



RESEARCH PAPER

An Empirical Relationship between Government Size and Economic Growth of Pakistan in the Presence of Different Budget Uncertainty Measures

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PAPER INFO	ABSTRACT
<p>Received: July 21, 2021</p> <p>Accepted: October 03, 2021</p> <p>Online: October 06, 2021</p> <p>Keywords: Budget Uncertainty, Economic Growth, Government Size, Policy Credibility</p> <p>*Corresponding Author:</p> <p>sunilajabeen@hotmail.com</p>	<p>Relationship between government size and economic growth has always been a debated issue all over the world since the formative work of Barro (1990). However, this relationship becomes more questionable when policy uncertainty is added in it. Hence, this paper presents evidence on the effect of government size on economic growth in the presence of budget uncertainty measured through three different approaches. Rather than relying on the traditional and complicated measures of uncertainty, a new method of measuring uncertainty based on government budget revisions of total spending is introduced and compared with the other competing approaches. Using time series annual data from 1973-2018, the short run and long run coefficients from Autoregressive Distributed Lag (ARDL) framework validate the negative effect of budget uncertainty and government size on economic growth of Pakistan regardless of the uncertainty measure used. Therefore, to attain the long run economic growth, along with the control on the share of government spending in total GDP, government should keep the revisions in the budget as close to the initial announcements as it can so that uncertainty can be reduced. Further, the uncertainty in fiscal spending calculated through the deviation method raises a big question on the credibility of fiscal policy in Pakistan. Higher will be the deviation higher will be the uncertainty and lower the fiscal policy credibility hence making fiscal policy less effective in the long run.</p>

Introduction

Although according to the economists, the mechanism of free markets is the supreme device to allocate the resources in a society. But government also plays a vital role to control and allocate the resources of the economy to the different sectors by the different means and channels. Pakistan's economy is a mixed-market economy as along with feely functioning markets there is substantial direct and indirect public intervention in the economy. Theoretically, government size is likely to be detrimental to economic growth, due to inefficiency of government activities. Freeman (1975) extracted that the larger the size of government the higher the inefficiencies. But, empirically the relationship of government size with economic growth is found ambiguous all over the world. Same is the

case with Pakistan. Some studies indicate the negative effect of total government size on economic growth e.g., Zareen and Qayyum, (2014), while others have proven positive effect e.g., Farooq, (2016). On the other hand, the non-linear relationship between government spending and economic growth is also verified in Pakistan (see Husnain, 2011). The variation of results can be because of the use of different data, methodology and the number of control variables. But an important factor which is ignored and may have harmful effect on growth is the budget uncertainty. Macroeconomic uncertainty triggered by budget uncertainty is a fundamental part of decision making and condenses strong implication for economic growth. More specifically, the dilemma of uncertain government expenditures reduces total factor productivity and impedes economic growth (Henrekson, 1993). However, Barro (1990) came with a different reason for these ambiguous results by decomposing the total government expenditures into production- enhancing and consumption-enhancing component. According to the Barro (1990), the production-enhancing component of total government spending works as positive externality for private producers hence have a positive effect on growth while consumption- enhancing component has a negative effect on the growth by decreasing the saving and consequently investment. Hence, total government expenditures of a country may have a positive or negative effect on the growth of that country depending upon the share of the production or consumption enhancing component in total government spending. But, Balducci (2005) solved the model mathematically without differentiating between consumption-enhancing and production-enhancing component and found that growth will be much higher if we assume that all kind of government expenditures affect utility of the consumers and production of the producers at the same time. Later on Echevarria, (2012) extended the Barro (1990) model mathematically and analytically for aggregate uncertainty and found that although uncertainty can negatively affect the long run growth but it does not affect the relationship between government size and economic growth.

However, in the original Barro (1990) model and its extensions one thing is very common and that is “private producers believe that government will not deviate from its initial announced budgeted spending” But practically the implementation of budget does not represent the true picture of the approved amounts. Even though sometimes the funding amount is not spent for the purposes for which it was approved. Although, a lot of studies produced different reasons for such deviations of actual amounts from the final accounts such as lack of monitoring from representative bodies (Wildavsky, 1992), budget exploiting bureaucrats (Niskanen, 2004), lack of transparency in the process of the implementation of the budget (Cleveland, 2006), and some other factors such as the less control over revenue deviation which in turn increases the overspending expenditures (Liu and Wang, 2015)

For Pakistan, it is estimated that such deviations in the budget from final accounts are due to the external factors (Zakaria and Ali, 2010). However, whatever is the reason these deviations in the budget from its final accounts are likely to increase macroeconomic or more specifically the fiscal uncertainty. Pakistan has long history of such deviations and uncertainty calculated through these deviations reached to about 29% in the fiscal year 2010. But in literature, to measure the fiscal policy uncertainty more focus is given to the volatility of actual government spending and deviations of the final spending from their respective initial announcements in the form of budget is regarded as a way to measure the government forecasting efficiency.

Broadly speaking, measures of uncertainty used in the literature can be categorized into two methods; ex ante and ex post. Ex ante approach measures the uncertainty by using the survey data. The advantage of this approach is that the uncertainty measured through this method represents individual's perceptions of risks based on the information available to them. But practically the data obtained through this approach would be reliable only if there are large numbers of respondents and countries should be more than 100. While, uncertainty variable constructed through ex post approach relies heavily on historical data. The variance calculated through this approach can be divided further into four groups; conditional variance generated through Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) model, simple statistical variance, variance generated through the unpredictable part of a stochastic process (UPSP hereafter) and finally variance calculated from motion of the Geometric Brownian. Under this approach, GARCH type models and UPSP are more prevalent in empirics specifically for macro data.

In this regard, Abbas et. al, (2019), for instance, used the best fitted GARCH model to compute the variable of macroeconomic uncertainty. The results of short run and long run coefficients extracted from ARDL method revealed that macroeconomic uncertainty and political stability have robust effect on overall investment in Pakistan.

Fatima and Waheed, (2011) used the accelerator model of investment and endogenous growth model to analyze the effect of uncertainty related to macroeconomic variables such as openness, capital inflows and fiscal policy. For creating the uncertainty, the conditional variance is estimated through the Generalized Autoregressive Conditional Heteroscedasticity (GARCH). The results clearly indicate that the macroeconomic uncertainty have significant negative effects on investment and per capita income of Pakistan. Working with the same line they found through forecasting of the model that economic policy uncertainty not only affects the current level of investment and economic growth but also hampers the future prospects (Fatima and Waheed, 2014). Whenever an adjustment is made in economic policies in response to the change in policy objectives an uncertain environment is formed in the country, hence, leading to the deterioration of the investment climate and economic growth.

Farooq and Yasmeen, (2017) estimated the effect of fiscal uncertainty on output per capita of Pakistan in the presence of financial development indicators using ARDL approach to cointegration. The uncertainty in government expenditures, revenue and budget deficit is calculated through GARCH model. Based on the results, it is suggested that government should promote financial development indicators to mitigate the detrimental effects of fiscal policy instability.

Rather than relying on ex-post method of measuring uncertainty, Choudhary et.al, (2020) developed an Economic Policy Uncertainty Index by using four leading newspapers of Pakistan. The longer EPU Index ranging from August 2010 to April 2020 revealed that uncertainty was highest in the period of 2010. The period from July 2012 to July 2014 was the period of low uncertainty specifically 2013 was the period of almost no uncertainty in terms of events effecting policy uncertainty. From August 2014 to September 2014 was the period of high uncertainty, which remained subdued during the year of 2015 and 2016 but remained persistently high from July 2017 onwards.

Thus, in this study, a big vacuum in empirical literature is covered by introducing not only the fiscal uncertainty in the Barro model but also considering three different methods of measuring fiscal uncertainty. It is observed through literature that to measure the fiscal uncertainty mostly the economists use the variance of the final outcomes. But, in real life people are more concerned about the budget announcements and the way these announcements are fulfilled. Hence, rather than relying on the more complicated and stubborn traditional methods of measuring macroeconomic uncertainty, this study has introduced a new and simple method of measuring uncertainty based on the deviations of the revised budget estimates from its initial estimates. Further, the effect of these deviations on economic growth and fiscal policy effectiveness is analyzed to answer the question of why policy makers should control the inefficiency in forecasting the budget raised by the study of Zakaria and Ali, (2010).

With this background, the objectives of the study are;

1. To measure and compare the budget uncertainty calculated through three different methods.
2. To estimate the effect of government size on the economic growth of Pakistan in the presence of budget uncertainties.

Here, the first objective is constructed to analyze whether deviations in government spending from the announced budget creates same uncertainty that did the volatility of actual or final government spending. While the second one analyzes the comparison of all of three budget uncertainties in terms of their effect on economic growth and how important are these uncertainties to make fiscal policy more effective.

Data and Model Specification

Our empirical specification is motivated by endogenous growth model of Barro (1990). The production function in the endogenous growth models is stated without diminishing returns. Hence, the factors that affect the level of technology can affect the long run growth. The Cobb-Douglas production function in labor per worker form is given as,

$$Y = A K^\alpha G^{1-\alpha} \dots \dots \dots (1) \quad \text{Where, } 0 < \alpha < 1$$

As labor corresponds to population therefore, Y is per capita GDP, A is Total factor productivity, K is capital to labor ratio, and G is per capita government purchases.

The model relates real GDP per capita growth to two kinds of factors of productions: Capital and Government spending and exhibits constant returns to scale. Because, Barro (1990) assumes that government spending is a productive input for private production. He divided total Government spending into productive and unproductive. But, we have assumed following the Balducci, (2005) that all kind of government expenditures enters into the production function as well as utility function.

The model can be linearized by taking the natural log of equation (1).

$$\ln Y = \ln A + \alpha \ln K + (1-\alpha) \ln G \dots \dots \dots (2)$$

$$y = A_0 + \alpha k + (1-\alpha) g \dots \dots \dots (3)$$

Where, $y = \ln Y$, $A_0 = \ln A$, $k = \ln K$, $g = \ln G$,

But a simple causal relationship cannot be found between government expenditures and economic growth of Pakistan (Muhammad et al., 2015). Therefore, it is necessary to extend the simple model of Barro (1990) for other control variables. Other control variables can be augmented directly in the equation (3) following Lensik et al., (1999) or indirectly through productivity channel following Amir and Dar (2002) and Echevarria, (2012). We have applied two of the approaches.

$$A_0 = \alpha_0 + \alpha_1 BUN \dots \dots \dots (4)$$

In equation (4), BUN is the total budget uncertainty that is going to affect the growth rate of GDP through total productivity channel. While other control variables are added directly into the simple Barro model. Substituting Equation (4) into Equation (3) and adding the other control variables, we get the following version of our extended Barro model.

$$y = \alpha_0 + \alpha_1 BUN + \alpha_2 TO + \alpha_3 INF + \alpha_4 g + \alpha_5 k \dots \dots \dots (5)$$

To make the dependent side as a growth rate $\ln Y_{t-1} = y_{t-1}$ is subtracted from both sides of the equation.

The econometric representation of above model is

$$y_t - y_{t-1} = \alpha_0 + \alpha_1 BUN_t + \alpha_2 TO_t + \alpha_3 INF_t + \alpha_4 GS_t + \alpha_5 CAP_t - \beta_0 y_{t-1} + \mu_t \dots \dots \dots (6)$$

Where, y is the Real GDP (Gross Domestic Product) per worker constant at 2006 prices, CAP is the capital stock per worker, GS is the nominal government size defined in terms of the share of total government spending in GDP, BUN is the budget uncertainty defined in terms of volatility of total government expenditures calculated through three different methods (detail of measurement procedures is presented below), INF is the annual percentage change in GDP Deflator with 2006 as base year, TO is trade openness measured as the share of total trade in GDP, μ is the error term and α_i 's ($i=0, 1, \dots, 5$) are the coefficients to be regressed. Subscript t represents the annual time series ranging from 1973-2018.

Data is taken from Pakistan Economic Survey (different issues) to make the series of government size and budget uncertainty. While, all other data series are taken from World Development Indicators, (2019, online).

The Measurement of Budget Uncertainty

To measure the budget uncertainty calculated through deviation of the announced government spending from their subsequent revised government spending following equation is used;

$$BUNR = (RBE - IBE) / (IBE) \dots \dots \dots (7)$$

Here, BUNR represents budget uncertainty of government spending, IBE is the initial estimate of government spending which is calculated before the start of each fiscal year, and RBE is the revised estimate of government spending calculated at the end of the every ongoing fiscal year.

To verify whether these deviations create the uncertainty or not two other methods to measure uncertainty are also used. The first method to measure the volatility of government expenditures is based on conditional variance called GARCH (1, 1) model and the second one is based on the unconditional variance called UPSP following Lensink et al., (1999).

The comparative analysis of all the three measures of budget uncertainty is given in table 1.

Table 1
Descriptive Statistics of Three Budget Uncertainty Measures

	BUNR	BUNU	BUNG
Mean	0.004	0.003	0.004
Median	0.002	0.001	0.003
Maximum	0.029	0.020	0.023
Minimum	-0.004	1.34E-06	0.001
Std. Dev.	0.007	0.005	0.004
Skewness	1.550	2.045	2.619
Kurtosis	4.817	6.502	10.877
Jarque-Bera	23.68	53.17	164.09
Probability	0.000	0.000	0.000
Sum Sq. Dev.	0.002	0.001	0.000
Observations	44	44	44

In short, although in terms of descriptive statistics all the three measures of budget uncertainty used in the study are almost the same, but in terms of measurement and realism our newly produced measure of budget uncertainty BUNR has an edge on the other two measures namely BUNU and BUNG. First, unlike the other two measures our newly produced measure does not need any prior information for forecasting so the number of observations will not be consumed. Such as in a time series data for the GARCH model to be efficient and reliable a long data series is needed. Second, this measure of uncertainty is more practical than the other measures. In the real-life people are more concerned about the government announced budget estimates rather than to forecast the budget by themselves given the prior information of government spending. Third is the simplicity of this newly produced measure. Unlike the other two complicated procedures to measure the budget uncertainty, BUNR is a simple deviation which does not need any comprehensive forecasting and performance diagnostics.

Material and Methods

Before starting any estimation procedure, it is necessary to check the unit root of the individual series, because the presence of unit roots in the series leads to the spurious results.

Test of Stationarity

To test the unit root in the series Augmented Dickey Fuller (ADF) test is applied.

Table 2
Augmented Dickey Fuller Unit Root Results

Variable	Level	First Difference	Order of Integration
lnCAP	1.34	-5.69*	I(1)
lnGDP	4.31	-4.59*	I(1)
GS	-0.12	-7.26*	I(1)
INF	-2.25**	-----	I(0)
TO	-7.64*	-----	I(0)
BUNR	-3.64*	-----	I(0)
BUNU	-4.16*	-----	I(0)
BUNG	-5.38*	-----	I(0)
lnGEX	-3.88**	-----	I(0)

Note: *, ** represents 1% and 5% level of significance

Optimal lag length is selected based on Schwarz Information Criterion (SIC).

The results of above Table 2 clearly indicate that all the variables are showing a mix order of Integration. All variables are stationary at level except lnCAP and lnGDP and GS that are stationary at first difference.

Auto Regressive Distributed Lag (ARDL) Method

Pesaren and Shin (1999) developed Auto Regressive Distributive Lag (ARDL) model to investigate the existence of cointegration and the long run relationship between the variables. The specified variables and their lags when added to auto-regression, tend to generate Auto regressive Distributive Lag model. The basic purpose of the model is to incorporate I (0) and I (1) variables in the same estimation. Because OLS is only appropriate if all the variables are I (0) and VECM (Johanson Approach) is appropriate if all are I(1).

$$\begin{aligned}
 \Delta Y_t = & \alpha + \sum_{j=1}^p \beta_{1j} \Delta Y_{t-j} + \sum_{j=0}^q \beta_{2j} \Delta CAP_{t-j} + \sum_{k=0}^r \beta_{3k} \Delta GS_{t-k} + \sum_{u=0}^m \beta_{4u} \Delta BUN_{t-u} \\
 & + \sum_{v=0}^n \beta_{5v} \Delta INF_{t-v} + \sum_{w=0}^x \beta_{6w} TO_{t-w} + \gamma_1 Y_{t-1} + \gamma_2 CAP_{t-1} + \gamma_3 GS_{t-1} \\
 & + \gamma_4 BUN_{t-1} + \gamma_5 INF_{t-1} + \gamma_6 TO_{t-1} + \gamma_7 D_y + \epsilon_t \dots \dots \dots (8)
 \end{aligned}$$

In equation (8) Δ is the difference operator and Y is the \ln GDP per worker, hence dependent variable is growth rate of GDP per worker. Here Dy is the dummy variable which takes the value of 0 until 2004 and 1 for the values equal to and greater than 2005. On the right-hand side of equation (8), all the coefficients of differenced variables are representing the short run dynamics and coefficients attached with level variables are representing long run effects. Hence, coefficients from β_1 to β_6 are the short run and from γ_1 to γ_6 are the long run coefficients and ϵ_t is the error term. The values p, q, r, m, n and x are number of lags selected basis on the Schwarz Information Criteria (SIC).

To evaluate the existence of long run cointegration between variables Pesaran et.al (2001) uses F-Bound test with the upper and lower bound critical values. If the calculated value of F-test is higher than the upper critical value, then the following hypothesis is rejected, and existence of long run relationship is accepted.

$$H_0: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0$$

But if the calculated value of F-statics appears less than the lower bound critical value then it is accepted that there is no log run relationship between the underlying variables. Further, the F-statistics value lying in between the upper and lower bound critical values gives inconclusive results about the long run relationship.

In the next step, Vector Error Correction Model is used to identify any possible causality between BUN and GDP growth.

$$\begin{aligned} \Delta Y_t = & \alpha + \sum_{j=1}^p \beta_{1j} \Delta Y_{t-j} + \sum_{j=0}^q \beta_{2j} \Delta CAP_{t-j} + \sum_{k=0}^r \beta_{3k} \Delta GS_{t-k} + \sum_{u=0}^m \beta_{4u} \Delta BUN_{t-u} \\ & + \sum_{v=0}^n \beta_{5v} \Delta INF_{t-v} + \sum_{w=0}^x \beta_{6w} TO_{t-w} + \gamma_7 ECT_{-1} \\ & + \epsilon_t \dots \dots \dots (9) \end{aligned}$$

Here, in equation (9) ECT_{-1} is the lagged value of Error Correction term and the coefficient attached to it represents speed of adjustment. For reliability of the results γ_7 should not be equal to zero.

Results and Discussion

This section deals with the elaboration of the results estimated through ARDL method.

Table 3
ARDL Results for Long run Coefficients

$\Delta(\ln$ GDP)	Specification 1: with BUNR (1,1,0,0,0,0)	Specification 2: with BUNU (1,1,0,0,0,2)	Specification 3: with BUNG (1,1,0,0,0,0)	Specification 3: without BUNR (1,1,1,2,0)
F-statistics	6.996* [4.21]	10.557* [4.21]	8.003* [4.21]	10.305* [4.44]

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LnCAP	0.963*	1.005*	0.982*	0.945*
GS	-1.787**	-2.926*	-1.409**	-0.747
INF	-1.220**	-0.937*	-0.705***	-2.722*
TO	0.514	-0.060	-0.481	0.784
BUNR	-0.702**	-0.291*	-0.150*	-----
ARDL Results for Short run Coefficients				
D(lnCAP)	1.195*	1.102*	1.090*	1.070*
D(GS)	-0.220***	-0.383*	-0.225**	-0.560*
D(INF)	-0.150**	-0.122***	-0.113	-0.202***
D(INF(-1))	-----	-----	-----	0.178*
D(TO)	0.063	-0.007	-0.077	0.121
D(BUN)	-0.086**	-1.400**	-2.417*	-----
D(BUN(-1))	-----	0.770*	-----	-----
D05	0.030*	0.017*	0.027*	0.040*
ECM(-1)	-0.123*	-0.130*	-0.160*	-0.155*

Note: 1- '*', '**', '***' stands for 1%, 5% and 10% level of significance, respectively.

2-Values given in parenthesis () represent the number of lags selected based on SIC.

3- Values given in [] brackets are upper bound critical values for F-bound test.

In the above table 3, $\Delta(\text{LnGDP})$ is representing the growth rate of GDP per capita. In specification 1, at very first is the coefficient of lnCAP (capital per worker) which shows that a one percent changes in capital leads to 0.96 percentage point positive change in the growth rate of GDP per capita. It means that even if the number of persons employed in the economy is constant still the increase in capital will improve the growth rate. In other words, being a labor-intensive country there is a need to induce more capital in the economy to boost the growth. These results are in accordance with the classical growth model of capital accumulation. Second is the GS (government size) which shows that higher the share of total government in the GDP lower will be the growth. The size of this negative effect is about 1.78 percentage point; hence a one unit increase in government size will decrease the growth by about 1.78 percentage point. On empirical side some studies e.g., Zareen and Qayum, (2014), Berg and Henrekson, (2011) also find the negative relationship between government size and economic growth. Third variable is the INF (inflation) which shows that a one percent unit change in inflation will decrease the GDP growth by about 1.22 percentage point. High inflation is forever associated with large cost discrepancy, which leads to the doubtfulness about the expectations of the effectiveness of investment projects. This behavior affects the conventional investment judgment that would be the case otherwise. Hence leads to lesser levels of investment and economic growth. Inflation might also impact an economy's balance of payments by making its exports comparatively more expensive. It can lead to the lesser demand from foreigners for domestic goods and services resulting in low GDP per capita. Fourth is the TO (trade openness) which is positive but not significant enough to affect the growth. This is the case with many developing countries because they do not have enough share of trade in GDP, hence is the case in Pakistan. Fifth is the BUNR (budget uncertainty) which is negative and significant as expected and according to theory. Hence, a one percent unit change in budget uncertainty will decrease the growth by 0.45 percentage point. The more often the government misses a target the more will be uncertainty in the minds of investors, consumers, and labors as well. When labor is uncertain about the wage their productivity is compromised. Investors

are uncertain about whether the government will complete the announced projects and invest the said amount or not. Consumers are uncertain about whether the concessions announced in the annual budget i, e., in the form of subsidies, or taxes will be given or not. So, all these uncertainties make the policy of government less effective. Resultantly even with the increase in the government expenditure aggregate demand does not increase to its full extent making the growth rate lower.

The comparison of the results given in specification 1 with the specification 2 and 3 shows that all the variables maintaining the same signs and significant except for the magnitudes. The magnitude of BUNU calculated through unpredictable part of the stochastic term is reduced to 0.29 as compared to specification 1. While the magnitude of BUNG is reduced to 0.15 as compared to specification 1 and 2. Hence, in terms of the statistical significance budget uncertainty due to deviations in the revised estimates is equally important and effects the growth of the GDP per capita as the uncertainty attached with the actual government spending do. But in terms of the magnitude, the effect of the revised estimates uncertainty is much stronger than the others which shows that control of this type of uncertainty will improve the credibility of the government policy and hence the growth.

To see the effect of the budget uncertainty on fiscal policy in column 4 of the table 3 budget uncertainty is removed from the original model, which is the traditional model of Barro (1990) used in literature. The results from this specification show that there is no difference in the signs and significance of the coefficients of all the variables except government size. In specification 4, government size is not showing a significant long run effect on the growth rate of GDP. Thus, for the fiscal policy to be effective in the long run it is necessary to control the budget uncertainty along with the other variables. Muhammad et. al. (2015) also finds no long run relationship between GDP growth and government size for Pakistan in a simple growth model where uncertainty is not controlled.

However, it does not mean that if a policy is not significant in the long run, it will necessarily not be effective in the short run as well. Therefore, to analyze the short run effectiveness of these variables on the growth rate of GDP, Vector Error Correction Model is used. The results of the short run coefficients are given in the lower part of table 3. In comprehension, short run results are not very different from long run results. Capital has a significant and positive effect on growth rate and size of this effect is about 1 percentage points in all the specifications of the model. Government Size is showing very interesting results from policy perspective that fiscal policy can be effective in the short run even if we do not control the BUNR (specification 4). Hence, a one unit decrease in Government Size will increase the growth by about 0.22 percentage point. Inflation is again negative and significant for all the specifications except specification 3 where inflation is not significant enough to affect the GDP growth in the short run. However, specification 4 is showing that any change in inflation in the previous year can have a significant positive effect on the growth rate of GDP per worker in the current year. It implies that to gain the fruitful results from inflation policy makers must wait for at least one year. Trade openness is again not significant enough to affect the economic growth in the short run as well. Budget Uncertainty again has a significant and negative effect on the growth rate of GDP in the all the specifications. However, the results from specification 2 show that in the short run budget uncertainty BUNU can affect the GDP growth positively after one year. Two other

coefficients are also present in the table 4; D05 and ECM (-1). The coefficient of the dummy variable, D05 is positive and significant as found by the studies in the same stance of literature in Pakistan e.g. Zareen and Qayum, (2014). Although in 2005 a devastating earthquake hit the economy of Pakistan but after this incidence a huge amount of foreign aid came in the country. It led to the increase in the development expenditures that resulted in a positive effect on the economic growth. At last is the coefficient of the ECM (-1) which represents the speed of adjustment of the economy towards its long run path. It is negative and significant for all the three specifications. It implies that, if we control the variables given in equation (6), any deviation of GDP per worker growth from its long run path will be adjusted by about 12% to 15% every year. In other words, it means that economy will take about 7 to 8 years to come back to its original long run path.

Table 4
Post Estimation Model Diagnostics

Adjusted R2	0.721	0.790	0.741	0.790
Durbin Watson	1.986	2.215	2.056	1.965
CUSUM	Within 95% confidence interval	Within 95% confidence interval	Within 95% confidence interval	Within 95% confidence interval
CUSUM Square	Within 95% confidence interval	Within 95% confidence interval	Within 95% confidence interval	Within 95% confidence interval
BGSC_LM test	Prob.F(2,33) 0.377	Prob.F(2,30) 0.168	Prob.F(2,33) 0.882	Prob.F(2,30) 0.370
Heteroscedasticity ARCH test	Prob.F(1,40) 0.712	Prob.F(1,39) 0.908	Prob.F(1,40) 0.710	Prob.F(1,39) 0.975
Ramsey RESET test	Prob.F(1,34) 0.142	Prob.F(1,31) 0.773	Prob.F(1,34) 0.773	Prob.F(1,31) 0.599

Table 4 presents different tests for robustness of the results given in table 3. At very first is the value of adjusted R² which is the measure of goodness of fit. In all the four specifications the value of adjusted R² is more than 70% but less than 95% hence representing that these are fitted good enough. Durbin Watson value is ranging 1.95 to 2.5 for all the four specifications which indicates no autocorrelation in the estimation residuals. CUSUM and CUSUM squares are within the 95% confidence interval which shows that coefficients are stable enough and will not change with the change of the data range. Breusch-Godfrey Serial Correlation (BGSC) _LM test is used to test the serial correlation in the residuals of the series. Here the probability of F-statistics is insignificant, and we have accepted the null of no serial correlation present in all the four specifications. Then there is the result of ARCH test to test the Heteroscedasticity of the variance and insignificance of F-statistics shows that variance in all the four specifications are homoscedastic. At last there is result of Ramsey RESET test which is representing that all the four specifications are specified correctly, and the evidence of non-linearity is not found.

Conclusion

Although the issue of macroeconomic uncertainty has been raised several times in Pakistan, but the methods used to measure uncertainty heavily rely on the conditional variance of a series measured through ARCH or GARCH models. Therefore, in this study to measure the budget uncertainty three different methods are applied. Out of these three methods one measure of budget uncertainty is based on the conventional method of GARCH model. Second measure of uncertainty BUNU is based on the Unpredictable Part of the Stochastic Process which is less common but relatively less restrictive in terms of length of the data needed. Third method of measuring uncertainty is completely unconventional and rarely produced (to our best knowledge) in any other study in Pakistan is called BUNR. To produce this method a simple deviation of initial government spending estimates announced at the start of the fiscal year from its revised estimates and then dividing this whole term with the revised budget estimates of government spending is used. Pakistan has a long history of such deviations. A long trend of such deviations creates uncertainty in the minds of consumers, producers and investors and put a big question mark on the credibility of government policy. A comparative analysis of all the three measures of budget uncertainty shows that not only in terms of descriptive statistics but also their effect on growth is almost same. The estimated short run and long run coefficients obtained through the ARDL technique show that to enhance the GDP per worker growth in Pakistan Budget uncertainty calculated in terms of government spending should be reduced. Government size has proved to have a significant negative and linear relationship with the growth not only in the short run but also in the long run. However, this comes not true when Budget Uncertainty is excluded from the main model. In the absence of control on the Budget uncertainty, government size has only short run negative effect on the economic growth and in the long run fiscal policy has no role. All other variables such as inflation rate and capital per worker maintain their signs and significance in all the specifications and with any of the uncertainty measures used. Hence the results indicate that inflation has a significant and negative effect on the growth while capital per worker has a significant and positive effect. Therefore, to enhance the growth of GDP per capita in Pakistan there should be more focus on the accumulation of physical capital and much control on government size, inflation, and budget uncertainty.

Recommendations

Based on the results and conclusion drawn it can be suggested that if the policy makers want to make the fiscal policy more effective in the long run along with the short run then they should make the fiscal policy more transparent and try to increase the credibility by keeping the budget estimates as much close to the final accounts as they can. This kind of enhancement in the credibility of the fiscal policy will reduce the uncertainty in the minds of consumers, producers, investors, and laborers and make the fiscal policy more effective.

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