Research Publication

Tax Revenue Analysis

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Tax Revenue Analysis

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Content

1. Tax revenues Analysis and Tax Decomposition

The main source of overall budget revenues is tax revenues, therefore, analysis of tax revenue components is crucially important. After 2009, based on budget law, there are six types of taxes: personal income tax, value added tax, excise, import duty and real estate tax.

This research publication analyses dynamics of tax revenues as well as assesses tax burden. Tax burden is estimated as the ratio of taxes to GDP. Therefore, tax burden implies share of overall revenues that are paid by taxpayers.

As chart 1 represents during 1996-2003 size of the tax burden was 8.4%-12% of GDP, while during 2004-2009 tax revenues reached 25% of GDP. After 2009, the size of tax burden stabilize by adoption of organic law of Georgia on economic freedom imposes fiscal limits.

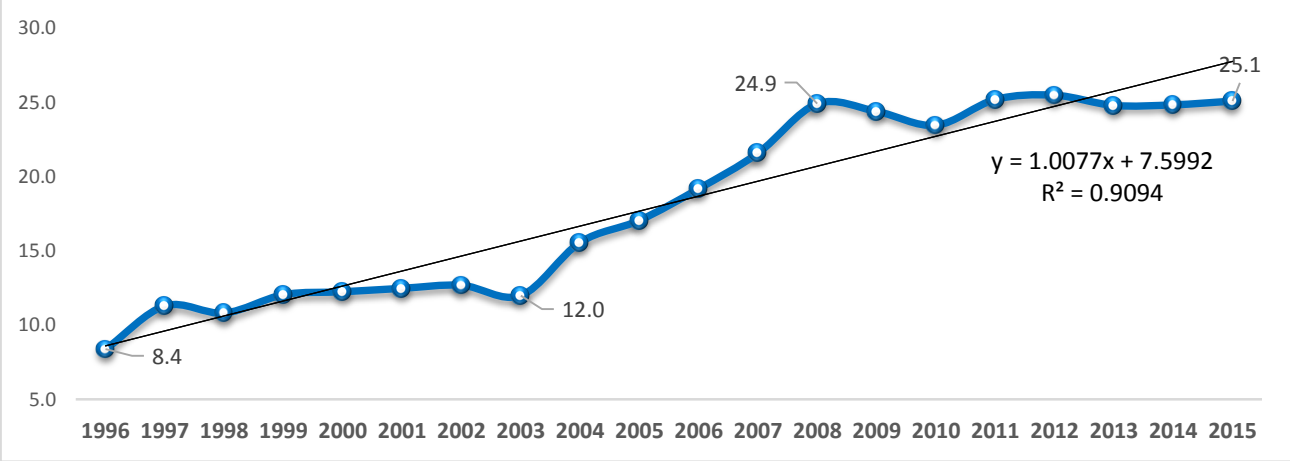

Chart 1: Tax revenues as a % of GDP.

After 2009 based, on budget law there are six types of taxes, five of them are state taxes, and one of them is subnational government tax. As chart 27 shows, value added tax takes the highest share of tax revenues. Furthermore, personal income tax, corporate income tax and excise have a significant share of tax revenues. After In 2008, personal income tax and social taxes were merged; therefore, share of personal income tax in overall tax revenues increased significantly. Also it is noteworthy that after merging of social and personal income tax rate was set 32% and then eventually decreased to 20%.

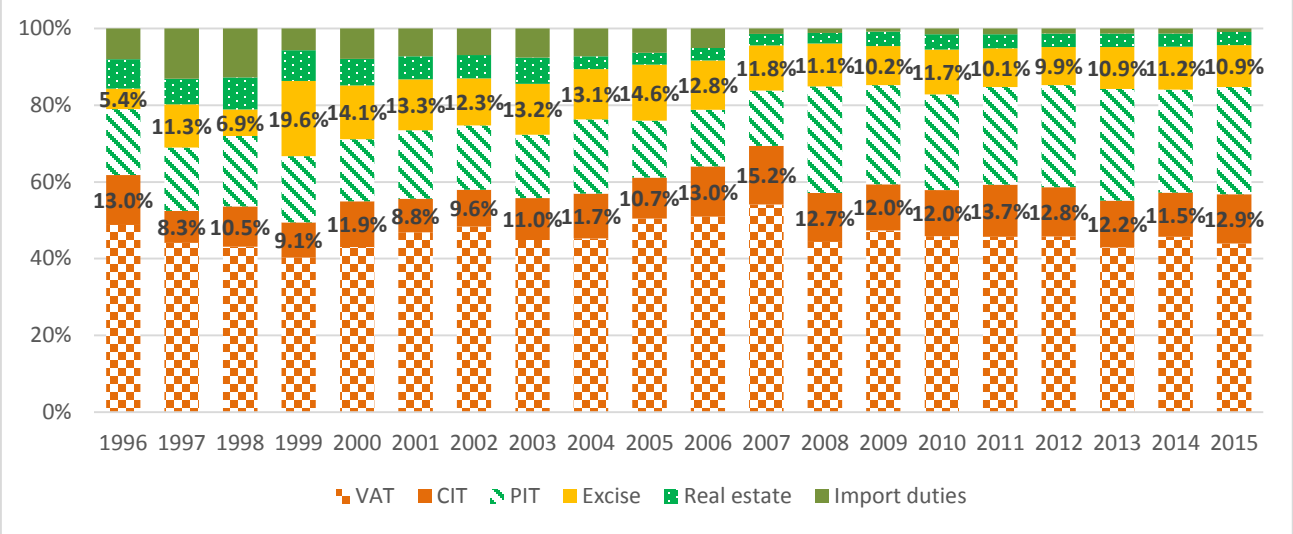

Chart 2: Structure of Taxes.

Furthermore, it is crucial to analyse stability of taxes mobilization and potential responses to various policy changes.

In order to estimate response of taxes to policy changes, one should check stationarity of times series data. Nonstationary variables are characterized by some trend; therefore, impact of policy changes on them does not deteriorate over time. Namely, policy shocks have temporary effects on nonstationary variables. However, policy shocks to stationary variables have a one-time impact, meaning that after policy impact stationary variable eventually will return to initial level. Therefore, impact of policy shocks on stationary variables has a downward trend over time.

Using Dickey-fuller and Phillips-Perron diagnostic tests it was cheeked stationarity of each tax component. It is worth to highlight that both of them had almost the same results. The results show that based on both tests personal income tax, value added tax, and excises are nonstationary variables at the level. In contrast to Dickey-fuller test, Phillips-Perron test shows that profit and property tax are stationary variables. According to both tests import duties is stationary. (See table 1)

	VAT	CIT	PIT	Excise	Real Estate	Import duties
Dickey-Fuller	I(1)**	I(1)***	I(1)***	I(1)***	I(1)***	I(0)**
Phillips-Perron	I(1)**	I(0)***	I(1)***	I(1)***	I(0)***	I(0)**

Table 1. Results of Stationarity Tests[1]

For evaluating stability, in order to determine how **stable** taxes are, we can use coefficient of variation, which is estimated as a stander error over the mean ($CV = \frac{s}{\bar{X}} * 100$).

[1] *** means 1%, **-5% and *-10% Significance level.

For analytical point of view, the time series[2] are divided into two parts: before and after tax policy changes. It is interesting that it gives us very different results. (See table 2)

	VAT	CIT	PIT	Excise	Real Estate	Import duties	Tax revenues
1996-2015	38.5	46.1	58.1	35.5	18.5	55.2	33.5
1996-2007	41.8	50.8	27.2	42.7	18.3	33.8	27.6
2008-2015	3.5	7.4	6.8	4.5	8.4	21.6	2.5

Table 2. Coefficient of Variation

As table 2 represents, coefficients of variation are high before 2007. The high coefficients may be caused by various tax system reforms before 2008. However, after 2008 almost all taxes except import duties have stabilized eventually. Import duties variance coefficients is high because exchange rate directly affects it. Moreover, share of import duties in tax revenues is small (see chart 1). Therefore, high variance coefficient of import duties is not expected to jeopardize mobilization of budget taxes.

2. Tax mobilization Sensitivity with respect to GDP

In the process of budget analyzing, it is crucially important to study the behavior of the tax revenue conjointly the debt sustainability and cost effectiveness analysis.

2.1 Tax buoyancy

Estimation of tax buoyancy for every taxes helps to evaluate the impact of GDP on tax revenues. When tax buoyancy is 1, it implies that 1 % increase in GDP will increase tax revenues by 1%. If tax buoyancy is less than one, then growth rate of GDP exceeds growth of tax revenues; if tax buoyancy is more than one, then growth rate of GDP is less than growth of tax revenues.

Tax buoyancy may differ between short-run and long-run. Short-run buoyancy is closely related to the stabilization function of fiscal policy. **If tax revenues increase by more than GDP (short-term buoyancy exceeding one), the tax system is a good automatic stabilizer. In other words, *ceteris paribus,* tax revenues promote accumulation of economic buffer during economic boom and stimulate economy during recession.** If short-term buoyancy is smaller than one, tax revenues are more stable than GDP and function less as an automatic stabilizer. Long-run

[2] CV is calculated using series tax/GDP and it is analyzed how stable is this ratio.

buoyancy is important for the impact of economic growth on fiscal balance. **Long-run buoyancy exceeding one, *ceteris paribus*, implies that higher growth will improve the fiscal balance through the revenue side of the budget, whereas a long-run buoyancy smaller than one will do the opposite**

Buoyancy can be estimated based on various methods. The easiest way to estimate buoyancy is to compute percentage change in tax revenues over percentage change of GDP.

$$tax\ buoyancy = \frac{\%\Delta\ tax\ revenues}{\%\ \Delta GDP}$$

This formula can be used to calculate overall tax revenues buoyancy as well as each tax buoyancy.

	VAT	CIT	PIT	Excise	Estate property	Import duties	Overall tax revenues
1996-2015	1.37	1.70	2.29	2.80	0.83	1.64	1.46
1996-2007	2.01	2.28	1.81	3.62	1.17	1.87	1.68
2008-2015	0.48	0.90	2.95	1.67	0.38	1.33	1.15

Table 3. Tax Buoyancy1997-2015

Table 3 represents that buoyancy of the overall tax revenue is more than 1 in each period. If in 1996-2007, buoyancies were quite high, in 2008-2015 they decreased for all type of tax revenue instead of PIT which sensitivities with respect to GDP increased after tax system reform and became almost 3. Based on this table and simple buoyancy calculation we can get some results and make some analyses but for more precise results it is preferable to use more sophisticated methods like regression analysis.

Regression analysis represents one such method of buoyancy rate. Before using regression analysis, we have to take into account table 1, where we evaluated taxes on the stationarity. We also need to remember that nominal GDP is stationary on the first difference. Econometrical models which is mostly used for evaluating tax buoyancies have this form:

$$\ln(tax_t) = c + \alpha \ln(tax_{t-i}) + \beta \ln(GDP_{t-i}) + \sigma \ln(GDP_t) + \varepsilon_t$$[3]

Based on this model current tax revenue is depended on the lagged revenue and on the current and lagged GDP as well.

From this equation, short-run buoyancy is $\boldsymbol{\beta}$ and long-run buoyancy θ can be calculated as: $\boldsymbol{\theta} = \frac{(\boldsymbol{\beta}+\boldsymbol{\sigma})}{(\mathbf{1}-\boldsymbol{\alpha})}$

This signed analysis can be expanded and fitted for our goals. If there are long run relationships (co integration) between variables, we can evaluate Error Correction Model (ECM). Using ECM, we can obtain long run and short run buoyancies as well[4].

[3] This model calls as Autoregressive Distributed Lag model (ARDL).

To check co-integration "Johansen test" is used". The test allows building Error correction model for the total tax revenue and for each individual tax revenue as well. Theoretical unrestricted ECM looks like this:

$$\%\Delta \ln(tax_t) = c + \alpha \ln(tax_{t-i}) + \beta \ln(GDP_{t-i}) + \mu \%\Delta \ln(GDP_t) + \varepsilon_t$$[5]
(3)

Based on this formula **short-run buoyancy is μ** and **long-run buoyancy - λ**, which can be calculated as: $\boldsymbol{\lambda = \frac{\beta}{-\alpha}}$.

Our Error correction model has this form and based on this result we can evaluate short-run and long-run coefficients at the same time.

Dependent Variable: LOG(TAX)-LOG(TAX(-4))
Method: ARMA Generalized Least Squares (Gauss-Newton)
Sample: 1997Q1 2015Q4
Included observations: 76

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.268216	0.570451	-3.976181	0.0002
LOG(Y)-LOG(Y(-4))	1.177992	0.219003	5.378873	0.0000
LOG(TAX(-4))	-0.457847	0.087280	-5.245700	0.0000
LOG(Y(-4))	0.645423	0.136256	4.736832	0.0000
LOG(TAX(-1))-LOG(TAX(-5))	0.346921	0.116454	2.979038	0.0040

R-squared	0.653257	Mean dependent var	0.172500
Adjusted R-squared	0.633443	S.D. dependent var	0.164143
S.E. of regression	0.099379	Akaike info criterion	-1.713705
Sum squared resid	0.691330	Schwarz criterion	-1.559206
Log likelihood	69.26395	Hannan-Quinn criter.	-1.652015
F-statistic	32.96960	Durbin-Watson stat	2.122847
Prob(F-statistic)	0.000000		

Table 4. Results of Error Correction Model

The estimated results show that **short-run buoyancy** is around 1.178, meaning that 1 percentage change of nominal GDP causes 1.178 percentage change of total tax revenue and **long-run buoyancy** is around 1.41, which can be obtained after a simple calculation (0.645/-(-0.458)) (note that in the long run economy reaches steady state).

As Table 5 represents, overall tax revenues buoyancy is more than one as in the short-run, as in long-run periods. **Therefore, Georgian taxation system is a good automatic stabilizer (short-run buoyancy 1.18), and in ceteris paribus, it promotes fiscal sustainability in the long-run (long-run**

[4] In the regression analysis there is used quarterly data: 1996Q1:2015Q4
[5] In our cases I is equal to four. It means that taxes and GDP are used in one-year lag

buoyancy 1.41). Regression based analysis of tax buoyancy (1.41) is close to the estimates represented in Table 4 (1.46).

	PIT	CIT	Excise	VAT	Real Estate	Import Duties	Overall Tax Revenues
Short-run Buoyancy	**0.94**	**1.58**	**1.42**	**1.19**	**0.24**	**1.31**	**1.18**
Zero probability	0.01	0.00	0.01	0.00	0.60	0.00	0.00
Long-run Buoyancy	**1.63**	**1.56**	**1.42**	**1.49**	**0.84**	**0.37**	**1.41**
Zero probability	0.00	0.00	0.00	0.00	0.00	0.09	0.00
R2	**0.71**	**0.35**	**0.86**	**0.58**	**0.34**	**0.74**	**0.65**

Table 5. Tax Buoyancy

Corporate Income Tax and VAT have the highest buoyancy, meaning that they are good stabilizers. During the past decade, the highest CIT buoyancy is characterized for the countries where labor income share decreased and capital income share increased. VAT buoyancy exceeds one and it can be explained by rapid decline of consumption relative to revenue due to accessibility of consumer loans during economic recession. Moreover, luxury goods are mostly subject to standard VAT rates, for which the income elasticity exceeds one. Buoyancy of excise (luxury goods are mostly subject to excise) in the long-run and short-run exceeds one (1.42).

Buoyancy of **personal income tax is less than one**, therefore it cannot be considered as an automatic stabilizer. However, in the long-run buoyancy of PIT is highest. In countries with rigid wages revenue from PIT is relatively stable and, therefore, the short-run buoyancy coefficient might be below one. For Georgia, buoyancy of PIT is less than one and equals to 0.92,

The **short-run buoyancy of import duties exceeds one,** and in the long-run is relatively stable because in the long-run buoyancy depends of volume of imports and exchange rate.

2.2 Tax Elasticity

Tax buoyancy differs from the so-called macroeconomic tax elasticity, which is similar but corrects revenue data for changes in tax policy parameters.[6]

Tax elasticity are calculated using Error Correction Model, (ECM). In the regression analysis, there are used Dummy variables to catch structural brakes or different policy changes, which have taken a place in each tax component and in the total tax system as well.

[6] Tax Buoyancy in OECD Countries-Vincent Belinga , Dora Benedek, Ruud deMooij and Jonh Norregaard.“ IMF Working Paper

	PIT	CIT	Excise	VAT	Real estate	Import duties	Overall tax revenues
Short-run Elasticity	**0.70**	**1.58**	**1.44**	**1.47**	**0.36**	**1.36**	**1.45**
Zero probability	0.04	0.00	0.02	0.00	0.39	0.02	0.00
Long-run Elasticity	**1.67**	**1.64**	**1.44**	**1.52**	**0.83**	**0.28**	**1.45**
Zero probability	0.00	0.00	0.00	0.00	0.00	0.17	0.00
R2	0.76	0.36	0.88	0.64	0.45	0.82	0.69

Table 6. Tax Elasticity

In the table 6, there are shown tax elasticities, which are calculated using ECM and taking into account one time policy changes or shocks, which were different according to the tax specifics. It should be mention that both, short-run and long-run total tax elasticities are equal to 1.45. In the both cases they are more than their own buoyancies. It can be conclude that different shocks and economic reforms taxes are getting more sensitive with respect to GDP changes.

As tables, 5 and 6 represent, almost for all taxes, elasticity coefficient is equal or exceeds to the buoyancy. Only in case of PIT short-run elasticity is less than short-run buoyancy but long–rung elasticity is still higher.

The analysis concludes that **structural changes or reforms does not influence on the taxes in short-run**. Exception is VAT, when **one time shocks' effect on the short-term sensitivity of VAT is significantly high.**

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