ANALYZES OF STATE BUDGET FORECASTING ERRORS AND ISSUES OF FORECASTING ACCURACY

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ABSTRACT

In our paper, we made a review of forecasting methods and concepts related to state budget, tested two proposed hypotheses, and found the evidence to support them. For this, we used as a sample the state budget data for Uzbekistan for the period from 2007 to 2013. First, we found that the difference between forecasted data and actual data is high but when corrected budget estimates are used based on current changes the corrected forecast gets closer to actual data. Second, we found that forecasts on state expenditures have less error than forecasts for state revenues.

Keywords: forecasting, state budget, corrected forecast data, expenditures and revenues

INTRODUCTION

It should be no surprise that forecasts are not always accurate – they are essentially about predicting the future with incomplete information. Nevertheless, forecast inaccuracy, particularly consistent underestimation of revenues and budget surpluses, generally draws intense criticism.

Ample forecast errors may have significant implications: excessive financing of deficits, debt accumulation, cutbacks of crucial public expenditure, such as investment. “A lack of credibility increases the likelihood of overshooting the deficit target or increasing the level of arrears. This can arise from pressures created by over-optimistic revenue forecasts and under budgeting of non-discretionary expenditures. It can also arise from on-compliance in budget execution.

Such issues are not unique to Uzbekistan, and forecast accuracy has been a matter of concern and subject of review. In general, there are some proposed reasons for inaccuracies and general they fall into the following categories: technical issues, such as data accuracy, forecasting methodology, process and agency structures, effects of fiscal objectives and the economic cycle.

In spite of the importance of budget forecasts accuracy, little research effort seems to have been devoted to it in Uzbekistan. In this paper, therefore, a modest attempt is made to examine the errors in the budget estimates and in the revised estimates of revenues and expenditures of the Government of Uzbekistan. In view of the increasing prominence and sensitivity of budgetary forecasts, we examine the measurement of fiscal forecasting performance and, in particular, we address the problem of the evaluation of the budgetary forecast errors, i.e. the variations between actual revenues and expenditures from their forecasted values, also we compare it with corrected budget forecasts. These errors are indicative of the non-optimization or the non-attainment of set objectives of fiscal policy. The period covered is from 2007 to 2013, a choice governed by the availability of relevant data.

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LITERATURE REVIEW

In the process of reviewing the related literature, we found several studies, which were focusing their attention on mentioned issues. Prest (1961), Allan (1965), and Davis (1980) studied the accuracy of budget forecasts in the context of the UK and concluded that accurate budget forecasts are needed if fiscal policy is to be used to move the economy toward full employment without engendering excessive inflation. In addition, Auld (1970) has investigated forecasting errors in budgetary estimates in the context of Canada, Morrison (1986) for the US, Asher (1977) for Singapore, Rabushka (1976) for Hong Kong, Bird (1970) for Colombia, and Bagdigen (2005) for Turkey. More recently, Chakraborty and Sinha (2008) have tested budgetary forecasts and their efficiency for India for the period 1990/91 to 2003/04.3. The study found that both revenue and expenditure forecasts in India are not rational. Heilemann and Stekler (2007) analyzed why macroeconomic forecast accuracy in the last 50 years in G7 has not improved. They explain it as first, due to the critic brought to macroeconomic models and to forecasting models, and the second due to the unrealistic expectations of forecast accuracy.

Ruth (2008), using the empirical studies, obtained forecasts with a higher degree of accuracy for European macroeconomic variables by combining specific sub-groups predictions in comparison with forecasts based on a single model for the whole Union.

Armstrong and Fildes (1995) showed that it is not sufficient to use a single measure of accuracy. Thus in this study more accuracy indicators were computed for the three types of forecasts on the specified horizon. The main findings suggest that implemented budgetary adjustment falls systematically short of planned adjustment for GDP, for primary balance and overall balance. Actually, the main determinants of the implementation error of both primary and overall balance are the expenditures, in particular, the capital expenditures. Moreover, it seems that errors in macroeconomic forecasts cannot be considered the driving force of the budgetary slippages. According to literature (von Hagen, 1992; von Hagen and Harden, 1994; Alesina and Perotti, 1999; Tanaka, 2003) credible plans are the conditions for healthy budget outcomes and resorting fiscal transparency and accountability.

Concentrating on one single country, Uzbekistan, allows us to provide a greater detail on the budgetary process, while using the original national documents allows us to analyze a higher number of fiscal variables. This is more difficult with cross-country data as availability and homogeneity problems may arise and then limit the analysis of fiscal forecasting performance across countries. In fact, although a number of studies have compared macroeconomic forecast accuracy of private sector economists and international organizations (Artis 1996; Ash et al. 1998; Loungani 2000; Artis and Marcellino 2001; Isiklaret al. 2004), many others have focused on single countries (Tanaka 2003 for Japan; Paleologou 2005 for UK; Mühleisenet al. 2005 for Canada; Chakraborty and Sinha 2008 for India; Balassone et al. 2010 for Italy), given the difficulty in obtaining a cross-country data set of comparable budget forecasts.

Based on the reviewed literature we propose the following two hypotheses for our study:

> Hypothesis 1: The corrected budget forecast has higher accuracy related to actual data than initially forecasted data.
>
> Hypothesis 2: Forecasts on state expenditures have higher accuracy than forecasts for state revenues.

METHODOLOGY

There are several statistical methods available to evaluate forecast performance. Mean Squared Error is the most widely used measure for its statistical properties.

In literature, there are several traditional ways of measurement, which can be ranked according to the dependence or independence of measurement scale. A complete classification is made by Hyndman and Koehler (2006) in their reference study in the field, "Another Look at Measures of Forecast Accuracy. In practice, the most used measures of forecast error are, according to Fildes and Steckler (2000) are the followings:

The *mean error* (ME) refers to the average difference between the forecast and the outturn. It is only a rough indicator of quality as positive and negative errors can offset each other, there by limiting the size of the error. The ME is however a pointer to a possible bias in the forecast. More formally, $\boldsymbol{e_{t,t} = y_{t,t} - y_t}$ for the current year and $\boldsymbol{e_{t+1,t} = y_{t+1,t} - y_{t+1}}$ for the year ahead.

The *mean absolute error* (MAE) is the average absolute difference between the forecast and the outturn. Negative errors are treated as positive ones meaning that errors can no longer cancel each other out. The MAE is thus a more accurate measure of the average forecast error than the ME. It can expressed with the following formula:

MAE $= \boldsymbol{\frac{1}{T}\sum_{t=1}^{T}\left|e_{t,t}\right|}$ for the current year and MAE $= \boldsymbol{\frac{1}{T}\sum_{t=1}^{T}\left|e_{t=+1,t}\right|}$ for the year ahead.

The *root mean squared error* (RMSE) is a measure of the relative size of the forecast error. It takes into account the fact that large forecast errors are usually considered more harmful than small differences. Formally,

RMSE $= \boldsymbol{\sqrt{\frac{1}{T}\sum_{t=1}^{T} e_{t,t}^{2}}}$ for the current year and RMSE $= \boldsymbol{\sqrt{\frac{1}{T}\sum_{t=1}^{T} e_{t+1,t}^{2}}}$ for the year ahead.

The sign of indicator value provides important information: if it has a positive value, then the current value of the variable was underestimated, which means expected average values too small. A negative value of the indicator shows expected values too high on average.

These measures of accuracy have some disadvantages. For example, RMSE is affected by outliers. Armstrong and Collopy (1992) stresses that these measures are not independent of the unit of measurement, unless if they are expressed as percentage. If we have two forecasts with the same mean absolute error, RMSE penalizes the one with the biggest errors.

All of these measures are subject to interpretation. For example, a simple dollar amount of mean or mean squared error would provide some useful information for a particular variable (or class of revenue), however, the mean percentage error means the relative errors can be compared across a number of variables (or revenue classes). Ignoring the sign of the error term by adopting absolute changes, one gets an idea of the magnitude of the errors generated by the forecasting techniques. While these tests provide useful information on the errors in forecasts, they will not provide commentary on the underlying forecast techniques.

To ask the question whether the model being used is providing valuable information, there is another technique - a 'Theil's U statistic'. In essence, the U statistic compares the performance of a forecast against a naive one-step ahead forecast. "Naive model" method assumes that the variable value in the next period is equal to the one recorded at actual moment. Theil proposed the calculation of U statistic that takes into account both changes in the negative and the positive sense of an indicator.

DATA ANALYSES, RESULTS AND DISCUSSION

In this section we have analyzed internal features of Uzbekistan's state budget for 2007-2013 period. In our analyses, we have used three variables for each category state revenues and for expenditures. The data for these categories are in forms of forecasted data, corrected budget data and actual data.

Table 1. Forecast errors in state revenue and expenditures for Uzbekistan, in percents

Indicators	**2007**		**2008**		**2009**		**2010**		**2011**		**2012**		**2013**	
	I*	II**	I	II	I	II	I	II	I	II	I	II	I	II
I. Revenue (without funds) – Total	**17**	**2,8**	**18,9**	**2,3**	**3.9**	**3,9**	**3,5**	**2,8**	**5,2**	**1,8**	**3,2**	**0,9**	**4,3**	**4,3**
1. Direct taxes	22,5	1,6	22,4	1,8	2,5	0,7	3,6	0,3	5,7	0,5	4,0	0,5	-3,6	-3,6
2. Indirect taxes	15	1,6	13,4	1,5	5,1	5,6	-1,7	4,0	-5,3	1,4	-7,2	0,6	2,7	2,7
3. Payments for resources and property taxes	6,2	0,7	8,1	2,4	5,6	1,2	5,8	3,4	12,1	2,3	17,1	0,7	3,3	3,3
4. Other revenues	45,7	13,8	47,7	6,7	-3,5	8,9	31,8	2,0	43,1	6,6	30,5	4,2	33,1	33,1
II. Expenditure (without funds) - Total	**8,4**	**-0,3**	**9,1**	**0,01**	**-1,4**	**1,0**	**-2,6**	**-1,2**	**-1,6**	**-0,5**	**-3,3**	**-1,5**	**-1,9**	**-1,9**
1. Social area and social support	0,7	0,3	5,8	0	-4,7	-0,1	-3,5	-0,4	-4,2	-0,2	-1,7	-0,3	-2,8	-2,8
2. Expenses and grants for development of civil society institutes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Expenses of the economy	1	0,9	0,8	-0,6	-3,5	0,3	-3,9	-3,2	-1,1	-0,3	-2,4	-0,9	-1,5	-1,5
4. Expenses on financing of centralized investments	4,5	2,4	3,6	3,5	2,4	1,8	4,1	2,3	13,3	5,4	-16,9	-3,7	7,7	7,7
5. Central and local governing expenses	77,8	1,3	8,6	0,6	23	-0,3	4	0,7	0,8	0,4	3,7	1	3,2	3,2
6. Other expenses	26,3	-2,9	21,1	-0,8	6,4	3,9	-2,4	-4,1	0,3	-3,4	-6,1	-5	-3,6	-3,6

Source: Calculated by author on the basis of the data from Ministry of Finance of the Republic of Uzbekistan, www.mf.uz (accessed in 2015), *I - Forecasted error, **II - Corrected budget error

The process of approving the budget in Uzbekistan is in the following described way: first, prepared forecasted budget for the next year is provided as a project before the 15th of October of the current year to the Parliament of the country (Code of budget, 2000). Then the project is discussed in the Parliament and after corrections and some additions will be approved. The accepted budget will be corrected during the financial year. Previous year's corrections usually are included in the current year's project. Sometimes the corrected budget is called as partially actual partially forecasted data. In the last step, after all estimates and after the implementation of the budget the actual data will be published. In our paper we used actual, corrected and forecasted data for analyzes.

Table 1 shows the data for Uzbekistan's budget forecast and errors occurred in forecast for 2007-2013 period. If to analyze the provided data we can see that state budget revenue (without revenue of state purposive savings) had a difference between actual and forecasted data for 17 percent in 2007 and for 18 percent for 2008 accordingly. The main reason for this kind of high level of variance for years 2007 and 2008 is because of a high variance in the category of revenue from indirect taxes (15 and 13.4 % accordingly) and the variance in other revenues (45.7 and 47.7% accordingly). This variance in those years occurred due to the budget-tax policy of the government on that period which had a goal to support the early period of modernization of the economy through leaving a significant part of revenue in hands of producers. Later in years from 2009 to 2013 due to high revenue from other sources, the variance has decreased. We can assume also that another reason for decrease of the variance could be the positive results of economic reforms conducted earlier. If to analyze the variance between actual and forecasted data for the state budget we can see that for later periods the variance is not significantly high. In this aspect 2008 and 2009 results are different from other years. We can find 8.4 and 9.1 % range of variance in actual and forecast data. This means that the expenditures were more than it was planned. This happened due to higher than planned expenses in such areas of budget as education, health issues, and state investments, central and local governing. Starting from 2009 to 2013 due to underfinancing of such areas as social support of population and other social expenditures there was a variance in actual and forecasted results between -3.3 to -1.9 percent. Some positive conclusion arises from such results in recent years, where some portion of budget is not used.

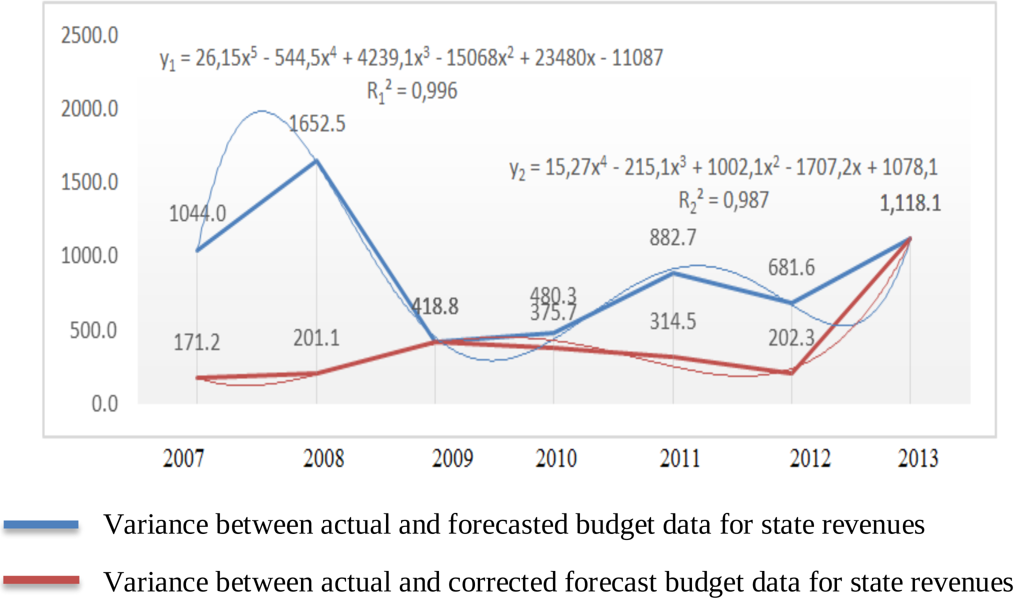

Figure 1. Dynamics of variance between forecasted, corrected and actual budget data for state revenues (in million UZS)

This can be because of increase of efficiency of financial management through implementation of new regulation for state purchases. For the period from 2007 and 2013 the corrected budget error is around 0.9 to 4.3 which means it is relatively small. This proves that corrected budget data is partially forecasted and partially actual data.

Smallest variance for the corrected budget data was for years 2007 and 2008, in -0.3 and 0.01%. Thus, there was a maximum closeness of actual and corrected data for those years.

Figure 1. shows that in recent years the difference between state budget forecasts and corrected budget data is becoming smaller. This relationship has high level of determination coefficient ($R^2 = 0{,}996$ ва $R^2 = 0{,}987$). Figure 2. on the other hand shows the relationship between budget expenditures forecasts and corrected budget for expenditures. We can see from the trend here that they get closer to each other as they are closer to the current time. In addition, they have negative signs. This means that either there is a mistake in forecasting or that there is a lack of financing of state budget expenditures.

Noteworthy that the difference between actual data for budget on expenditures and corrected budget is smaller if compared with forecasted data. This means that government is achieving higher efficiency of budget implementation through current corrections to the forecasted budget. Coefficient of determinant is $R^2 = 0{,}899$ and $R^2 = 0{,}999$ which means high level of correlation and that this line of best fit explains the proposed model well enough.

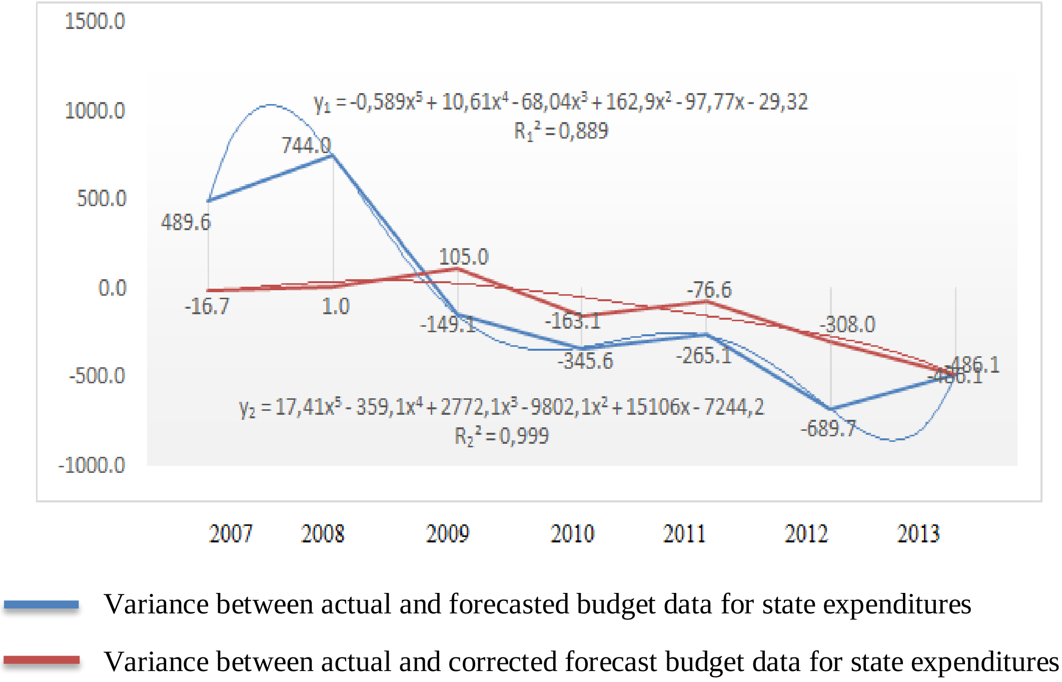

Figure 2. Dynamics of variance between forecasted, corrected and actual budget data for state expenditures (in million UZS)

In general, we can conclude that in most cases state budget revenue was underestimated and also that in reality it had higher revenue levels and that some of state budget expenditure were not sufficiently financed.

In the given table 2, data shows that corrected budget variable has smaller standard deviation and Theil's U statistics. Standard deviation of forecasted and actual state revenue is highest for indirect taxes (455.73) and is also high for the corrected budget forecasts (123.15).

Table 2. State budget forecast data and its standard deviation and Theil's U statistics, 2007-2013

Indicators	Forecasted and actual data (s.d.)	Corrected budget forecast and actual data (s.d.)	Theil's U statistics Forecasted and actual data (Theil's U statistics)	Corrected budget forecast and actual data (Theil's U statistics)
I. Revenue (without funds) – Total	**394,65**	**305,88**	**0,221**	**0,117**
1. Direct taxes	218,44	89,28	0,257	0,083
2. Indirect taxes	455,73	123,15	0,172	0,092
3. Payments for resources and property taxes	167,9	38,12	0,492	0,100
4. Other revenues	278,77	274,2	1,265	0,661
II. Expenditure (without funds) - Total	**485,03**	**188,03**	**0,097**	**0,050**
1. Social area and social support	225,08	145,24	0,100	0,057
2. Expenses and grants for the development of civil society institutes	0	0	0	0
3. Expenses of the economy	25,95	19,87	0,080	0,053
4. Expenses on financing of centralized investments	103,38	51,82	0,282	0,162
5. Central and local governing expenses	42,49	12,11	0,173	0,063
6. Other expenses	260,38	98,99	0,229	0,132
State budget surplus (+) and deficit (-)	368,2	454,64	0,993	0,921

The difference between the forecasted data for state budget expenditures and corrected budget forecasts is more than 2.5 times. And in the list of expenditures social area and social support expenses have the highest contribution. Theil's U statistics indicates that corrected budget forecasts are twice closer to the actual data. This supports our proposed hypotheses.

CONCLUSION

In this paper we made a thorough review of concepts and methods of forecasting and discussed issues related to budget forecast accuracy. Also there have been made an attempt to make analyzes of errors for budget forecasts. We have used as a sample for our analyzes the data from the Republic of Uzbekistan for years 2007-2013. We have proposed two hypotheses, where in the first hypothesis we assumed that the corrected budget forecast should have higher accuracy related to actual data than initially forecasted data and found the that in our sample, the difference between forecasted data and actual data is high but when corrected budget estimates are used on the basis of current changes the corrected forecast gets closer to actual data. This fact supports our first proposed hypothesis.

Our second hypothesis stated that forecasts on state expenditures have higher accuracy than forecasts for state revenues, after several tests we found that in our sample forecasts on state expenditures have less error than ones for state revenues, which also means that our hypothesis found its support.

Beside of it we make the following additional conclusions. In our opinion in our sample, which also could be same in other countries also, due to problems with transparency of the data to obtain from different sources the forecasts before the budget period have higher errors than those when are made on the basis of current changes. Last, we found the tendency of improving the forecast results as it gets closer to the actual data by years.

These findings are based on empirical analyzes and are based on one particular country, they should be used with caution. Future researches recommended examining the moderate effect of various factors, they can explore how different factors contingently contribute to improve or deprave the forecast accuracy.

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