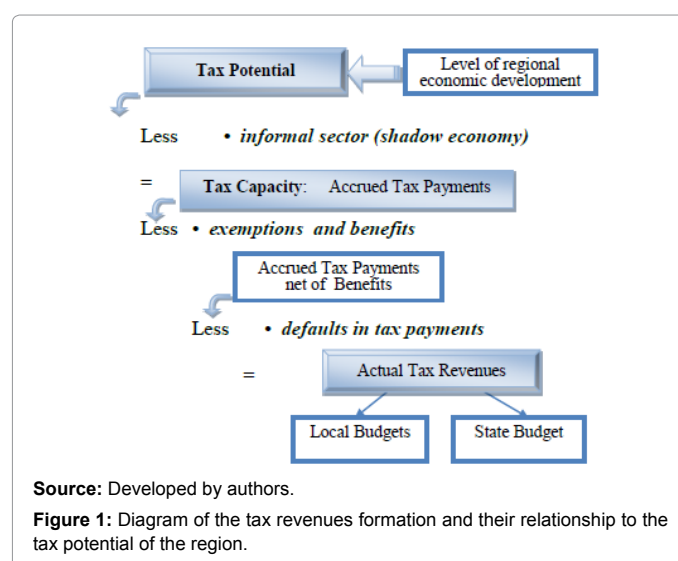
Methodology and Data

Critical analysis and generalization of alternative definitions of tax capacity and tax potential leads to the *following main conclusion*: the gap between tax potential and actual tax revenue is determined by three major factors - the extent of the shadow economy, the size of tax exemptions and benefits, as well as the number of defaults in tax payments (Figure 1). The tax capacity itself is completely determined by the level of economic development.

The second conclusion is that the tax potential is an unobservable indicator, as there are no generally accepted reliable methodological approaches to assess the extent of the informal sector.

Shortcoming associated with the instability of tax legislation, to some extent can be overcome if for assessing the structure of tax revenues the most recent tax statistics in the regional cross-section context (for the last year of reported period) is used. However, besides the instability of the dynamics of tax revenues, there also should be accounted the problem of instability caused by regional differences¹.

In these conditions the most reasonable compromise to the selection of methods for assessing the tax capacity is to use *standard econometric*



¹Thus, for one of the leading tax, VAT, regional gap in its magnitude (in per capita terms) consisted 25 times (ratio estimate of the Tashkent city to the estimate of the Samarkand region), according to preliminary data for 2010. The greatest regional differences also observed for profit tax (46 times) and property tax (19 times).

approach to the analysis of cross-section regional annual statistics (as a rule, for the last year of the reporting period). Without simple extrapolation techniques (used in time series statistics) this approach is free from distorting influence of instability of the tax system, whereas use of regional indicators of economic activity, available resources, and conditional variables to a considerable degree takes into account regional differences.

This technique does not include two broad sources of state budget revenues: a) compulsory deductions and payments to non-budgetary funds, as their consumption is not part of regional municipal authorities, b) taxes and fees administered by the Uzbekistan State Customs Committee. It involves both local taxes and state taxes, as deductions from the latter constitute a significant share of the income of regional budgets.

The general scheme of such analysis is reduced to search the best (in conceptual and statistical content) form of the relationship between tax indicators T_i (by i -th single tax) and macroeconomic development indicators of the region within a linear function:

$$T_i = c + a1 \cdot F_1 + a2 \cdot F_2 + a3 \cdot D_1 + a4 \cdot D_2$$

where T_i - amount of tax payments for the i -th type of taxes, F_1, F_2, F_3, \dots - factors of regional economic activity and resource potential; D_1, D_2, \dots - dummy variables specific to each region; $c, a1, a2, \dots$ - econometrically estimated parameters of the relationship showing statistical significance and impact of each factor on the tax indicator.

Indicators of economic activity (GDP, industry output, income and etc.) do not coincide fully with tax base indicators by specific types of taxation, which is one of the shortcomings of this approach. But this problem can largely be overcome by expanding the range of macroeconomic factors F_1, F_2, \dots

Econometric analysis of tax potential of the regions of Uzbekistan (14 regions, including the city of Tashkent) is performed for 8 types of taxes (VAT, a unified tax on small business, profit tax and others, see Table 1) according to regional statistic data for 2009.

Since macro regional economic indicators reveal the level of the economic development and changes in the tax base for various types of taxes, all available indicators in the current regionally reported statistics are used. They comprise indicators of production (output and value added of industry, agriculture, construction, transport, services, small business, energy production, non-ferrous metals, see Table 1); income (GDP, average salary); resources (area under crops). All indicators (except for acreage) are used in the analysis in value terms (uzbek sums) per capita to ensure interregional comparability.

Tax statistics use official data on tax accruals, tax benefits, tax accruals net of benefits, actual tax revenue payments. As mentioned above tax potential of the region is an unobservable indicator. The closest one to it is an indicator of the accrued taxes (Figure 1). In addition, tax accruals (before benefits) are more closely related to macroeconomic indicators than accrued taxes net of benefits. All this determined accrued taxes (before benefits) to be the object of econometric analysis, distinguishing this analysis from similar research carried out earlier by the usage of such primary and single indicator².

Analysis of the best form of relationship between tax revenues and

economic activity indicators influencing the tax base is carried out under strict conceptual and statistical quality criteria, including:

- Coherence of factors included in the model, the consistency of interpretation of estimated model parameters.
- number of factors in the model should not exceed two (based on requirement of having 6-7 observations for each factor, and no more than three if dummy variable is included);
- Statistical significance of the model and its parameters, including significance of regression coefficients (t-statistics), equation as a whole (F-statistics), insignificant heteroscedasticity of residuals (White test);
- Moderate (low) correlation of factors (absence of multicollinearity in two-factor models);
- High share of the explained variance of the dependent variable (model explanatory ability reflected by the coefficient of determination).

Empirical Results

Generalizing theoretical concepts use in budget analysis, the authors propose a model predicting the tax capacity. Tax capacity of each region is characterized by matched adequate tax bases for the calculation of single tax, particularly, the amount of income received, value-added in the manufacturing process, the value of the property, the presence of certain natural resources etc. There are currently 5 types of taxes (VAT, corporate profit tax, income tax, property tax, land improvement tax). In addition, tax payers can instead of paying them use three special tax regimes (simplified tax system, a single tax on imputed income, single retail trade and public catering tax).

Obtained results are presented in Table 1. Their analysis allows us to make the following conclusions.

For Value Added Tax statistically significant factors in the reporting period were GRP (without agriculture value added) and the output of the oil and gas sector. Changes of these indicators in 2009 explained 97.4% of the variance of accrued VAT in all regions of the country.

In this case, as follows from the parameters of estimated equation, increase in GRP by 100 sums increases VAT collections by 6.9 sum in average, i.e. effective (real) VAT rate was around 7% (compared to nominal 20%). In addition, one region (Tashkent city) by statistics of accrued VAT deeply differs from other regions (in per capita terms 5 times higher than the average for all regions).

Inclusion in the equation of relevant dummy variable ("1" corresponds to the region of Tashkent and "0" to all other regions) dramatically increases equation quality and makes it possible to take into account the individual regional characteristics of this type of tax.

For income tax the most appropriate economic indicators to estimate the tax base were the average monthly salary and the sum of two factors "Small business + Paid services". In addition, third factor was the dummy for the city of Tashkent and Navoi region, which accounts special situation of these regions (in terms of economic development, incomes, revenues, concentration of financial resources and other criteria). Membership of the region in this two-area group increases the accrued income tax ceteris paribus by 47 thousand sum (per capita, in 2009 prices).

The effective incremental income tax rate was 13%, i.e. with each additional increment of nominal wages, for example, by 100 sum, the growth of the accrued income tax is 13 sum (in 2009 prices), which is

²See, for example, articles of Chepel S., Babaev, S. "Evaluation of the tax potential of the regions in the global crisis: the case of Uzbekistan", Journal "Taxes and taxation". Moscow, № 2, 2010; Kadochnikov P., et al. "Modeling the dynamics of tax revenues, the estimate of the tax potential of the territories." Moscow: IET, 1999

Tax types	Factors	Coefficients	% of explained dispersion
1. Value Added Tax	Gross Regional Product (without agriculture)	0,069**	97,4
	Oil and Gaz sector Output	0,228***	
	Tashkent city (dummy)	576,2***	
2. Income tax	Average monthly salary	0,133***	99,1
	Sum of two factors "Small business Value Added + Paid services"	0,025***	
	Tashkent city and Navoy region (dummy)	47,1***	
3. Unified Tax on Small Business	Small business Value Added	0,059***	98,3
	Agriculture Output Tashkent city and Tashkent region (dummy)	-0,049***	
		6,95*	
4. ProfitTax	Gross Regional Product (without small business) Tashkent city (dummy)	0,010** 121,00***	96,4
5. Property Tax	Gross Regional Product (without agriculture) Tashkent city and Kashkadarya region(dummy)	0,025*** 21,84**	93,5
6. Unified Tax on Retail Trade and Public Catering	Retail Trade	0,022***	94,8
	Tashkentcity (dummy)	49,97***	
7. Land Tax for Juridical Entities	Retail Trade	0,006***	93,0
	Industry Output	0,0011***	
8. Tax on Territory Improvement and Social Infrastructure	Paid Seervices	0,041***	97,3
	Tashkent city and Kashkadarya region (dummy)	38,54***	

Source: Results of econometric analysis of regional tax (accrued tax with concessions) and macroeconomic statistics for the year 2009.

Notes: *** and ** statistical significance of regression coefficients at 1% and 5% level of significance (t-statistics).

Table 1: Results of model specification by tax payment types.

the highest growth compared with growth of other factors and taxes (except for the factor "oil and gas production" in the calculation of accrued VAT, see Table 1).

Another feature of the obtained model for income tax is its high quality. Explaining ability of the model is the highest and significant at 99%.

In the similar way analysis can be done for the rest types of taxes (on small businesses, property, etc.) using the results of the construction of econometric relationships.

Strength of the econometric approach to the analysis of the tax system is not limited to the identification of the range of macroeconomic factors that shape the amount of accrued tax payments for each type of tax at the regional level. There are ample opportunities to use it.

Above we have already discussed the issue of what kind of tax statistics (tax charged with all benefits or less of them) should be used at the initial stage of such analysis. Testing the corresponding hypothesis (hypothesis 1) using different statistical methods confirmed our conclusion on the need to use statistics of *tax liability with benefits*, because in this case the degree of closeness of the relationship between macroeconomic factors and tax payments is higher, moreover, there is possibility to use different scenarios for the provision of new tax incentives and the efficiency of tax collection.

Test results for the second hypothesis suggest *inapplicability of widely used in practice simplified scheme of the tax forecast (from the base of the previous year) in the form: Tax = Previous Year Tax *% GRP growth in nominal terms*. For each type of tax a unique set of economic indicators that best reflect its taxation base should be rather used.

Next feature of the econometric approach is that in contrast to the traditional one, construction of the models for forecasting of tax charges, can take into account *regional characteristics* (domination of various sectors in the economy of the region, income level relative to regional average and etc). This is evidenced by the based on analysis of these equations results (testing hypothesis 2).

Analysis of the derived equations *refutes rather often made statement that oil&gas and steel sectors are the main source of tax revenue* (hypothesis 3). Variable "metallurgy industry output" was not significant in any of the equations, and the "output of oil and gas sector" became part of the factors of equation only for VAT.

The developing tax system of the country reflects processes of liberalization and deepening of economic reforms. In these circumstances problem of assessing the direction of such changes on the tax burden is relevant. Macroeconomic and tax statistics for 2007-2008 made it possible to estimate the parameters of equations corresponding to this data, and to compare them with equations based on data for 2009. The results of such comparisons do not permit an unambiguous assessment on the increase (hypothesis 4) or decrease in the tax burden during this period. For individual factors and the tax types coefficients of equations have increased, while for others have decreased, and for some have remained stable. However, there were no sharp changes of the coefficients explained by the fact that changes made in recent years in the tax code did not affect the principal base of tax system and the adaptation of firms and entrepreneurs to these changes is close to completion.

Along with new analytical capabilities, econometric approach is more perfect in comparison with traditional methods of forecasting of tax potential of the regions.

Conclusion

From results of testing considered hypotheses the following conclusions can be derived.

Firstly, in the construction of schemes and forecasting algorithms for tax potential there should be used statistics of accrued taxes before deducting benefits. This allows to assess the impact of economic factors more accurately, to use different scenarios in forecasts of possible size of the granted tax benefits.

Secondly, test results indicate failure of widely used in practice, the simplified procedures of tax revenues forecasting (from the base of the previous year), which use indexes of nominal GDP growth as

approximation to the growth of tax base (this year tax = tax of the previous year * percentage of nominal GRP growth).

For each type of tax there should be used an individual set of economic indicators, that optimally reflect its tax base capacity.

Lastly, among factors of forecasting equations for the most of them variables reflecting the specifics of particular regions have to be included.

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