Public Sector Development Expenditures and Economic Growth: The Case of Pakistan

by

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(2015)

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Abstract

It is an established fact that investment and economic growth have a positive relationship but no consensus has been developed on the type of investment. The study investigated the relationship of PSDP, FDI and Private investment for Pakistan's economy, and the results reveal that all the three forms have a long-run positive relation with growth where private investment has a strongest impact and FDI has a least impact. Moreover, it is the private investment and growth of Pakistan's economy which leads to increased public development projects which means increasing private investment in the economy has two folds impact on PSDP; increase in economic growth increases development projects, increased revenue generation through taxes create more resources for PSDPs.

Introduction

Economic Growth is a course of action in which production capacity of an economy is flourished bringing out increased national output and income. Economic growth is also related to bring out full employment level of the economy through investment as its key determinant, where literacy level, capital stocks and technology is enhanced.

Investment and production of goods and services ultimately help generating wealth and add in to growth of an economy. Positive relationship between economic growth and investment is an established fact but there is no consensus on whether it is the public investment or private investment which plays the stronger or no role in growth of an economy.

In FY 2014, Pakistan experienced a period of slack growth with current economic growth of 4.14%, which is very low for an economy in developing stage, the growth being lower than the previous years. On average, Pakistan has faced annual growth rate of 4% over the last 60 years, where increased inflation, high unemployment rates, rising budget deficits, energy crisis, low literacy rates are the major challenges to economic growth since the time of independence of Pakistan.

Shortfalls in revenue generation and inefficient or non-development government projects have caused large fiscal deficits and low economic growth in Pakistan, to fasten the pace of growth, government invests in some development projects for the public under the head of Public Sector Development Programs (PSDP) which utilises a significant portion of the budget every year funded by borrowing or tax collected.

The rationale behind spending on public sector development projects is that it not only generates positive spill-overs in the economy through the provision of education, health, basic scientific research and physical infrastructure, and it may also crowd in private investment thereby enhancing economic growth but there also exists the argument that these government funded projects increase government outlays and crowds out private sector, thus stifling economic growth.

Empirical literature suggests that public investments might have positive, negative or no impact on economic growth. Furthermore, a correlation between economic growth and PSDP expenditures may be established, a causal relation is less certain, the relation might be otherwise, i.e., growth in economy increasing productivity and outputs of public sector development projects. Also there might be some components of PSDP which have no impact on the growth of the economy and otherwise.

Private investments and FDI, other forms of investment, significantly affect growth of an economy, and hence private investments could also affect or be affected from public sector Introduction

development programmes. So there arises a question regarding behaviour of public investment (budgetary PSDP), private investment and foreign direct investment in Pakistan.

This study investigates the relationship of PSDP and economic growth along with other forms of investment, private and foreign direct investments, so that a relationship can be established regarding efficiency and impact of all three forms of investments on economic growth using Johansen Co-integration Technique. Further the study investigates the cause and effect relationship of PSDP, economic growth and private investment using Granger Causality Tests. Also the study suggests the possible relationships between some components of PSDP (and economic growth for further analysis.

The results indicate that the investments (Private, PSDP & FDI) have positive long-term relation with economic growth where private investment have a strongest impact and FDI has a least impact on economic growth. The results also suggest that growth of the economy and increase in private investments creates more PSDPs which means government must focus on helping domestic and private investment grow instead of attracting FDI and investing huge sums on PSDP which will in turn boost economic growth, generate more revenues and public development projects.

History of Economic Growth and Investment in Pakistan

Over the last 35 years Pakistan has experienced inconsistent real GDP growth rates. These have varied from decade to decade like in 1960s, the growth rate was over 10 percent and 1997-98 saw a low GDP of just over 1 percent only. There was highest GDP growth rate in 1960 because this decade was considered as private sector friendly, so there was a boom and prosperity seen by the economy in 1960s. After the Nationalization policy of the Zulfiqar Ali Bhutto's government the 1970s were subjugated by an increasing participation of government in investment bustle so at one time the government was investing double than the private investors. In 1980s the military government reversed the process of nationalization and this act encouraged the private sector to invest. The 1990s, with a similar distribution of investment between the private and the public sector, saw the lowest growth rates because there was inconsistency in the policies of the government, government was changed four times in 1990s, cotton crop disease and imposition of international sanctions after nuclear test in 1998 so the government investment activity remained less than its trend level.
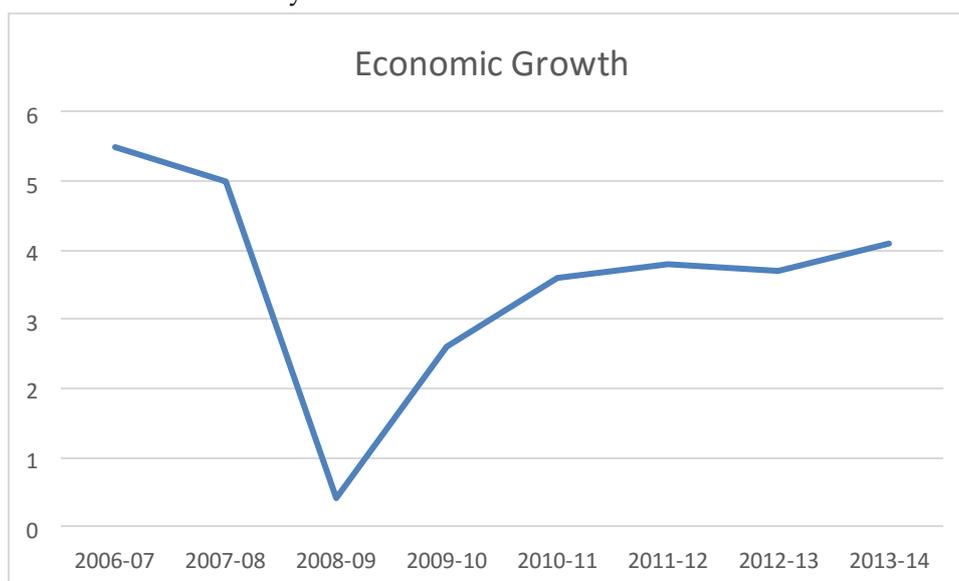
Pakistan faces a sluggish development unlike other South Asian and South East Asian countries, with an extra impulsive investment performance in the public sector than in the private sector so this situation points toward the need to observe the impact of economic insecurity on investment activities. Additionally in 1990s Pakistan has the lowest investment-to-GDP share in the South Asian region, (Sial *et al.* 2010).

Investment as % of GDP

17.73% 17.19% 17.61% 15.95% 14.20% 12.52% 13.48% 12.97% 12.39%

2005-06 2006-07 2007-08 2008-09 2009-10 2010-11 2011-12 2012-13 2013-14
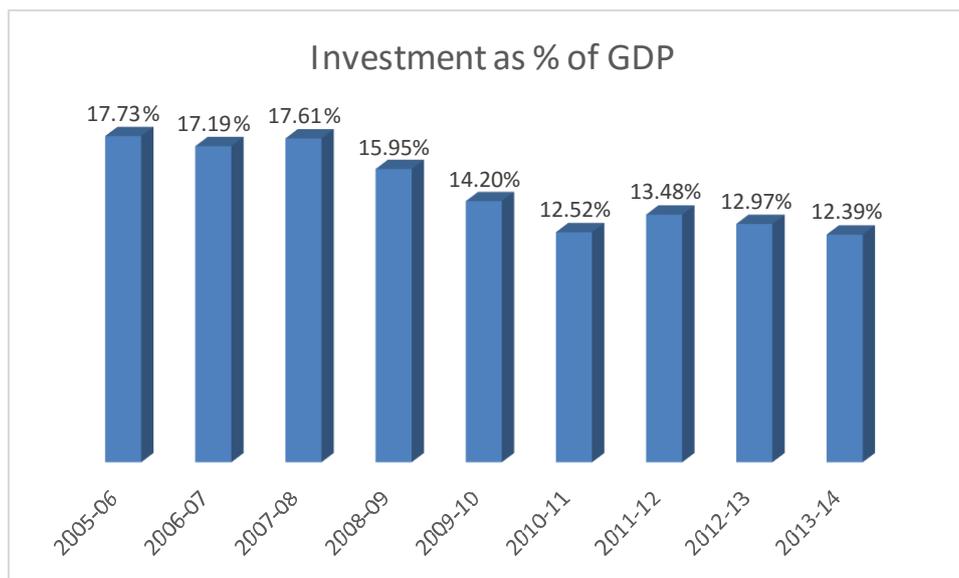
After getting 17.73 percent total investment in GDP in 2006-07 growth lowered it pace with 17.19 percent in FY07. In 2007-08 growth increased to 17.61 percent but fell down to 15.95 percent in the FY09 followed by a decline of 11% in FY10. In FY11 fixed investment decreased to 12.52 percent of GDP. Total investment has enlarged 13.48 percent of GDP in 2011-12. In the last FY, investment as percent of GDP remained low at 12.39. Throughout the same period in real terms Private investment increased by 12.5 percent per annum. For the period of the last three years the composition of investment has altered among private and public sector. Private sector investment grew by 9.7 percent this year as against 13.3 percent last year in nominal terms. Public sector investment has also increased by 15.7 percent per annum during the last four years and 9.7 percent during the current fiscal year in real terms. The development of infrastructure by public sector investment has shaped spill-overs effects for private sector investment.

Literature Review

The significance of public investment in the growth of an economy has been enquired by a growing body of theoretical and empirical literature considerable effect of government outlays on macro factors of the economy. For example, variations in public investment may affect both the long-term rate of growth and private investment. The endogenous growth models including Romer (1986) and Barro and Salai-i-Martin (1999) suggest that investment in public projects have spill-over effects as it is largely non-rival & non-excludable. These

models allow for the possibility of external effects through which public investment can have an effect on economic growth[1].

Empirical studies have used various approaches like production function where Ebert (1986), Costa, et al. (1987) and Deno (1988) found public investment to be a significant input in the production process and private and public investments complements of each other.

Khan (1996) explored the impact of public and private investment in boosting economic growth for a group of developing countries. He found that private investment having a much larger impact than public investment. Also, substantial regional variations are found in terms of the effects of public and private investment. Devarajan, Swaroop, and Zou (1996) focused on the components of public expenditure, their study revealed that current expenditure of public has positive and significant growth effects, the effect of capital component on per-capita growth is negative.

Aschauer (1989a, 1989b) analysed and estimated the productivity of public capital inside an aggregate production function. Public capital was found to be a major and important determinant of economic growth. Whereas, some studies are of the view that public investment had a negative effect and private investment had a positive and significant impact on economic growth.

In the context of Pakistan some studies explored the role of public capital in the economy both at national and sectoral levels. These research studies mapped out the bond between economic growth and productivity of public capital. It was revealed that public capital significantly and positively contributed in national product. Relationship between economic growth, public investment and private investment was also investigated in Pakistan. Results emphasized the importance of economic growth as source of investment. Character of public and private investment in economic growth of Pakistan was further explored. Private investment showed a significant positive impact on economic growth.

Literature Review

Ahmad *et al* (2012) in reviewing the causal relationship between GDP and investment found a bi-directional relation between both using time-series data for Pakistan.

Iqbal and Zahid (1998) in investigating the effect of some of the major macro-economic variables on economic growth found that primary education positively accelerated economic growth in the long run.

Rahman & Salahuddin (2010), carried out an empirical analysis on the relationship of economic growth and its determinants in Pakistan using modern time series analysis. The

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[1] Ghani, E and M. Din (2006), "The Impact of Public Investment on Economic Growth in Pakistan" The Pakistan Development Review, Vol.45, No.1, 87-98.

results indicate that stock market, human capital & FDI positively affect economic growth while inflation & financial instability harms it.

Asghar *et al.* (2011), found a positive relationship between government spending on human capital and economic growth. They assessed the effect of govt. expenditure on economic & community services, law & order and subsidies, where subsidies appear to be negatively related to economic growth.

Rizvi et al. (2010) in their paper investigated the relationship of government development expenditure and Gross Provincial Product (GPP) for Sindh and found a long run relationship between development expenditures of province and economic growth where growth in economy affects development expenditures.

Shahbaz et al. (2008) explored some of the causal factors for sustained economic growth in the Country Financial sector's development seems to stimulate economic activity and hence increases economic growth in long span of time but in short run. Remittances are positively correlated with economic growth in the country. Trade-openness erodes economic growth while financial openness promotes it. Domestic investment activities generate employment opportunities and in resulting contribute to improve economic growth. Finally, increased inflation and economic growth correlated inversely in the country.

Imran & Niazi analysed the effects of infrastructure expenditure and its components on growth of Pakistan. They found that investment in power generation, enhancing water flows for agriculture and tele communication have much larger impacts on economic growth than spending a huge share of PSDP on constructing roads.

Ahamad & Tanin (2010), in their study of effects of FDI on Bangladesh economic growth found that FDI has more influence on conventionally export oriented economies. FDI has a positive significant effect on economic growth of the countries with labour extensive economic activities, creating increased employment opportunities. While Khan *et al.* (2012) found a weak positive correlation of FDi and economic growth of Pakistan and Iqbal *et al.* (2010) found a bi-directional causal relationship between FDI and economic growth in Pakistan.

Methodology and Framework

The study postulates to find out the impact of public investment (PSDP) on economic growth. Modern sophisticated econometrics has allowed the researchers to find the behaviour of variables and their long-run impact on one another, and if they are cointegrated or not.

Economic Growth = f (PSDP, Private Investment, FDI)

The above model is first estimated for it short-run and long-run dynamics using Johansen Co-integration Methodology. Then causal relationship of economic growth and PSDP is inquired

using Granger Causality Tests. The data for above variables is collected through standard data sources[2] for the period of 1980-81 to 2013-14.

The data of the sub components of PSDP (Health, Energy, Education, Housing and Transport & Communication) was then tested for their relationship with economic growth.

Economic Growth = g (Health, Energy, Education, Housing, Transport & Communication)

Time-series properties of all the variables is tested. This is necessary as time series data inherently exhibit strong trends and random and non-random properties. First of all stationarity of the variables was tested then co-integration using Johansen Co-integration test method. Granger causality tests were then applied i.e., if present or past values of variable X explains future values of Y.

Results and Analysis

Standard econometric techniques have been applied on the variables to check for stationarity, long run and short run relationship of economic growth and PSDP, private investment and FDI. The causality of the private investment, PSDP and economic growth is also estimated using causality tests. Similarly relationship between components of PSDP and economic growth has also been established. The results shows that in the long-run all the three forms of investments have significant positive impact on economic growth but private investment have

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[2] State Bank of Pakistan, Economic Surveys of Pakistan, World Development Indicators

a strongest impact while FDI has a least impact on economic growth among all. The technical econometric results are explained in the annexure.

Economic Growth and PSDP

The long-run estimates of Johansen Co-integration shows a positive significant relation between economic growth and PSDP, yet the impact is less strong than private investment. A one unit change in Public Sector Development Expenditures causes 0.304 units change in Economic Growth. Furthermore, the causality tests shows that it is the Economic Growth which Granger causes PSDP expenditures i.e. increased economic growth generates more wealth and resources which are then used in public sector projects.

The budget on public sector development programmes in the FY15 is Million Rs. 1,175,000 which were Million Rs. 1,155,000 in the last fiscal year. Overall actual expenditures on PSDP since last decade have been increasing. Expenditure on PSDP in FY02 were Million Rs. 130,000 and it reached up to Million Rs. 814,720 in FY14.

The increasing trend of PSDP expenditure shows that prior focus of the federal government is to accelerate economic growth by increasing expenditure on PSD projects but as per results increased expenditures on PSDP will not increase economic growth because economic growth is in actual accelerating PSD projects. The government should instead focus on other factors which boost the pace of growth and the short-run analysis shows that immediate impact of PSDP expenditure on the growth of economy is negative.

Economic Growth and Sub-Components of PSDP

There are many public sectors in which PSDPs are initiated and carried out like, energy, health, education, infrastructure, transport and communication, food and water security, justice & human rights etc. Although PSDP and economic growth have positive significant relationship but there always exists a need to identify to which extent a spending add into the growth and what are the sectors which needs to be focused more and which sector specific development expenditure needs to be cut down. For the purpose we took five subcomponents

of PSDP (Energy, Transport & Communication, Education, Health, and Housing & Work Division) and estimated their individual relationship with Economic growth of Pakistan.

Energy Sector

The results show that development expenditure made on Energy sector positively relates to growth of the economy. Energy is supposed to be fuel of economy's engine therefore, development in energy sector ultimately accelerates economic functioning.

Housing and Work Division

Government spending on Housing and Work Division on the other hand have very less but negative relation with economic growth which means the development expenditure made under this head do not reap fruitful. One possible reason could be investment on Housing and Work Division is never consistent, government keeps on cutting down or increasing budget on Housing and Work Division as shown below:
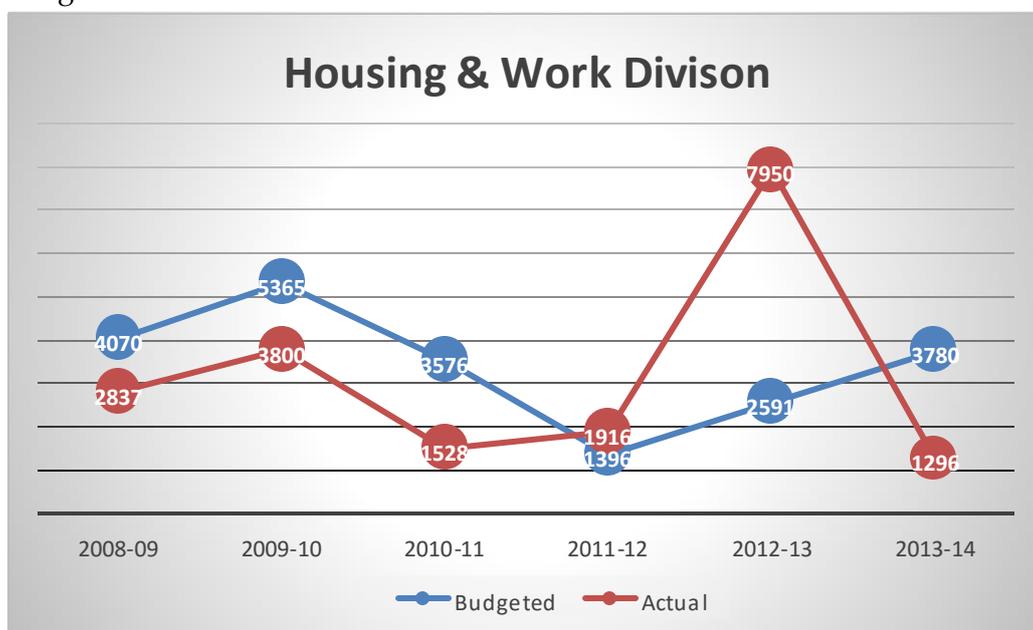
Results and Analysis

The above chart shows sharp cuts and increase in expenditure on Housing and Work Division development projects, the inconsistency in the resources negatively affect the life and outcome from the projects as a result the investments has no returns.

Transport and Communication

The results indicate that the development expenditure on Transport and Communication have a strong positive relation with economic growth in Pakistan. Economic development is always followed by improved infrastructure and communication of the economy which in turn again helps the economy to boost by decreasing time, cost and efficiency of production of goods & services.

Health Services, Regulations & Coordination Division

Our results show that expenditure made on Health Services, regulations and coordination division and economic growth have a negative relationship. The development expenditure under this division are made on forming regulations and increasing coordination in provision of health services to the public which ultimately have nothing to do with the growth of the economy.

Education Division

Development expenditure on Higher Education and Scientific and Research development have a positive significant impact on economic growth as per our results.
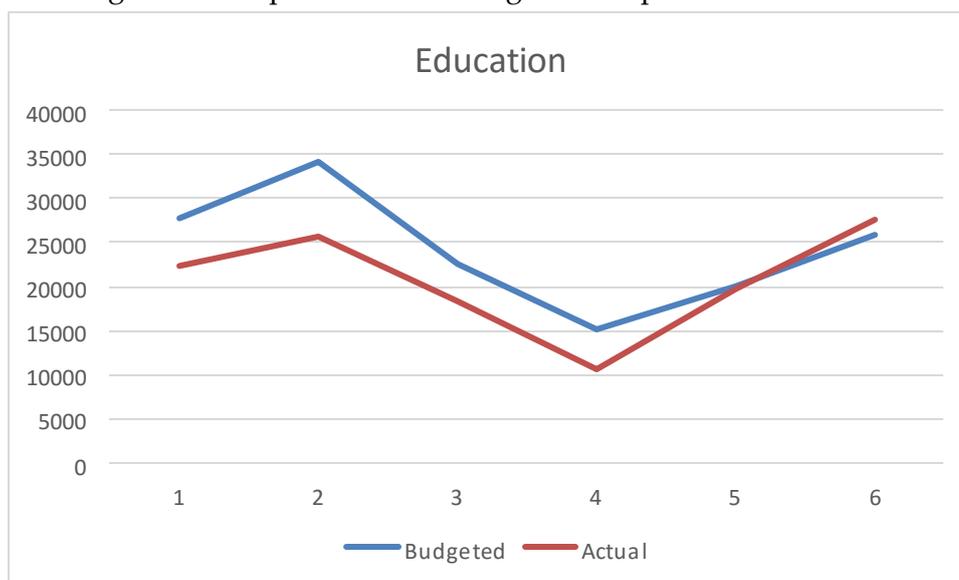
But the actual development expenditure on Education are always less than the budgeted amount. Also investing in education creates human resources which help in growth of the economy.

Economic Growth and Private Investment

Private investment and economic growth have a positive significant relationship both in the short-run and long-run in Pakistan. Private Investment have the strongest impact on the economic growth of Pakistan among all three types of investments i.e. PSDP, Private investment and FDI. A one unit change in private investment brings about 0.60 unit change in economic growth.

The factors that hinders growth of private investment are regulations, large government outlays and absence of investment environment in Pakistan.

Economic Growth and Foreign Direct Investment

Foreign direct investment (FDI) have no significant impact on the growth of Pakistan economy in the short run, while it has positive, significant but least impact among the all three types of investment in the long-run.

PSDP and Private Investment

Private Investment have a positive correlation with public investments, where increase in private investment is followed by increase in public sector development programmes. Government heavily relies on public development projects for growth of the economy but in-fact it is the private investments which help boost economic growth and public investments in development projects.
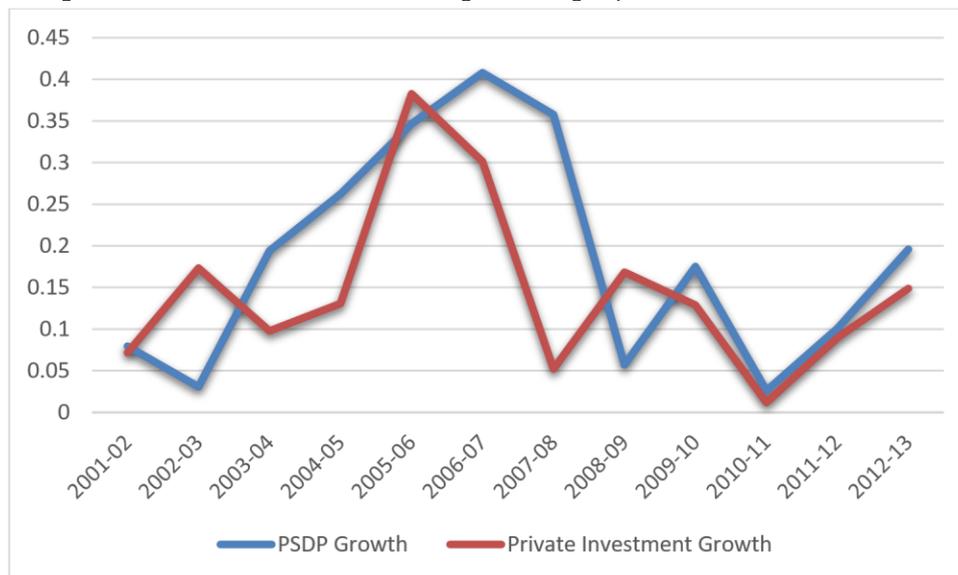
But the above chart indicates that growth of expenditure on PSDP is higher than growth of private investment in Pakistan over the last decade.

Conclusion

Conclusion

Pakistan's economic growth is on average 4%, and it remained lower in the past few years due to many reasons like high inflation rates, high unemployment rates, rising budget deficits, energy crisis, and low literacy rates. It is a known fact that a positive relationship exists between economic growth and investment, but there is no such consensus on the type of investment (public, private and FDI). Government spends on Public Sector Development Programmes to increase efficiency of the economy but the causal relationship is less certain. There is no evidence if the economic growth accelerates these development programmes or vice a verse.

A standard econometric technique has been applied in the study to find the nature and cause of the relationship between PSDP and economic growth in Pakistan. The results show that PSDP and economic growth have a positive long run relation in Pakistan but it is not PSDP

causing economic growth but increased growth of economy increases efficiency of PSDP. Also PSDP have negative impact on economic growth in the short-run.

Private investment has the strongest impact on economic growth among all three types of investment, (public, private and FDI). Individual impact of components of PSDP on economic growth is also estimated where transport and communication, energy and education have positive impacts on economic growth while housing and work division and health development expenditure have negative relation with economic growth.

The results also revealed that in the long-run increase in private investment generate sufficient resources which on the one hand boost economic growth and on the other hand public sector development programmes also increase due to increased private investments.

Recommendations

Public Sector Development Programmes (PSDP) although have a positive long-run relationship with growth of Pakistan's economy but the cause and effect relation is economic growth boosting up public sector development expenditures, which means government needs to reform its priorities in terms of development projects like:

- The current structure of attaining economic growth is to spend on public development programmes. In order to attain high growth rates government must focus on other impediments to growth which will ultimately help in reaping fruits of public development projects like education, transport and communication and energy sector.

- Since private investment has the strongest impact among all three types of investments on economic growth, private investment positively affects public investment in PSDP. Also, FDI has a minimal role among all three types of investments, so there exists a need of shifting the debate and efforts on how to attract foreign direct investment in Pakistan's economy to increasing potential of private investments which will have two way impact on public investment; direct positive impacts on public investments (PSDP) and secondly through increasing economic

growth.

- Public investment on housing and work division has a negative relation with economic growth of Pakistan, where one possible reason might be the inconsistency of the budget allocated to the sector, but even negative the impact on the growth in too small, which means the expenditure should be cut down and be spent on sectors with higher potential outcomes.

- Investments in energy sector has a strong positive significant relation with the growth of the economy. If private energy markets are encouraged, it will have spillover effects on the growth of economy, by decreasing burden of public sector energy projects, increasing efficiency of the sector and increasing private investment which will then ultimately boost up the growth of the economy.

- There must be cuts in the regulatory and coordinating expenditures in the health and nutrition sector because they cause no benefits to the growth of Pakistan's economy.

<div align="right">References</div>

References

- Ahamad, M. G., & Tanin, F. (2010). Determinants of, and the relationship between FDI and Economic growth in Bangladesh. MPRA, paper no. 20236.

- Aladejare, S. (2013). Government spending and economic gowth: Evidence from Nigeria. MPRA.

- Aschauer, D. (1989), "Does Public Capital Crowd-Out Private Capital?" Journal of Monetary Economics, Vol.24, 171-88.

- Aschauer, D. (1989), "Is Public Expenditure Productive?" Journal of Monetary Economics Vol. 23, 177-200

- Asghar, N., Azim, P., & Hafiz-ur-Rehman. (2011). Impact of Government Spending in Social Secotrs on Economic Growth: A Case Study of Pakistan. Journal of Business and Economics, Vol 3.

- Barro, R. J., and X. Sala-i-Martin (1999) Economic Growth. Cambridge, MA: The MIT Press.

- Belloc, M., and P. Vertova (2004), "How Does Public Investment Affect Economic Growth in HIPC? An Empirical Assessment" Working paper, Department of Economics, University of Siena, Vol.416.

- Blejer, M. I. and M. S. Khan (1984), "Government Policy and Private Investment in Developing Countries" IMF Staff Papers, 379-413.

- Burki, S. J. (2008), "Pakistan's Economic Difficulties and Their Consequences" Woodrow Wilson International Center for Scholars 2008.

- Caballero, R. J. (1999), "Aggregate Investment" Handbook of Macroeconomics, Chapter 12, Vol.1, Edited by. J. B. Taylor and M. Woodford. Elsevier Science B.V.

- Chrinko, R. S. (1993a), "Business Fixed Investment Spending: Modeling Strategies, Empirical Results, and Policy Implications" Journal of Economic Literature, Vol.31, No.4, 1875–1911.

- Costa, J. da Silva, R. W. Ellson, and R. C. Martin (1987) Public Capital, Regional Output and Developments: Some Empirical Evidence. Journal of Regional Science 27:3, 419–437.

- Deno, K. T. (1988) The Effect of Public Capital on U.S. Manufacturing Activity: 1970 to 1978. Southern Economic Journal 55:1, 400–411.

- Eberts, R. W. (1986) Estimating the Contribution of Urban Public Infrastructure to Regional Growth. Federal Reserve Bank of Cleveland. (Working Paper No. 8610)

- Economic and Social Survey of Asia and Pacific (2008), "United Nations Economic and Social Commision for Asia and Pacific".

- Evidence for the US and the Netherlands. Economic Modeling, 12, 60-72.

- Ghali, K. H. (1998), "Public Investment and Private Capital Formation in a Vector Error-Correction Model of Growth" Applied Economics, Vol.30, 837-844.

- Ghani, E and M. Din (2006), "The Impact of Public Investment on Economic Growth in Pakistan" The Pakistan Development Review, Vol.45, No.1, 87-98.

- Haroon, M., & Nasr, M. (2011). Role of Private Investment in Economic Development of Pakistan. International Review of Business Research Papers, Vol. 7.

- Hussain, F. (2008), "Pakistan's economic growth may pick up to 6.5 percent next year: ADB" Business Recorder. (April 03 2008).

- Ibrahim, M. H. (2000), "Public and Private Capital Formation and Economic Growth in Malaysia, 1961-1995" IIUM Journal of Economics and Management, Vol.8, No.1, 21-40.

- Imran, M., & Niazi, J. (n.d.). Infrastructure and Growth.

- Iqbal, M. S., Shaikh, F. M., & Hussain, S. A. (2010). Causality Relationship between FDI, Trade and Economic Growth in Pakistan. Asian Social Science, Vol 6.

- Iqbal, Z., & Zahid, g. M. (1998). Macroeconomic Determinants of Economic Growth in Pakistan. Pakistan Development Review, 125-148.

- Khan, A. H. (1997) "Foreign Direct Investment in Pakistan: Policies and Trends" The Pakistan Development Review, Vol.36, No.4, 959-985.

- Khan, M. K., Khan, M. A., Awan, S. L., Usman, A., & Imran, A. (2012). Spillover effect of FDI on Economic Growth in Pakistan. International Business Research, Vol 5.

- Khan, M. S. (1996) Government Investment and Economic Growth in the Developing World. The Pakistan Development Review 35, 419–439.

- Khan, M. T. Y. and K. Sasaki (2001) "Roles of Public Capital in Pakistan's Economy: Productivity, Investment and Growth Analysis" RURDS, Vol.13, No.2, 143-162.

References

- Mallik, G. and A. Chowdhury (2001), "Inflation and Economic Growth: Evidence from Four South Asian Countries" Asia-Pacific Development Journal, Vol.8, No.1, 123-135.

- Milbourne, R., G. Otto, and G. Voss (2003) Public Investment and Economic Growth. Applied Economics 35, 527–540.

- Naqvi, N.H. (2002), "Crowding-in or Crowding-out? Modelling the Relationship between Public and Private Fixed Capital Formation Using Co-integration Analysis: The Case of Pakistan 1964-2000" The Pakistan Development Review, Vol.41, No.3, 255-276.

- Rahman, M. M., & Salahuddin, M. (2010). The Determinants of Economic Growth in Pakistan: Does Stock market development play a major role? Economic Issues, Vol. 15.

- Ramirez, M.D. and N. Nazmi (2003), "Public Investment and Economic Growth in Latin America: an Empirical Test" Review of Development Economics, Vol.7, No.1, 115-126.

- Rizvi, S. Z., Zia-ul-Qamar, & Shamim, A. (October, 2010). Imapct of Development Spending on Economic Growth Measuring the effectiveness of Fiscal Policy in Sindh. Pakistan Business Review.

- Romer, Paul M. (1986) Increasing Returns and Long-Run Growth. Journal of Political Economy 94:5 (October), 1002–1037.

- Shahbaz, M., Ahmed, k., & Chaudhary, A. (2008). Economic growth and its Determinants inPakistan. The Pakistan Development Review, 47:4.

- Sturm, J. E. (1998) Public Capital Expenditure in OECD Countries. The Causes and Impact of the Decline in Public Capital Spending. Cheltenham: Edward Edgar Publishing Ltd.

- Sturm, J. E., and J. de Haan (1995) Is Public Expenditure Really Productive?

Annexure

Time series variables generally do not turn out to be stationary and if they are termed to have linear combination in between them this mean that there is presence of cointegration. In order to test cointegration there are different approaches which can be used important in this regard include Engle and Granger (1987) test. Engle and Granger test is said to be residual based test based on two step procedure. The drawback of Engle and Granger test of cointegration is that, this procedure cannot be followed for more than two variables. Beside this procedure of cointegration, there is another procedure called Auto Regressive Distributive Lag (ARDL) or unstructured vector error correction model (UVECM) by

Pesaran et al (2001). This process of ARDL can be used for all variables having me (1) or me (0) or can be mutually cointegrated. But to perform this test we have to follow assumption that explanatory variables shouldn't have linear relationship. It was Johansen (1988) who presented the Maximum likelihood Method for the estimation of more than one cointegrating vector. According to this approach of Johansen all variables should have same order of integration .i.e. all variables should be I (1). In Johansen Cointegration test in order to avoid problem all variables are taken as endogenous.

Augmented Dickey Fuller Test Results

Variables	Order of Integration
LGDP	I(1)
LGFC	I(1)
LFDI	I(1)
LPSD	I(1)

Long Run Equation using Johansen Cointegration with (standard Errors)

Based on VAR, lag length was decided to be 1 according to AIC criteria. After this we found that there is one cointegrating equation present for which long run equation is given below along with chi-square values:

$$LGDP_t = 8.483 + 0.6369 LGFC_t + 0.12616 LFDI_t + 0.30396 LPSD_t + \varepsilon_t$$
$$(16.845) \quad (25.023) \quad (1.135) \quad (5.2772)$$

We have calculated this equation based on maximum likelihood estimation technique. Above coefficients are given in normalized form along with chi-square values shown in (

)This equation above tells that gross fixed capital formation and PSDP are having positive and significant relationship with GDP .i.e. with 1 percent change in any of the said variable there occurs 0.6369 and 0.30396 percent change in gdp. On the other side Foreign Direct Investment, though have positive sign but based on chi-square value shown in ( ) it is found to be insignificant in the long run.

Short Run Dynamics

After estimation of cointegrating equation, we move towards short run dynamics. In short run we use, variables in difference form while error correction term (ECT) for the evidence of long run. Following general to specific criteria by removing all the insignificant variables, we found the evidence of long run with significant ECT term. Beside this presence of long run, gross fixed capital formation has positive and significant relation while lagged PSDP has negative and significant relationship.

$$DLEX_t = -0.004 + 0.251DLGFC_t - 0.0216DLPSD_{t-1} - 0.103ECT_{t-1} + U_t$$

$$(-0.094) \quad (4.042) \quad (-2.237) \quad (-2.620)$$

Diagnostics

After testing for the cointegration with both long and short run, we now move forward to test the dynamics for problems. These problems include testing for autocorrelation, heteroskedasticity, normality of residuals and stability of parameters. It can be seen from the table below that there is no problem of autocorrelation and heteroskedasticity present because of low calculated values in comparison to the critical values.

Test	Calculated Values	Critical Values
Breusch Godfrey Serial Correlation LM Test	0.344256	3.841
Autoregressive Conditional Heteroskedasticity	1.7319	3.841

Similarly looking at the plots below, it can be seen that residual is normally distributed as there is low JB (Jarque Bera) value. And there is present stability of parameters because in both the cases from CUSUM (mean stability) and CUSUM of square (variance stability) calculated lines in both the cases are in between the 5% significant region.

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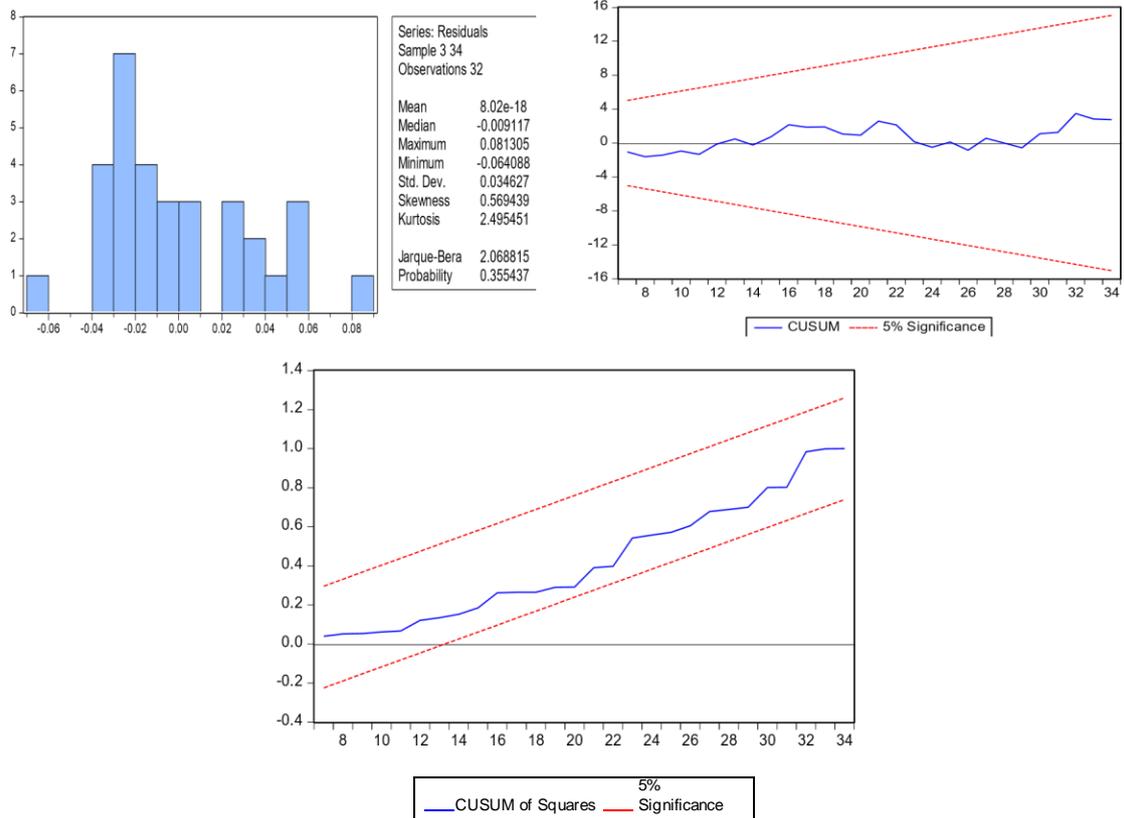
Estimation Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.615267	58.88214	54.07904	0.0175
At most 1	0.353207	28.31555	35.19275	0.2275
At most 2	0.314207	14.37221	20.26184	0.2646
At most 3	0.069425	2.302469	9.164546	0.7171
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.615267	30.56659	28.58808	0.0276
At most 1	0.353207	13.94335	22.29962	0.4672
At most 2	0.314207	12.06974	15.89210	0.1819
At most 3	0.069425	2.302469	9.164546	0.7171

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LGDP	LGFC	LFDI	LPSD	C
-2.978713	1.897298	0.375807	0.905434	25.26997
13.16048	-14.24502	2.932590	0.063566	-21.48742
6.475574	-4.680762	0.278319	-2.233551	-35.78902
-3.885619	3.883078	0.428880	-0.357552	10.65654

Unrestricted ̣ent Coefficients
Adjust ̣lpha):

D(LGDP)	0.044917	0.004951	0.011839	-0.000143
D(LGFC)	0.034276	0.015873	0.033829	-0.018300
D(LFDI)	0.011783	-0.218410	0.009430	-0.055050
D(LPSD)	-0.198213	0.056281	0.204549	0.108415

1 Cointegrating Equation(s):	Log likelihood	51.48973		

Normalized cointegrating coefficients (standard error in parentheses)

LGDP	LGFC	LFDI	LPSD	C
1.000000	-0.636952	-0.126164	-0.303968	-8.483517
	(0.12733)	(0.11107)	(0.13232)	(2.06698)

Adjustment coefficients (standard error in parentheses)

D(LGDP)	-0.133795
	(0.02417)
D(LGFC)	-0.102097
	(0.05708)
D(LFDI)	-0.035099
	(0.24259)
D(LPSD)	0.590420
	(0.33229)

2 Cointegrating Equation(s):	Log likelihood	58.46141		

Normalized cointegrating coefficients (standard error in parentheses)

LGDP	LGFC	LFDI	LPSD	C
1.000000	0.000000	-0.625192	-0.745515	-18.27939
		(0.17431)	(0.25996)	(2.36201)
0.000000	1.000000	-0.783461	-0.693218	-15.37928
		(0.16838)	(0.25112)	(2.28163)

Adjustment coefficients (standard error in parentheses)

D(LGDP)	-0.068637	0.014693
	(0.10872)	(0.11579)
D(LGFC)	0.106800	-0.161081
	(0.25525)	(0.27185)

D(LFDI)	-2.909475	3.133605
	(0.94123)	(1.00243)
D(LPSD)	1.331109	-1.177798
	(1.49814)	(1.59556)

3 Cointegrating Equation(s):		Log likelihood	64.49628	
Normalized cointegrating coefficients (standard error in parentheses)				
LGDP	LGFC	LFDI	LPSD	C
1.000000	0.000000	0.000000	-1.362275	-8.238268
			(0.36429)	(4.35473)
0.000000	1.000000	0.000000	-1.466113	-2.796222
			(0.48134)	(5.75389)
0.000000	0.000000	1.000000	-0.986514	16.06087
			(0.71194)	(8.51053)

Adjustment coefficients (standard error in parentheses)			
D(LGDP)	0.008030	-0.040724	0.034695
	(0.11567)	(0.11681)	(0.02295)
D(LGFC)	0.325863	-0.319427	0.068845
	(0.26583)	(0.26844)	(0.05274)
D(LFDI)	-2.848410	3.089465	-0.633453
	(1.04365)	(1.05391)	(0.20708)
D(LPSD)	2.655682	-2.135244	0.147490
	(1.55378)	(1.56905)	(0.30829)

Shot Run Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.004046	0.042892	-0.094325	0.9255
D(LGFC)	0.251595	0.062533	4.023400	0.0004
D(LPSD(-1))	-0.021644	0.009673	-2.237578	0.0334
E(-1)	-0.103629	0.039550	-2.620192	0.0140

Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
LPSD does not Granger Cause LGDP	33	0.00345	0.9536
LGDP does not Granger Cause LPSD		20.4869	9.E-05
LPSD does not Granger Cause LGFC	33	0.23049	0.6346
LGFC does not Granger Cause LPSD		20.2373	0.0001
LFDI does not Granger Cause LPSD	33	16.1691	0.0004
LPSD does not Granger Cause LFDI		0.26649	0.6095

The above table shows that public sector development expenditures are granger caused by economic growth which means increasing economic growth will help increasing public sector development programs not the otherwise.

Sub-Sectors of PSDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LE	1.395349	0.241340	5.781678	0.0000
HOUS	-0.000344	0.000108	-3.182417	0.0035
H	-0.000139	3.56E-05	-3.914573	0.0005
LTC	1.159738	0.289303	4.008724	0.0004
LED	0.511704	0.248970	2.055281	0.0490