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Public revenue, fiscal deficit and economic growth: Evidence from Asian countries

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Abstract. This paper examines the impact of public revenue and fiscal deficit on economic growth in 20 Asian Countries. We use panel Autoregressive Distributed Lag Model (ARDL) to estimate both the short-run and long-run impact of the fiscal variables. The results indicate that fiscal deficit adversely affect growth both in short-run and long-run. In the long-run, deficit finance leads to debt accumulation which is also negatively associated with growth. However, panel ARDL results show that revenue is positively associated with growth in the long-run. In absence of fiscal deficit, public revenue influences positively on growth in the long-run. The impact of revenue in the short-run is not significant. The findings have important policy implication in fiscal sector reform. As the developing countries in Asia are more dependent on fiscal deficit, special care has to be taken in raising public revenue to ensure desirable results. The research suggests that in the case of Asian countries where revenue level is already low and deficit is persistent, raising revenue would reduce the debt level, contributing to higher growth.
Keywords. Fiscal deficit; revenue; economic growth; investment; panel ARDL.
JEL. E60, H60, O40.

1. Introduction

Deficit finance has long been the major characteristics of fiscal policy in most of the Asian countries. Budget deficit indeed arises due to the fiscal pressure, where government spending exceeds the public revenue. Either expansionary fiscal policy targeting to achieve certain fiscal goal or the inefficiency of the government to collect sufficient revenue is responsible for fiscal deficit. Low revenue mobilization due to low tax effort has been widespread phenomenon in Asia, which attributes to persistent fiscal deficit in Asian countries (Amgain, 2017). However, the recent rise in fiscal deficits in many industrial countries is due to transitory increment in public spending (Roubini & Sachs, 1988). Whatever the reason behind the persistent deficits, the views over its impact on growth has been debatable. Keynesian view suggests that deficit financing increases the aggregate demand in the economy, ensuring more employment and output growth. This view advocates that fiscal stimulus is required to boost up the economic activities, and for this, deficit financing is the major instrument to inject the public investment. Recent developments in endogenous growth theory highly emphasize the role of fiscal policy on growth (e.g. Barro, 1990; Barro & Sala-i-Martin, 1992). The notion of fiscal policy to raise the economic activities by changing the aggregate demand is only justified when model of deficit financing is practiced (Arestis & Sawyer, 2004).

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However, other views suggest that persistent fiscal deficit attributes to debt accumulation, which will be the cost for future taxation, and this hampers growth in the long-run. When fiscal deficit to GDP ratio crosses the critical level, capital growth declines and this leads to lower growth rate (Bräuninger, 2005). The experiences form heavily indebted poor countries show that debt reduction would positively affect the growth rate both in short-run and long-run (Siddque *et al.,* 2015). Raising public revenue would reduce fiscal deficits, boosting economic growth (Koczan, 2015). If the debt-GDP ratio increases persistently, this leads to lower output growth in the long-run, but if the increased debt-GDP ratio is brought back to normal level, then it does not affect growth (Chudik *et al.,* 2013). However, the relationship between deficit and growth should be re-examined to explore the real implication of saving and investment (Cole, 2016).

A large number of studies focus on debt sustainability, while the implication of deficit financing as well as revenue shortage is less clear. Inefficiency in raising revenue is a major cause of fiscal deficit in Asian countries. Low public revenue not only increases fiscal deficit, but also leads to higher debt stock. This debt has to be paid back through taxation, which may reduce the prosperity in the long-run. Hence, this study tries to examine the impact of fiscal deficit under the existing level of public revenue.

2. Overview of public revenue and fiscal deficit

The budgetary system in Asian countries is heavily dependent on fiscal deficits. Many of the Asian countries are in developing stage and hence needs higher public investment for the expansion of the economic activities including infrastructure development. However, the major source of public revenue, tax revenue, is considerably lower in Asian Countries (Amgain, 2017). Lack of public revenue not only increases fiscal deficit, but also leads to higher debt stock. Higher deficit in present causes future burden to tax payers as they have to payback the debt through taxation.

Table 1 summarizes the growth performance and the overall development of revenue, fiscal deficit, and gross debt in 20 years across the Asian countries. Due to lack of sufficient data in the 1980s, we could not present the data of 1985 and 1980 to assess the comprehensive comparison. During the recent 20 years, the notable feature of the fiscal policy observed in this region is the persistent fiscal deficit. Only two countries, namely Singapore and South Korea experienced continuous budget surplus over the whole sample period. In 2015, 16 out of 20 countries had fiscal deficit. The pattern of fiscal deficit in 1995 and 2005 was almost same and there is no significant improvement in public revenue over the years. The debt stock in Japan in 2015 was significantly higher (237 % of GDP) and rest of the countries except Singapore had less than 100 percent of GDP. Coming from 2005 to 2015, Afghanistan raised public revenue from 14 percent of GDP to 25 percent, with the significant improvement in reducing public debt from 206 percent to 9 percent of GDP.

Figure 1 shows the trends of public deficit and growth over the period. Both variables show the constant trend with notable fluctuations. The pattern of fiscal deficit facing by the countries in the 1980s and 2015 seems to be the same, although country specific pattern may vary. Rapid fall in growth rate and sudden rise in deficit have been observed in 1998 and 2008. The Asian financial crisis of 1997/98 and global financial crisis of 2008 were responsible for this.

Table 1. *Trend of revenue, fiscal gap, public debt and growth across the Asian countries*

	Revenue (% of GDP)			Deficit (% of GDP)			Gross Debt (% of GDP)			Growth		
	Year			Year			Year			Year		
Country	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015
Afghanistan		14.73	25.03		0.96	1.40		206.35	9.30		11.17	1.11
Bangladesh	11.89	9.35	9.92	0.44	2.85	3.88		42.29	33.90	5.12	6.53	6.55
Bhutan	39.29	30.72	28.80	1.35	7.22	0.19	40.14	84.53	94.35	7.07	7.12	6.49
Cambodia		11.94	18.84		0.38	1.55		37.42	32.53	6.44	13.25	7.03
China	10.14	16.72	28.53	0.94	1.3	2.78	21.44	26.09	42.60	10.94	11.39	6.90
Indonesia	12.54	17.8	14.86	-0.64	-0.42	2.49		42.61	26.87	8.22	5.69	4.87
India	17.85	19.06	20.38	6.69	7.36	7.07	69.65	80.89	69.55	7.57	9.28	8.01
Japan	29.34	28.69	33.12	4.32	4.41	3.51	91.91	184.86	237.96	2.74	1.66	1.21
S. Korea	16.52	20.49	21.26	-2.27	-0.85	-0.33	8.94	26.95	37.75	9.57	3.92	2.79
Lao PDR		13.87	24.03		4.42	2.69		84.96	65.55	7.03	7.10	7.27
Nepal		14.02	20.85		-0.26	-0.66		51.48	25.15	3.46	3.47	2.72
Myanmar		10.49	18.61		2.72	4.41				6.94	13.56	7.29
Malaysia	26.06	22.01	22.23	-1.53	2.87	2.85	38.70	41.35	57.94	9.82	5.33	4.96
Maldives	25.59	31.93	34.76	5.66	8.11	9.46		44.87	72.00		-8.12	2.84
Pakistan	12.57	13.12	14.49	4.86	2.81	5.24	65.22	58.92	63.56	4.96	7.66	4.71
Philippines	19.67	17.83	19.39	0.01	1.69	-0.61	62.71	59.16	36.28	4.67	4.77	6.06
Singapore	32.06	19.90	22.00	-16.06	-5.73	-3.68	67.35	92.06	103.23	7.02	7.48	1.93
Sri Lanka	18.24	14.69	13.06	7.35	6.13	6.98	80.42	79.16	76.03	5.50	6.24	4.83
Vietnam		24.97	23.74		1.21	6.21		36.54	58.25	9.54	7.54	6.67
Thailand	20.23	20.97	22.38	-3.05	-1.39	-0.13		43.96	42.69	8.12	4.18	2.94

Source: World Development Indicator (WDI) and World Economic Outlook (WEO) dataset.
Note: Although the data series cover 1980-2015, due to lack of sufficient observations, the table omits the data series of 1985 and earlier than this.

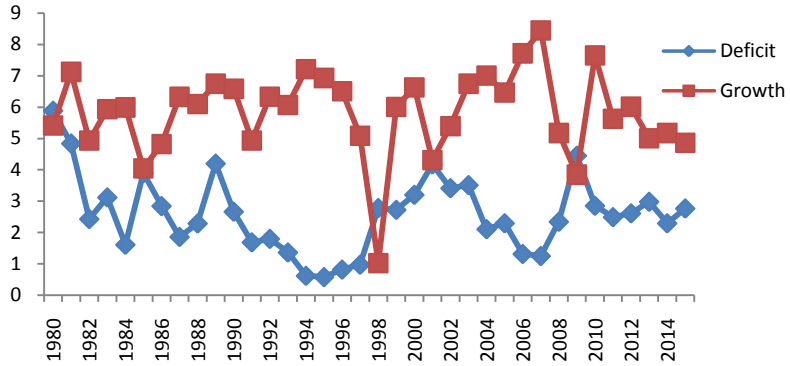

Figure 1. *Average deficit and growth over the period 1980-2015*
Source: Authors' calculation based on the WEO dataset

Only two countries among the 20 Asian countries were able to make budget surplus, while four countries faced continuous budget deficit every year during 1980-2015. Singapore and South Korea maintained the average budget surplus of 8.7 percent and 1.5 percent to GDP per year, respectively. India, Pakistan, Sri Lanka and Maldives never got budget surplus during the period. India faced highest budget deficit among all countries. The average annual budget deficit in India remained 8 percent of GDP. Maldives, Sri Lanka and Pakistan also faced alarming rate of budget deficits in GDP comprising 7.2, 6.6 and 4.8 percent, respectively. Figure 2 shows the average annual size of the deficit/surplus of 20 Asian countries during 1980-2015. Except Singapore and South Korea, all countries faced net deficit during the period. The figure indicates that deficit budget is the main feature of the fiscal policy in Asian countries.

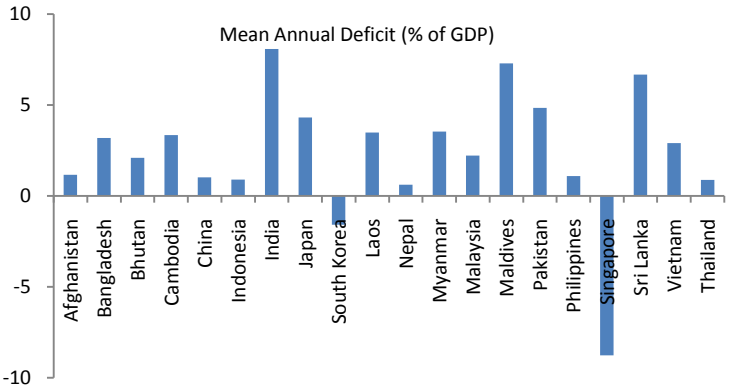

Figure 2. *Average annual deficit of the countries between 1980-2015*
Source: Authors' calculation based on the WEO dataset

Figure 3 shows the trends of public revenue and deficit over the period. Upper line in the figure represents the public revenue measured as percentage of GDP, while lower line represents the budget deficit measured as percentage of GDP. The movements of line over the period seem to be in opposite direction, indicating that low public revenue mobilization is responsible for budget deficit. When the government employs expansionary fiscal policy, especially heavy public spending, it experiences lower public revenue casing elevated deficit. In contrast, when public revenue falls or does not catch up the trend of inclined public spending, deficit automatically rises. Amgain (2017) explains that taxation in Asian countries has been in low level as compared to the other regions of the world. Hence, it is concluded that inefficiency to raise public revenue is a major cause of higher deficit in the Asian region. If the governments in these countries focus on raising higher revenue, it would reduce the fiscal deficit.

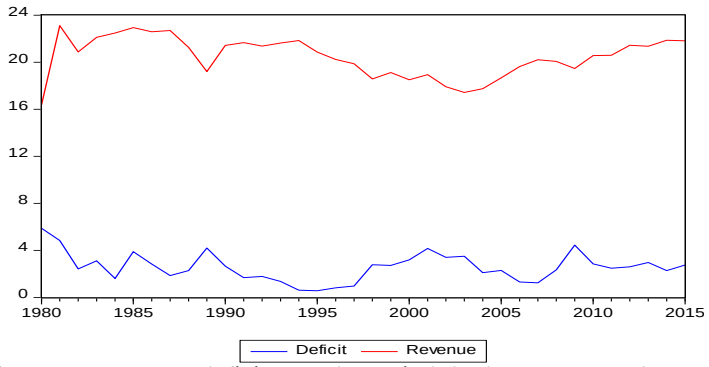

Figure 3. *Revenue versus deficit over the period (both are measured as % of GDP)*
Source: Authors' estimation based on the WEO dataset

3. Review of related literature

The theoretical and empirical literature show controversial results regarding the impact of fiscal deficits on economic growth. The Keynesian school advocate budget deficit, arguing that there is a positive relationship between these two series, while the non-Keynesian claimed the opposite, considering fiscal deficits to be detrimental to investment and growth. Moreover, the Recardian equivalence hypothesis argued that there is neutral relationship between budget deficit and economic growth (Briotti, 2005). It is observed from the survey of various theoretical and empirical literatures that the controversial opinion and results are due to difference in time dimensions, types of economies, methods of analysis and the scale of budget deficit. Some economists argue that deficit finance creates higher pressure on interest rate and reduces growth by diverting private investment. For example, Gale & Orszag (2003) concluded that high public debt adversely

affect capital accumulation and growth through the channel of long term interest rate. However, in practice, it is difficult to find the true link between budget deficit and the interest rate as well as private investment (Cole, 2016).

A number of time series studies find that deficit finance adversely affect growth. Explaining the conventional view regarding the role of debt Elmendorf & Mankiw (1999) found that debt can stimulate aggregate demand and output in the short run but crowds out capital and reduce output in the long run. Aslam (2016) studied the dynamic relationship of budget deficits and economic growth in Sri Lanka using Johansen cointegration technique and Vector Error Correction Model based on annual time series data from 1959 to 2013. The study found long run dynamic relationship between budget deficit and economic growth but no short run dynamic relationship was established. However, Fernando *et al.,* (2017) analysed the impact of public debt on economic growth in Sri Lanka with the annual data from 1960 to 2015, using ARDL model, and came to the conclusion that quantity of debt stock and quality of borrowings determine the impact of debt on economic growth. Excessive borrowings from non concessional sources may be the major factors that determine the negative impact of debt on economic growth of Sri Lanka. Similarly, Fatima *et al.,* (2012) found that budget deficit has adverse impact on growth in Pakistan. However, for Vietnamese economy, Von & Sudhipongpracha (2015) did not find any direct link between the budget deficit and growth. Keho (2010) found mixed results in 7 African countries: for three countries, there were no causal relationship between budget deficits and growth, while for remaining 4 countries, he found negative relationship.

Empirical studies linking the deficit and growth are limited. Most of the studies focus debt-growth relationship. Kumar & Woo (2010) studied the panel of advanced and emerging economies from 1970 to 2007, taking into account a broad range of determinants of economic growth as well as various estimation strategies. Their empirical results suggest that there is an inverse relationship between initial debt and subsequent growth, other determinants of growth being no change. They found that, on an average, a 10 percentage point increase in the initial debt-to-GDP ratio leads to the decline in annual real per capita GDP growth by around 0.2 percentage points per year; however the impact has been estimated smaller in advanced economies. They concluded that the adverse effect of debt on growth is mainly due to slowdown in labour productivity growth as a result of reduced investment and slower growth of capital stock.

Likewise, Chudik *et al.,* (2013) analysed the long run effects of public debt and inflation on economic growth on a sample of 40 countries over the period of 1965 to 2010. They found significant negative long run effects of public debt on economic growth. They also concluded that if the debt to GDP ratio is raised and it remains permanent, it will have negative effect on economic growth in the long run. But, if the increase in the ratio is temporary, there will be no long run growth effects so long as debt to GDP ratio brought back to its normal level. They also concluded that there is no universal threshold effect in the relationship between public debt and growth. Siddique *et al.,* (2015) studied the short run and long run relationship between external debt and economic growth on a sample of 40 highly indebted poor countries (HIPC) over the period of 1970 to 2007. They employed ARDL model on panel data. Their empirical results suggested that debt has negative association with GDP growth in the short run as well as long run.

Reinhart & Rogoff (2010) examined the experience of 44 countries up to two centuries of data on government debt, inflation and growth. They investigated that high debt/GDP levels (90 percent and above) are negatively correlated with lower economic growth in both advance and emerging economies. They further illustrated that the much lower levels of external debt/GDP (60 percent) are associated with adverse outcomes of emerging market growth. Babu *et al.,* (2015) examined the impact of domestic debt on economic growth in the 5 countries of East Africa Community (EAC) over the period of 1990 to 2010. Using various statistical tests and estimation techniques, they found that domestic debt has

significant positive effect on per capita GDP growth rate in EAC. Westphal & Rother (2011) examined the impact of government debt on per capita GDP growth in twelve euro area countries from 1970 to 2011. The study found nonlinear debt growth relationship in the long run with turning point at about 90 to 100 percent of GDP.

Regarding the effect of public revenue on growth, many studies do not find any significant relationship between them. Afonso & Jalles (2011) is one of the most comprehensive studies, which also did not find any significant relationship between revenue and growth. Kneller *et al.,* (1999) found that only distortionary taxes have negative impact on growth, while Amgain (2017) found nonlinear effect of taxation; up to certain level taxation has positive impact on growth but after crossing the critical level, it shows negative impact.

Review of literature in this regard indicates that panel study, especially for the Asian countries, lacks far behind and practical implication of deficit finance is less known. Hence, this study tries to measure the effect of budget deficit on growth both in long-run and short-run.

4. Data, model and estimation methodology

4.1. Data

Our empirical analysis is based on the dataset of 20 Asian countries traced from World Development Indicator (WDI) and World Economic Outlook (WEO). Total investment, deficit, public debt and revenue data are taken from WEO while rest of them are from WDI. The data sample includes the period from 1980 to 2015. Mostly the South and East Asian countries are included in the study. Sample countries include Afghanistan, Bangladesh, Bhutan, Cambodia, China, Indonesia, India, Japan, South Korea, Laos, Nepal, Myanmar, Malaysia, Maldives, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam. Since most of the west Asian countries have different fiscal scenario due to oil-based economy, these countries are omitted. Our dependent variable is real GDP growth rate. Independent variables such as public revenue, total investment and fiscal deficit are measured in terms of percentage of GDP. Fiscal deficit is the gap between the public expenditure and revenue, which is measured as the net primary barrowing.

Table 2 shows the summary statistics of the data. Mean growth rate of real GDP of the sample countries during 1980-2015 is 5.85 percent. Indonesia in 1998 faced lowest growth rate (-13.13%) and Bhutan in 1987 faced highest growth rate (28.69%). The mean value of public revenue in the observed Asian countries is 20.15 percent of GDP. These countries faced 2.47 percent fiscal deficit in GDP on an average. The highest fiscal deficit was faced by Maldives (19.51% of GDP) in 2008, while the highest budget surplus (20.23 % of GDP) was faced by Singapore in 1994. The average gross public debt in GDP is 61 percent. The interesting point is that Afghanistan faced highest public debt (345 % of GDP) in 2002 but faced lowest public debt (7.71 % of GDP) in 2010, showing the dramatic improvement in reducing public debt. Similarly, the average inflation faced by these countries is 7.52 percent. The maximum inflation (125 %) was in Laos in 1999 and minimum (-23.82 %) was in the Maldives in 1989.

Table 2. *Data statistics*

Variables	Mean	Standard Deviation	Minimum	Maximum	Number of Observation
Growth (%)	5.85	3.84	-13.12	28.69	650
Revenue (% of GDP)	20.15	7.96	5.67	48.84	517
Fiscal Deficit (% of GDP)	2.47	4.45	-20.23	19.51	491
Public Debt ((% of GDP)	61.08	42.34	7.71	345.97	403
Investment (% of GDP)	28.22	10.09	-0.65	73.00	628
Inflation (Consumer prices, annual %)	7.52	9.62	-23.82	125.27	634
GDP per capita (Constant US $)	6078.12	11367.63	190.91	52244.59	656

Source: Authors' calculation based on WDI and WEO dataset

Table 3 shows the correlation matrix, indicating the correlation coefficients among the variables. Fiscal deficit and initial GDP per capita have negative correlation with growth while other variables such as revenue, investment and inflation show the positive relationship with growth. The investment and fiscal deficit depict higher correlation with growth than other variables. The table shows that the variables do not suffer from multicollinearity problem.

Table 3. *Correlation matrix*

Variables	Growth	Revenue	Fiscal Deficit	Investment	Inflation	Initial GDP per capita
Growth	1.000					
Revenue	0.009	1.000				
Fiscal Deficit	-0.139	-0.191	1.000			
Investment	0.213	0.528	-0.220	1.000		
Inflation	0.029	-0.218	0.125	-0.14	1.000	
Initial GDP per capita	-0.2671	0.363	-0.279	-0.016	-0.336	1.000

Source: Authors' calculation based on WDI and WEO dataset using STATA software

4.2. Model

We model the growth regression from the view point of fiscal policy as in Barro (1990). By changing the public spending and tax rates, government achieves the targeted growth. On this course, one of the main factor which remains at the centre of fiscal policy is investment. Due to budgetary changes, there is net change in investment and hence ultimately to growth. The change investment is caused through the change in public spending, which is accompanied by public revenue and deficit. If government raises tax rate, there may be disincentive to private investment causing crowding out effect. Instead, if government lowers tax rate, private investment may be stimulated but it lacks public investment. Although deficit finance fulfils the need of public spending, expenditure pattern affects the economic prosperity. Spending in productive sectors such as infrastructure, health and education causes higher growth. However, spending in non-productive sector such as government consumption and social security reduces growth (Kneller *et al.,* 1999). On the other hand, if deficit is financed by domestic borrowing, it exerts pressure on interest rate and private investment may go down due to high interest rate. Hence, public revenue, deficit and investment are our main variables to cause growth.

Following Barro (1990) and Levine & Renelt (1992), we put initial per capita GDP as an important control variable. According to conditional convergence hypothesis, countries having high growth in previous year face low growth in this year. Hence, per capita GDP shows negative relationship with growth. Another control variable, inflation has been taken in to account as it is a major macro-economic variable with higher influence in the economy. Fiscal deficit causes higher inflation (Nguyen, 2015; Ishaq & Mohsin, 2015). The effect of inflation is expected to have negative impact on growth. Education enrolment as a proxy for human capital would be another important factor for growth, but recently the importance of human capital is recognized on the quality of education rather than the educational enrolment (Eric, 2013). Even the inclusion of this variable does not show significant relationship, hence, we do not take this variable in the regression.

Now, we define the growth model as given below.

$$y = f(Rev, Def, Inv, IniGDP, inf) \quad (1)$$

The functional form of the model can be written as:

$$y_{it} = +\beta_0 + \beta_1 Rev_{it} + \beta_2 Def_{it} + \beta_3 \mathrm{Inv}_{it} + \beta_4 IniGDP_{it} + \beta_5 Inf_{it} + \varepsilon_{it} \quad (2)$$

Where Rev is public revenue, Def is fiscal deficit, Inv is total investment, IniGDP is initial GDP per capita and Inf is inflation, i represents the individual

country and t represents time period, βs are the coefficients and ε represents error term.

4.3. Estimation Methodology

We employ most advanced technique of estimation, commonly known as autoregressive distributed lag (ARDL) developed by Pesaran & Smith (1995), Pesaran (1997) and Pesaran *et al.,* (1999). This method is useful to examine the long- and short-run effects of independent variables. Generally, in the growth literature, data are averaged to remove the cyclical pattern of the economy. This may loose the generality of the data. However, this ARDL model allows both short-run and long-run effects of the variables and does not need to average the data. This technique has several benefits over the other estimation techniques. For a long time, there have been a misconception that the long-run relationship between the variables can be assessed only between the cointegrated variables, i.e I(1) variables (Loayza & Ranciere, 2005). Unlike cointegration literature such as Johanson (1995), Phillip & Hansen (1990), this technique does not require the variables be integrated of order one. In this technique, the variables may be either integrated of order one or stationary. i.e. I(1) or I(0). But in case of variable of order I(2), this technique can not be used.

We acknowledge the the recent literature in panel ARDL technique such as Loayza & Ranciere (2005), Samargandi *et al.,* (2013) and Siddique *et al.,* (2015) to estimate the growth effects of fiscal variables. We use dynamic heterogeneous panel ARDL model. The model is as follows.

$$\Delta(y_i)_t = \sum_{j=1}^{p-1} \lambda_{ij} \Delta(y_i)_{t-j} + \sum_{j=0}^{q-1} \phi_{ij} \Delta(X_i)_{t-j} + \Psi_i[\beta_l(y_i)_{t-1} - \{\beta_0 + \beta_1(X_i)_{t-1}\}] + \varepsilon_{it} \quad (3)$$

Where y is the growth rate of real GDP, X represents the set of independent variables. Δ is the difference operator. λ and ϕ represents the short-run coefficients, whereas β represents long-run coefficient and Ψ represents the speed of adjustment in the long-run equilibrium. The regression term for long-run equilibrium has been included in the square bracket, which denotes error correction terms with the following co-integrating equation.

$$(y_i)_t = \beta_0 + \beta_1(X_i)_t + \mu_{it} \quad (4)$$

Where μ_{it} ~ I (0)

We estimate the model by pooled mean group (PMG) estimator developed by Pesaran *et al.,* (1999). PMG estimator allows short-run coefficients, intercepts and error variances to be different across the panel while long-run coefficients are same. Samargandi (2013) explains that this estimator provides efficient model if the time series T and panel unit N are large, with serially uncorrelated error correction model. When explanatory variables are taken exogenous, it gives more consistent result. Although Mean Group (MG) and Dynamic Fixed Estimator (DFE) are alternatives to this estimation, the results are more consistent in PMG, as suggested by Hausman test, and hence we consider only PMG.

4.4. Preliminary Results

Before applying the panel ARDL technique, we first test panel unit root test. 4 different approaches of unit root test developed by Levin, Levin, Lin & Chu (2002) (LLC); Im, Pesaran & Shin (2003) (IPS); Dickey & Fuller (1981) (ADF); and Phillips & Perron (1988) (PP) are applied. Table 4 shows the results of these tests. Panel unit root test confirms that variables are either integrated of order 1 or stationary I(0). The null hypothesis in these tests is that there exists unit root. All

tests statistics and probability values confirm that GDP growth rate, fiscal deficit and inflation are stationary at a level within 1 percent confidence interval. For the variables such as revenue and debt, null hypothesis is accepted within 5 percent level of significance for IPS. However LLC, ADF and PP tests confirm that these variables are stationary within 5 percent level of significance. All tests clearly shows that Investment and GDP per capita are I(1). When we take first difference of these variables, the all test results show that variables are stationary.

Table 4. *Panel Unit Root test results*

Data-based value of the test statistics (p-value in the parentheses)					
Variables	LLC	IPS	ADF	PP	Conclusion
A. At Level					
Growth	-12.928	-13.341	247.170	253.363	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Revenue	-2.134	-1.625	57.765	67.516	I(0)/I(1)
	(0.016)	(0.052)	(0.034)	(0.004)	
Fiscal Deficit	-5.247	-5.395	98.333	95.424	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Investment	-0.457	-0.600	47.747	50.617	I(1)
	(0.323)	(0.274)	(0.133)	(0.082)	
Inflation	-11.088	-11.1703	207.705	222.247	I(0)
	(0.001)	(0.000)	(0.000)	(0.000)	
GDP per capita	23.202	22.190	6.201	6.678	I(1)
	(1.000)	(1.000)	(1.000)	(1.000)	
Debt	-3.040	0.001	59.740	64.865	I(0)/I(1)
	(0.016)	(0.500)	(0.013)	(0.004)	
B. At First Difference					I(0)
Growth	-15.540	-15.877	471.894	467.552	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Revenue	12.928	-13.341	288.632	304.903	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Fiscal Deficit	-19.543	-18.353	327.521	413.957	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Investment	-14.826	-18.445	337.157	414.921	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Inflation	-18.4020	-22.158	438.873	714.032	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
GDP per capita	-4.012	-7.216	167.018	191.090	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Debt	-8.104	-7.816	135.052	151.870	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	

5. Empirical results

Table 5 presents the pooled mean group (PMG) estimation ARDL (1,1) results to show both the long-run and short-run effects of fiscal deficit on growth in three different sample groups. Specification (1) is the results obtained from whole sample over the period 1980-2015. Dependent variable is real GDP growth rate and independent variables are revenue, fiscal deficit, investment, inflation and initial GDP pre capita. The long-run and short-run regression coefficients with corresponding standard errors are shown in the column. For the long-run, revenue and total investment show strong positive relationship with growth whereas fiscal deficit, initial GDP per capita and inflation show negative relation. Except inflation, all variables are significant within one percent level of significance. For the short-run, only fiscal deficit and investment are strongly significant. Unlike in long-run, revenue does not show positive relationship with growth. The error correction term is negative and strongly significant (-0.66). This signifies that the model is dynamically stable and proves the existence of the long-run relationship between the dependent and independent variables.

In our sample, three developed countries, namely South Korea, Singapore and Japan have been included. Unlike other countries, South Korea and Singapore had continuous budget surplus over the period. Similarly, Japan had out standing debt stock, which was different scenario than the other countries. Hence, we checked

whether the results differ in developing countries. Table 2, specification (2) shows the PMG estimation results. Error correction term is also negative and statistically significant. Like in full sample countries, both fiscal deficit and investment are statistically significant both in the long-run and short-run. However, revenue is insignificant. The sign of the coefficient of fiscal deficit is same as the full sample. This implies that developing countries are more dependent on fiscal deficit and have less impact of public revenue.

To consider the occupancy and the time relevance of the data, we check the results on the recent dataset 1990-2015. Many countries lack data earlier than 1990. Highly unbalanced data may lead to different results. Keeping this issue in mind, we run the regression for the recent periods as well as comparatively balanced data, which is shown in specification (3) of Table 5. The results are almost same as in the full sample except the revenue which shows negative coefficient in the short-run. In this sample also, fiscal deficit shows negative effect on growth in both long-run and short-run. Public revenue after adjusting in long-run equilibrium, gives positive result on growth. The results indicate that initial GDP per capita is only significant in long-run, not in short-run. This implies that the conditional convergence hypothesis, which explains that the countries with higher growth in previous year face low growth this year, is valid only for the long-run.

Table 5. *Panel ARDL (Pooled Mean Group) estimation results*

Dependent variable: Real GDP growth rate			
	Full Sample	Developing Countries	Recent Period (1990-2015)
	(1)	(2)	(3)
Error correction term	-0.666***	-0.756***	-0.739***
	(0.105)	(0.198)	(0.152)
long-run			
Revenue	0.125***	0.034	0.061**
	(0.035)	(0.029)	(0.029)
Fiscal Deficit	-0.153***	-0.183***	-0.165***
	(0.045)	(0.065)	(0.046)
Investment	0.200***	0.250***	0.212***
	(0.023)	(0.022)	(0.020)
Inflation	-0.064*	0.030	0.007
	(0.038)	(0.035)	(0.035)
Initial GDP per capita	-0.0001***	0.0002	0.00006***
	(0.00001)	(0.0002)	(0.00002)
Short-run			
Revenue	-0.170	-0.190	-0.203*
	(0.111)	(0.141)	(0.122)
Fiscal Deficit	-0.384***	-0.522*	-0.492***
	(0.115)	(0.269)	(0.195)
Investment	0.286***	0.229***	0.298***
	(0.086)	(0.071)	(0.098)
Inflation	-0.031	-0.007	-0.035
	(0.058)	(0.052)	(0.060)
Initial GDP per capita	-0.010	-0.004	-0.001
	(0.009)	(0.020)	(0.013)

Note: ***, **, and * indicate that variables are significant within the 1%, 5% and 10% levels, respectively. Values in the bracket are standard errors.

To check the consistency of the results, given the different financing pattern, we slightly modify the model by adding and replacing the variables. Our purpose is to check how fiscal deficit affects the growth rate. In Table 6, specification (1), we present the results replacing fiscal deficit by gross public debt. It is because one of the channel through which public fiscal deficits affect growth is the public debt accumulation. Error correction term is -0.50, showing that the model is stable. Public debt variable is statistically significant and negatively related with growth both in long-run and short-run. Revenue is also significant and positively associated with growth in long-run. Other variables are also in the same direction as in the previous model. The results are not different from that of the previous model.

Furthermore, we check the effects of financing pattern as shown in specifications (2) and (3) in Table 6. Specification (2) includes the model with the government expenditure funded by public revenue whereas specification (3) includes the model funded by fiscal deficit. We do not put all expenditure, revenue and budget deficit variables at the same model as it creates perfect multicollinearity problem due to government budget constraint (Kneller *et al.,* 1999). Specification (2) shows that in absence of fiscal deficit, public revenue shows positive impact on growth both in long-run and short-run. Specification (3) shows that if public spending is financed by fiscal deficit, the impact of fiscal deficit would be negative both in long-run and short-run. In both specifications the coefficient of total public spending is negative and statistically significant. This result is in line with many previous studies such as Barro (1991), Engen & Skinner (1992).

Table 6. *Panel ARDL (Pooled Mean Group) estimation results with various financing pattern*

Dependent variable: Real GDP growth rate			
	(1)	(2)	(3)
Error correction term	-0.501***	-0.666***	-0.666***
	(0.103)	(0.105)	(0.10523)
long-run			
Government Expenditure		-0.153***	-0.125***
		(0.045)	(0.035)
Revenue	0.412***	0.278***	
	(0.053)	(0.026)	
Fiscal Deficit			-0.278***
			(0.064)
Gross Debt	-0.040***		
	(0.008)		
Investment	0.065**	0.200***	0.200***
	(0.028)	(0.023)	(0.023)
Inflation	-0.077**	-0.064*	0.064*
	(0.032)	(0.038)	(0.038)
Initial GDP per capita	-0.00008	-0.0001***	-0.0001***
	(0.00006)	(0.00001)	(0.00001)
Short-run			
Government Expenditure		-0.384***	-0.170***
		(-0.115)	(-0.111)
Revenue	-0.143	0.214*	
	(0.145)	(0.116)	
Fiscal Deficit			-0.214*
			(0.116)
Gross Debt	-0.153**		
	(0.066)		
Investment	0.347***	0.286***	0.286***
	(0.116)	(0.086)	(0.086)
Inflation	0.010	-0.031	-0.031
	(0.083)	(0.058)	(0.058)
Initial GDP per capita	-0.019**	-0.010	-0.010
	(0.008)	(0.009)	(0.009)

Note: ***, **, and * indicate that variables are significant within the 1%, 5% and 10% levels, respectively. Values in the bracket are standard errors.

To check the robustness and consistency of the results, we use other techniques of estimation such as Two-way Fixed Effects (FE), Random Effects (RE) and Generalized Method of Moments (GMM) developed by Arellano & Bover (1995). Table 7 presents the estimation results under these techniques. Two-way FE allows us to account for country specific and time specific characteristic, whereas RE does not account the individual characteristics. The benefit of GMM over FE and RE is that the heteroscedasticity, autocorrelation and endogeneity problems can be removed. All techniques show the same results although the values of the coefficients are slightly different. Except revenue, all variables are strongly significant. Fiscal deficit has negative impact on growth, while investment has positive. Revenue does not show any significant relationship with growth.

Interestingly, if we include government expenditure and public revenue, excluding budget deficit like in Table 6, specification (2), revenue shows positive impact on growth. This implies that if the government manages fund for spending only through public revenue, the impact of revenue on growth becomes positive. Overall, the results obtained from these techniques are similar to the results of ARDL as estimated before.

Table 7. *Growth effects under different estimation techniques*

Dependent variable: Real GDP growth rate			
	Fixed Effects (1)	Random Effects (2)	GMM (3)
Revenue	-0.066	0.024	-0.011
	(0.049)	(0.041)	(0.052)
Fiscal Deficit	-0.224***	-0.244***	-0.254***
	(0.067)	(0.056)	(0.074)
Investment	0.060**	0.053**	0.064***
	(0.025)	(0.025)	(0.026)
Inflation	-0.056**	-0.073***	-0.093***
	(0.027)	(0.026)	(0.025)
Initial GDP per capita	-0.0001***	0.0001***	0.0007***
	(0.00006)	(0.00003)	(0.0002)
Constant	5.087**	6.874***	7.453***
	(2.414)	(1.167)	(1.359)
R^2	0.33	0.11	Sargan test: $\chi 2$= 373.60, P-value= 0.101 AR(1 = 0.011, AR(2) =0.655

Note: ***, **, and * indicate that variables are significant within the 1%, 5% and 10% levels, respectively. Values in the brackets are standard errors. AR (1) and AR (2) are the Arellano-Bond test for autocorrelation at the first and second orders, respectively. Sargan test is for the over-identifying restrictions, which tests the overall validity of the instrument.

The reason for negative effect of deficit on growth is obvious. When deficit increases for a long, it raises the public debt stock. Higher public debt hampers growth by two ways. First, the government has to pay a large amount of money as an interest every year, which reduces the public fund to invest in developmental activities. Second, when debt level becomes very high, government looses its credibility and gets difficulty to borrow again. To repay the debt and raise further investment funds, government has to offer more interest rate on the new debt. This makes public investment more uncertain and cost-ineffective and hampers growth. The result of this study is in line with the previous studies such as Siddque *et al.,* (2015), Chudik *et al.,* (2013) and Kumar & Woo (2010).

It is difficult to assess the effect of public revenue on growth empirically. Majority of the studies are neutral although some have conflicting arguments. Since the major source of revenue is taxes, the effects of different kinds of taxes and public funding on investment may vary as per the country specific practices. When revenues are collected through non-distortionary taxes and the funds are used in productive investments, it exhibits positive impact on growth. However, when government raises the taxes through distortionary taxation and funds are used for the government consumption, the impact of revenue becomes negative (Kneller *et al.,* 1999). However, in case of developing countries, where tax level is low and deficit is persistent, raising revenue would reduce the deficit and debt level and ultimately contributes to higher growth.

6. Conclusion

This paper analyzes both long-run and short-run effects of public revenue and budget deficit using panel ARDL(1,1) technique in 20 Asian countries. Results indicate that fiscal deficit is negatively associated with growth both in long-run and short-run. The panel ARDL results indicate that public revenue is positively associated with growth at least in the long-run. Furthermore, findings show that if

the public spending is allowed to fund solely by its revenue, in absence of budget deficit, revenue exhibits positive impact on growth. Other control variables such initial GDP per capita and inflation both show negative effect on growth, whereas total investment shows positive effect. The consistency and the robustness of the results are verified by other techniques such as FE, RE and GMM.

Developing countries in Asia are heavily dependent on fiscal deficit and have a lower level of revenue mobilization. Although most of the Asian countries, except Singapore and South Korea, exhibit persistent fiscal deficits over the period 1980-2015, they have not elevated the public debt due to control in public spending. From the data trend, we can observe that one of the main reasons of higher fiscal deficit in these countries is low revenue mobilization. The existing pattern of fiscal deficits in Asian countries is not productive to growth. Increase in public revenue not only reduces fiscal deficit, but also impacts growth positively in long-run. The positive sign of coefficient for investment implies that when government creates a suitable fiscal environment to raise total investment, it can raise the output productivity.

The findings have important policy implication in fiscal sector reforms. Deficit finance is not supportive to growth and hence the government needs to focus on the stable source of public fund. Moreover, the crucial issue is that whether the public spending is expended into productive activities such as investment in infrastructure and human capital. Capital formation would raise the growth rate but the sources of finance should be better to be the stable revenue. Persistent fiscal deficits lead to higher public debt stock, which limits the future source of public spending and restricts the fiscal space. However, in the case of Asian countries where revenue level is already low and deficit is persistent, raising public revenue would reduce the deficit and debt level and ultimately contributes to higher growth. The government should focus to raise the public revenue rather than relying on deficit finance for higher growth in the long-run.

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