Crowding in and crowding out in Pakistan: A Co-Integration Analysis of Public and Private Investment (1972-2015)

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Abstract
Investments both public and private are essential to Pakistan's economy. Public investment is crucial for any nation's economic development, but private investment serves as a catalyst for the creation of jobs and income. The primary purpose of this study is to empirically examine the "crowding-out and crowding-in" effects of state spending on private investment in Pakistan. The 43 most recent years (1972–2015) of data were gathered and examined. The main data sources used for data collection were the "State Bank of Pakistan", "the Economic Survey of Pakistan," and "World Development Indicators". The researchers considered all forms of investment, including private investment, "government interest spending," "current government spending", and current government spending transfer. In the analysis section, the "Augmented Dickey-Fuller" test was employed to gauge the stationarity of the variables. All of the study's variables were found to be non-stationary using the analytical tools. The results of the "vector error correction model" (VECM), which was employed to examine both long-run and short-run causation, illustrate that government interest spending has a substantial and encouraging impact on private investments.

Keywords: *Government Interest Spending,* Augmented *Dickey-Fuller*, *Johanson Co-Integration Test*

Introduction

The phenomenon in which governmental investment replaces or has an impact on private investment is known as "crowding out." Public investment has frequently plummeted in private investment because of the burgeoning requirement for finances between the public and private sectors. Amplified public investment frequently results in larger budget deficits, which ultimately result in a greater need for borrowing from banks and other non-bank sources on the part of the government. Short-run versus long-run, or direct versus indirect crowding-out, are the two main categories used to categorize crowding-out types. Budget deficits and fiscal imbalances have a significant impact on macroeconomic variables like consumption and investment. In contrast to the effects on developing economies, the magnitude of these effects varies in developing

economies. However, developing economies are more negatively impacted by ongoing budget deficits due to insufficient finance sources. The predicament in emerging countries is made worse by political unpredictability and flimsy macroeconomic policies. Budget deficits in developing nations are typically trapped by excessive spending rather than earnings. Regarding the crowding-in and crowding-out effects, there are divergent views. Although recent research emphasizes the reverse, that government expenditure stimulates private investment, Şen and Kaya (2014) argue that government spending discourages private investment.

Economists and scholars disagree about whether public investment has a good or negative impact on private investment. Some economists contend that the crowding phenomenon, which is known as a governmental investment having a detrimental impact on private investment, exists (Cinner et al., 2021, Hussein and Obaid, 2021). But there is proof that there is a conflict between private and governmental investments. They contend that public investment quickens the pace of economic expansion and, in the long term, increases private investment. Additionally, due to favorable externality effects, public investment in the form of infrastructure development frequently causes an increase in private investment. Both direct and indirect crowding-out impacts on private investments are demonstrated by government spending. Direct crowding out to the private sector is caused by a reduction in the amount of financial and physical resources available and indirect crowding out is brought on by a rise in price and interest rates. Only the direct (actual) crowding-out effect is the subject of this investigation. Regarding the effects of crowding in and out, Keynesian, Neo-Classical, and Ricardian have three different perspectives. According to the neoclassical theory, when the government decides to raise expenditure over revenue, private investment is crowded out. They claim that because people believe that taxes would be collected from future generations and that those revenues will be used to pay the current deficit budget, consumption levels rise as a result of government budget deficits.

An increase in the interest ratio leads to unattractive private investments. So, "private investment" will be squeezed out by declining government spending. There is a disparity between Keynes' and "Neo-classical ideas". Compared to government spending, private investment is less productive. Government spending supported by debt boosts output but does not fully offset the negative impact of crowding out private investment, which lowers GDP (Alauddin, 2007). In their opinion, while the economy is operating at full employment, savings decline and consumption rise. It is anticipated that the interest rate will need to be raised in order to offset the decline in savings and preserve the role of investment in the economy. The rise in interest rates disproportionately affects the probability of private investment. Government spending will therefore overtake private investment, which will therefore decline. Between Keynes' and Neo-classical concepts, there is a discrepancy. According to Keynes, most economies are below the employment level. Full employment is uncommon, and in those circumstances, interest rate investment will always be low. As a result, an increase in interest rates will cause the economy's output level to increase. According to Keynes, the fiscal multiplier will be effective, and increased government expenditure will result in a larger change in the level of economic activity.

Concerns about a chronic current account surplus producing a demand that lowers performance in open economies globally are growing (Davidson, 2017). To raise demand and crowd in private investment, it reduces through conversions (Phillips and Perron, 1988, Tracey et al., 2011). Based

on his equivalence theorem, Ricardian offered his crowding-in and crowding-out effects. He asserts that government expenditure and private investment operate separately and are unrelated. Crowding in or out effects are not produced by private investments. He predicts that future tax increases will go hand in hand with increased government spending (Tracey et al., 2011). As a result, the government anticipates that its spending will be covered by the sale of public bonds that will eventually be repaid with tax revenue.

Problem Statement

Banks and the open market, which are excellent sources of capital for private enterprises, are where the government of Pakistan borrows excessively. Interest rates, public investment, and private investment all contribute significantly to economic growth. When the economy is fully employed, the government abruptly increases the budget deficit, which fuels competition for scarce investment capital in the private sector and pushes up interest rates. As a result, the situation will be disrupted by an increase in interest rates, and public investment will take the place of private investment. This situation discourages private investment, which is a crucial tool for economic progress.

Research Objective

The research objectives are:

- To investigate crowding-in and crowding-out, as well as how government spending affects private investment.
- To determine if the government's spending has a direct or indirect crowding out or crowding in influence on private investment.
- To find out how public and private investment have affected economic progress over the short and long terms.

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Literature Review

Hassan and Salim (2011) A 2011 study on the relationship between private and state investments was done by Hassan and Salim. Whether they provide a neoclassical production purpose that competes with or supports one another. Panel data spanning 17 years, from 1980 to 1997, was used in 19 developing nations. Using the model, the short- and long-term investment factors were eliminated. To validate the long-term co-integration relationship, co-integration tests were carried out. Private investments might be impacted by macroeconomic uncertainty. According to the empirical findings, private investment and state investment work best together. It demonstrated that throughout time, when public investment increased by 1%, private investment climbed by 0.5%. Half of the long run's significant favorable effect is present in the short run. According to statistics, the availability of private sector financing has a greater influence on investment level than the interest rate. Studies demonstrate that the loan market in developing nations is significantly influenced by private investment. Macroeconomic instability has negative long-term effects but negligible short-term effects. From a policy standpoint, public investment is crucial in promoting private investment in the economies of emerging nations. The availability of credit is a driving force behind private investment in emerging nations due to less established financial institutions.

Naqvi (2002) ascertain the link between private and public fixed capital in Pakistan from 1964 to 2000, a crowding-out research and co-integration analysis were done. His research revealed that the previous administration had a favorable effect on private investment. It proves that any government must wait at least five years to absorb or eliminate a shock or an increase in both public and private investment in a country's policies. Growth in the model drives both sorts of investment in the economy. This demonstrates that the most significant kind of investment growth is economic expansion. The prevailing uncertainty in the market adversely affects private investment. Studies indicate a sectorial analysis of investment, in which investment and sectorial private activity were analyzed and compared with the Pakistan Development Review because different types of government investment have varied outcomes (2005).

In 2012, Bint-e-Ajaz and Ellahi (2012) performed research on Pakistan's economic development and private and state investment. A significant contributor to total demand and a key driver of economic expansion is an investment. Investment changes have an impact on the expansion of economic productive capacity and aggregate demand. This study assessed the short- and long-term interactions between macro-variables such as GDP growth, private investment, and public investment in Pakistan's economy. They discovered significant connections between GDP, private and state investments, and macroeconomic variables. The amounts of inflation and GDP influence private investment and have a two-way causal relationship with each other. In Pakistan's economic framework, private investment was displaced by public investment, confirming negative overall theoretical correlations between the two types of investment. Public investment used to be predominantly financed by internal and foreign borrowing. Government tax money makes a smaller contribution to encouraging public investment.

In Pakistan, the effect of state borrowing on crowding out was investigated by Khan and Gill (2009). They look into how Pakistani private investment is impacted by public borrowing. Data for a 34-year time series, from 1971 to 1972 and 2005 to 2006, were collected. The variables considered are the gross domestic product, private investment, interest rate, and public borrowing. These studies' findings indicate that crowding-in effects are present but not crowding-out ones. This is a result of sustained public debt, excessive financial liquidity, and government spending on transfer payments.

The complementarity between private and public investment in India was examined by Pradhan et al. (1990). They used the economy as a model, breaking it down into 18 different sectors, of which 17 dealt with commodities and 1 with finance. Additionally, they separated the population into three groups: homes, businesses, and the government. Additionally, they separate them into several income brackets. Private investment, which reaches its pinnacle when financed by borrowing from markets, is displaced by public investment. It is complimentary and complementary between private and public investment in this scenario; it changes with different funding methods and the distribution of public investment. The results also indicated that greater public investment, or spending by the general public, can result in higher national incomes. Although it displaces private investment, increasing public investment has encouraged economic growth.

In the framework of investigating the consequences of public investment on private investment, Bilgili (2003) looks into the dynamic implications. Additionally, this study looks at the individual effects of "government spending" and investment spending on private investment as well as any potential connections between the variables. The effect was examined using the Vector Autoregressive (VAR) and VECM methods. The author also used the impulse function, but the second VAR scheme clearly shows that an investment is a job of total disbursements it is not just the government fiscal components.

Aero and Ogundipe (2016) look into Nigeria's fiscal deficits' repercussions. Deficits in Nigeria were converted to decimal numbers, and the government sold bonds on the stock market as a result of the lessening in the volume of loanable reserves available to private investors due to a surge in interest rates. This resulted in a plummet in private investment and subpar short-term economic growth. The study's findings, which were supported by the OLS and Granger Causality tests he utilized for this purpose, showed that budget deficits discourage private investment and have a foremost effect on the output, employment, and standard of living of the economy. He employed OLS and the Granger Causality test for this, and the analysis's findings supported that the budget deficit discourages private investment and has a major impact on the economy's output, employment, and standard of living.

Perotti (2005) suggested a structural VAR model for studying the repercussions of fiscal policy on macroeconomic accomplishments in five OECD countries between 1960 and 2001. He initiated that any change in government expenditure is a quick impact on inflation, vicissitudes in the gross domestic product and reserved investment have a more ongoing impression. Saeed et al. (2006) reconnoitered how a government can spend that in turn affect a private investment expenditure. Using a structural Vector Auto regression model, Saeed's findings disclosed that any strong private investment provides a profound comeback to public investment in the farming sector, but a meager one in the industrial sector.

In many nations, different variables produce various outcomes. In the past twenty years, the most frequently discussed issues in developed and developing nations have been the effects of public spending, financing the budget deficit with loans, and private investment on economic progress. This is because different countries economies have been affected differently by public spending over their revenue. Both crowding in and crowding out have an impact on economies, progress, investments, policymaking, and the financial outcome of loanable markets, according to academics.

Theoretical Framework

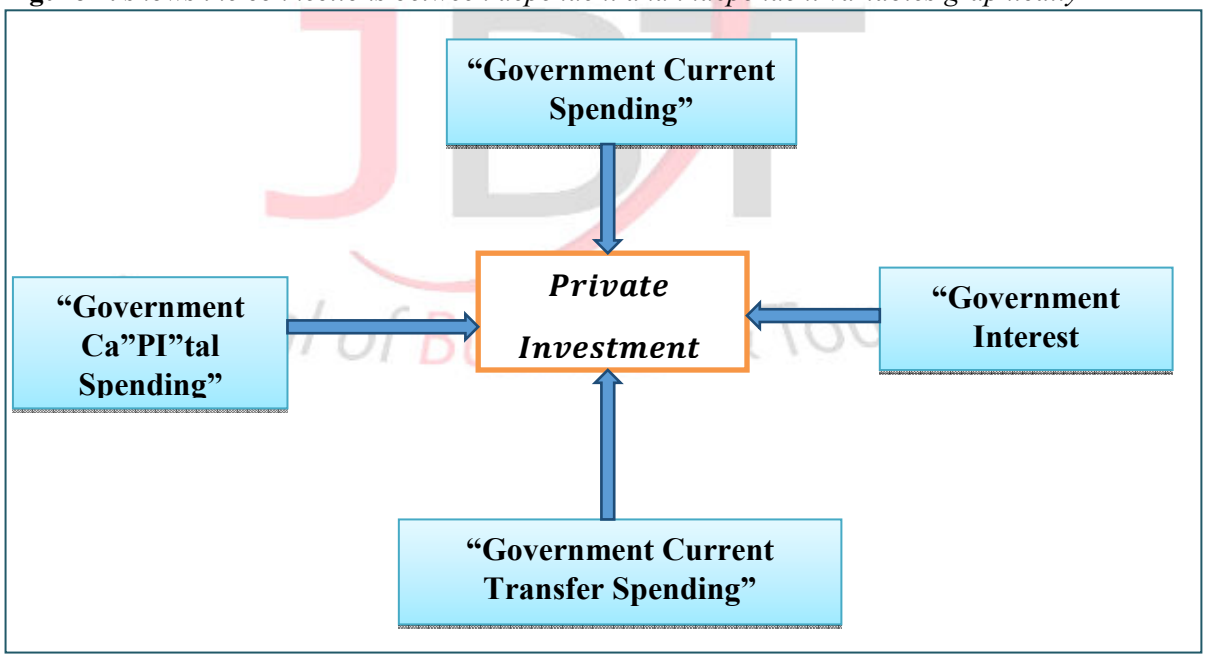
According to Aschauer (1990), it's critical to examine the effects of each element of government spending on private investment independently. Whether public spending affects private investment favorably, negatively, or whether they work in tandem. For this reason, we use a changed version of Aschaur's (1989) model to assess the results of each sub-item in the budget system that consists of government spending.

High real interest rates and financial crowding out have come from inability to address fiscal deficits and unsustainable public borrowing. It also devoured savings that could have been put

toward private investment. There is growing evidence that investments by public and private sector are crucial for a country's economic growth since they progress manufacturing techniques and increase the economy's capacity for output. Both are essential to a robust economy. This analysis will assist government policymakers in overcoming the challenges of internally financing the deficit budget and in lowering foreign debt. This encourages private investors to put money into various economic sectors.

Based on our theoretical framework, this study's explanatory variables include "government capital spending" (GCS), "government interest spending" (GIS), "government current transfer spending" without interest expenditure (GCTS), and "government current spending" (GCST). Our theoretical theory predicts that GIS will have an unfavorable influence on private investment. Moreover, GCTS and GCST may have a beneficial or adverse effect on private investment that depends on the results of earlier studies, which had diverse findings. GCAS is anticipated to have an encouraging impact on private stakes. Figure 1 shows the graphical representation of the interrelationships between the variables.

Figure 1: *shows the connections between dependent and independent variables graphically.*



Hypotheses
The following hypotheses have been tested

- Why Public expenditure doesn't discourage private investment.
- Why Private investment is not discouraged by government spending.
- There is a negligible relationship between private investment and economic development, either in the long run or the short term.

Methodology

Most social science researchers utilize quantitative, qualitative and hybrid strategies to investigate various phenomena. To gain an understanding of the issue, phenomenon, or concept, an open-ended questionnaire and interview data were evaluated and interpreted (Malik et al., 2019, Malik et al., 2021). (Primary data or first-hand information gained through in-depth interviews and observations is often used by qualitative researchers (Malik, 2021). However, a quantitative approach that uses statistical techniques to quantify the various features of the phenomenon is the methodology that is most suitable for this study. The researchers investigated the effects of government transfer expenditure, interest spending, capital spending, and current spending on private investment using quantitative research methods. "Private investment" is the dependent variable in this inquiry, while government current spending, capital spending, interest spending, and transfer spending are independent factors.

Data collection and Analysis Technique

The data between 1972 and 2015 were used and the main collection sources were "the State Bank of Pakistan", "the Economic Survey of Pakistan", and "the World Development Indicators". To investigate how government spending influences private investment as a result of crowding in and crowding out effects, the following model is used:

Econometric Model

The researcher used the following equation to empirically investigate the influence of government expenditures on private investment:

$$\text{"PI"}t = \beta 0 + \beta 1\text{GCAS}t + \beta 2\text{GIS}t + \beta 3\text{GCTS}t + \beta 4\text{GCST}t + \mu t$$

In the aforementioned equation "PI" stands for, GCAS denotes "government capital spending", GIS represents "government interest spending", GCTS indicates "government current transfer spending" (minus interest expenditure), GCST "government current spending", and μt means "error term".

Justification of the Variables

This model's variables are chosen after a sensitivity study. The variables used are those that have been used in other studies (Naqvi, 2002, Bilgili, 2003, Jan et al., 2021, Cumbers and Birch, 2006, Ahmed and Miller, 2000). According to the "sensitivity analysis", the variables "GIS", "GCTS", "GCST", and "GCAS" are reboot variables and not "change-sensitive". Table 1 provides descriptive statistics.

Table 1: *Model 1 denotes Descriptive Statistics*

	"PI"	GCTS	GCST	GIS	GCAS
Mean	9.089674	1.49E+11	9.62E+09	7.26E+08	1.12E+11
Median	9.397510	1.18E+11	8.76E+09	8.42E+08	1.05E+11
Maximum	13.50028	7.14E+11	2.37E+10	1.24E+09	2.27E+11
Minimum	3.935525	-9.42E+09	2.52E+09	76070000	3.57E+10
Std. Dev.	2.358682	1.32E+11	5.93E+09	3.51E+08	5.67E+10
Skewness	-0.187875	2.288226	0.807796	-0.514938	0.422685
Kurtosis	2.556175	9.682171	2.659911	2.101347	2.007301

Jarque-Bera	0.619977	120.2581	4.997300	3.425074	3.116853
Probability	0.733456	0.000000	0.082196	0.180408	0.210467
Sum	399.9457	6.54E+12	4.23E+11	3.19E+10	4.92E+12
Sum Sq. Dev.	239.2254	7.47E+23	1.51E+21	5.29E+18	1.38E+23
Observations	44	44	44	44	44

The predicted sign of the variables is provided in Table 2, which indicates Real GDP per capita growth rate is the dependent variable.

Table 2: *Expected Signs of Variables*

S.No.	Variables	Symbols	Description	Expected Sign
1	"Government Interest Spending"	GIS	Government Interest Spending (total expenditures in %)	-ve.
2	"Government current transfer spending"	GCTS	Government current transfer spending (total expenditures in %)	"+ve/-ve
2	"Government current spending transfers"	GCST	"Government capital spending" (% of total expenditures)	+ve/-ve.
3	"Government capital spending"	GCAS	"Public investment expenditures" (expenditures share)	+ve.

Additionally, the researchers use the "Augmented Dickey-Fuller" (Dickey and Fuller, 1979) and "Phillips-Perron" (Dickey and Fuller, 1979) tests. Because it has less tight assumptions than ADF test, PP unit root test is used to determine how an equation's error term behaves during testing. The ADF unit root test is also used by the researchers to look at the stationarity properties of the level of variables as well as the initial differences in the variables. The "Augmented Dickey-Fuller" test (Dickey and Fuller, 1979, Dickey and Fuller, 1981) assumes that an AR (p) route is taken in series and adds dependent variables with a lagged difference to the right side of the equation.

$$\Delta Yt = \alpha + \delta t + \gamma Yt - 1 + \beta \sum_{i=1}^{p} \Delta Yt - 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1a)$$

$$\Delta\, Yt \;=\; \alpha \;+\; \gamma Yt \;-\; 1 \;+\; \beta \sum_{i\,=\,1}^{p} \Delta\, Yt \;-\; 1 \ldots\ldots\ldots \quad \ldots\ldots (\;\; 1b\,)$$

In this work, serial correlation is controlled by using a non-parametric unit root test in addition to a parametric test that includes the summation of lag terms. The estimated equation when using the Phillips-Perron test is written as:

"Zt = άo + ά1Zt − 1 + ά2 (t − T/2) + ἐt"

Whereas Zt denotes "corresponding time series", T means the number of observations, ɛt indicates the error term.
The unit root's null hypothesis is H0: ά 1 =1.

Johansen Co-Integration Test
Researchers employed Sren Johansen's Co integration test in the study (1988). To run the Johansen test, it is necessary to first ascertain if the variables under examination are integrated, or I(0) or higher, or stationary. Since they are taken into account, heteroskedasticity and serial correlation may be major factors in the Phillips-Perron test. It is likely that the aforementioned variables are co-integrated if they are found to be I. All variables are independent, thus after running the ADF and PP tests to see if there is or isn't a long-term connection between them, one needs to perform the Johansen (1988) Co Integration test. Then, to examine both immediate and long-term relationships, the "Vector Error Correlation Model" (VECM) is built up.

Vector Autoregressive System
To determine how public investment affects private investment, the vector autoregressive method is used. The VAR methodology has primarily been applied to policy shocks like monetary and fiscal shocks. To scientifically examine the "crowding-in" and "crowding-out" phenomena in the domestic situation, this work uses the "VAR" system, the variance "decomposition technique", and the "impulse response function".

In this investigation, the following operational VAR model is used:
$Z\,t = \Psi_0\, Yt + \Psi_1\, Zt\text{-}1 + \Psi_p\, Z_{t\text{-}p} + \varepsilon_t$ ……. (2a)
Whereas Z denotes, "vector of endogenous variables", Ψ indicates "vector of autoregressive coefficients", P means "optimal lag length of coefficients", and ut represents "vector of innovations".

The inquirers employed the lags of Endogenous variables. The choice of the proper lag length is made using the "Schawrtz Bayesian Criteria (SBC)" and "Akaike's Information Criteria (AIC)".
The following can be written as the aforementioned model's reduced form:
$Z\,t = \alpha 1\, Zt\text{-}1 + \alpha 2\, Zt\text{-}2 + \alpha p\, Zt\text{-}p + \varepsilon\, t$ ……. (2b)
Where $\alpha = (1\text{-}\Psi)\text{-}1\alpha t$

Data Analysis and Interpretation
In this section, the study's findings and analyses on the effect of public spending and investment on private business in Pakistan from 1972 to 2015 are briefly explained. The effects of the "unit root tests" are shown at the beginning of this section. The analysis of the long-term association between variables is done using the Johnson co-integration methodology, which has a number of advantages over other co-integration methods. The results of these tests are shown in the next section. This study employs the VAR model methodology to examine how public funding affects private investment. The estimation findings of public investment on private investment are presented in this section.

Augmented Dickey-Fuller

The tests used by the researchers were the ADF – "Augmented Dickey–Fuller" (Dickey and Fuller, 1979) tests and the PP – "Phillips – Perron" (Phillips and Perron, 1988) tests. Because it has less tight assumptions than ADF test, PP unit root test is used to determine how an equation's error term behaves during testing. Additionally, the researchers apply the ADF unit root test to examine the initial difference of variables and stationarity characteristics of variables.

Unit Root test

Unit root testing is used to prevent incorrect regression results. The unit root test is employed to find the model's stationarity because the data is a time series. In addition, it is utilized to validate the integration order and establish if the Model 1 variable are stationary at level or first difference. The variables' stationary status is checked using the "Augmented Dickey-Fuller" test. For the technique to work, the data needs to be stationary.

Table 3. *"Augmented Dickey-Fuller Test" (Shlaes and Bradford) and "Phillips Peron Unit Root tests" (PP) results with "Unit Root Test"*

Variables	**ADF**		**PP**	
	Level	1st diff:	Level	**1st diff:**
GCAS	-1.21 (0.57)	-4.24 (0.000)	-0.68 (0.9676)	**-4.22 (0.0090)**
GCST	-0.97 (0.93)	-8.25 (0.000)	-0.66 (0.9697)	**-8.31 (0.0000)**
GCTS	-3.45 (0.50)	-6.38 (0.000)	-3.00 (0.1433)	**-13.35 (0.000)**
GIS	-2.01 (0.57)	-6.79 (0.000)	-1.98 (0.5950)	**-6.85 (0.0000)**
"PI"	**-2.71 (0.24)**	**-7..49 (0.000)**	**-2.71(0.2387)**	**-7.49 (0.0000)**

The probability values for the "Augmented Dickey-Fuller" test are displayed in Table 4. The outcomes show that every variable integrates in the same manner. At the level of significance of 1, "GCTS", GIS, and "PI" are stationary on the first alteration. "GCTS", "GCAS", and are stationary at the first difference with probabilities of 0.00900, 5, and 1, respectively. The consequences of the "Phillips Peron Unit Root Test" are displayed in table 4 to support the persistence of the unit root test.

The results of the ADF and PP Tests are quite similar. Each variable is unquestionably included in the same way (one). We can utilize the Johnson co-integration test based on the outcomes of the PP and ADF tests. This study may make use of the Engle-Granger Co-integration test, Fully Modified Ordinary Least Square (FMOLS), DOLS, and other co-integration techniques. However, this study uses the Johnson co-integration approach to assess the long-term relationship among the variables in Model 1 due to several advantages of the Johnson co-integration test.

Table 4: *Presents the "Ng-Perron Unit Root Test" (Ng-P) findings.*

"Ng-P Test Statistics"				
At level				
	"MZa"	**"MZt"**	**"MSB"**	**MPT**
"GCAS"	-7.6479	-1.7076	0.2232	**12.450**
"GCST"	-3.2950	-0.9678	0.2937	**21.837**
"GCTS"	-15.178	-2.7548	0.1815	**6.0037**
"GIS"	-6.4114	-1.7886	0.2789	**14.212**
""PI""	-9.9762	-2.2317	0.2237	**9.1417**
At 1st difference				
	MZa	MZt	MSB	**MPT**
"GCAS"	-18.134**	-2.9859	0.1646	**5.1774**
"GCST"	-19.455*	-3.0999	0.1593	**4.7988**
"GCTS"	-20.990**	-3.2396	0.1543	**4.3413**
"GIS"	-20.891*	-3.1410	0.1503	**4.9056**
"PI"	**-20.320***	**-3.1874**	**0.1568**	**4.4848**

Notes: *(**) demonstrates consequential at 1% (5%) levels respectively.

The results of the "Ng-Perron unit-toot test" show that the selected variables are integrated in the order in which they occur.

Lag Selection Criteria

The choice of lag is made using the Akaike Information Criteria and the unconstrained "vector autoregressive" (VAR) via the "Schwartz Bayesian Criteria". The most effective and widely applied criteria are the Akaike information criterion (AIC) and Schwarz criterion (SC). For long time spans, AIC is employed, while for short time periods, SC.

Short-run Diagnostic Tests

Table 5. *("PI", GIS, GCST, GCTS, and GCAS") or Endogenous Variables*

Lag	LogL	LR	FPE	AIC	SC	HQ
K=0	-4089.290	NA	3.24e+78	194.966	195.173	195.0421
K=1	-3883.290	353.14160	5.91e+74	186.347	187.588*	186.8023
K=2	-3847.660	52.5887*	3.76e+74*	185.841*	188.117	186.6754*
"ARCH Tests": 0.4830 (0.4860)						
"White hetroscedasticity Test": 5.960 (0.20)						
"Jarque-Bera Tests"= 2.550 (0.0.27)						

The outcomes of the VAR lag duration criteria are shown in Table 5. The outcomes unequivocally show that a lag length of two is ideal. The ideal lag length is chosen using the LR, AIC, SC, and FPE criteria. Short-run diagnostics findings imply that the model does not contain heteroscedasticity. Further evidence that the data is regularly distributed comes from the negligible Jarque-Bera value.

Johanson Co-Integration Test

To assess the long-term correlation of the selected variables employed in this investigation, table 6 illustrates the "Trace Statistics" and "Maximum Eigen Values". The test for co-integration is conducted by examining the long-term associations between the variables and the null hypothesis, which is either that there is no co-integration or that model 1 is the best fit for this study. The Johnson Co-integration results unequivocally show that there is as a minimum as 1 co-integration existent "36.09 > 33.87 at 5% level of significance".

Table 6. *"Vector Error Correction Model"*

Cointegrating Eq:	CointEq1				
""PI"(-1)	1.00000				
GIS(-1)	"-8.03E-09"				
	(3.0E-09)				
	[-2.64814]				
GCTS(-1)	-6.83E-11				
	(8.5E-12)				
	[-8.07404]				
GCST(-1)	-3.49E-10				
	(5.6E-10)				
	[-0.62371]				
GCAS(-1)	1.25E-10				
	(7.1E-11)				
	[1.75243]				
C	-3.640296"				
"Error Correction:	D("PI")	D(GIS)	D(GCTS)	D(GCST)	D(GCAS)
CointEq1"	"0.101737	206295.9	1.39E+10	-16676132	49858691
	(0.02849)	(4014934)	(2.6E+09)	(3.0E+07)	(1.4E+08)
	[3.57048]	[0.05138]	[5.37178]	[-0.55838]	[0.35566]"
"Log-likelihood": -3747.1870					
"Akaike information criterion": 185.960					
"Schwarz criterion": 88.677					

Following the identification of the long-term correlation between the variables in model 1, this part employs the "Vector Error Correction Mechanism" (VECM) econometric procedure to simultaneously calculate the short and long runs causality. GIS's T-Statistics, which are more than 2 and are 2.65 in absolute terms, have a significant impact on private investment "PI". It shows that while GIS will go up by 1, "PI" will go up by 8.031009 units, a very small but helpful change

to "PI". The GCTS "T-Statistics" in categorical form is greater than 2, i.e. 8.07, hence it also significantly influences the "PI".

It implies that when "GCTS" is raised one unit, "PI" will raise 6.831011 units, a very minor but beneficial change to "PI". Because the GCST's "T-Statistics" are less than 2, or 0.62 in absolute terms, "PI" is not much impacted by it, but private investment is. Therefore, "PI" will grow by $3.49\times 10^{10.}$, when GCST increases by 1 unit. GCAS has a nearly considerable impact on "PI" because of its "T-Statistics", which is 1.75 in absolute form and close to two. It implies that when "PI" rises by 1.25×10^{10}.

Impulse response

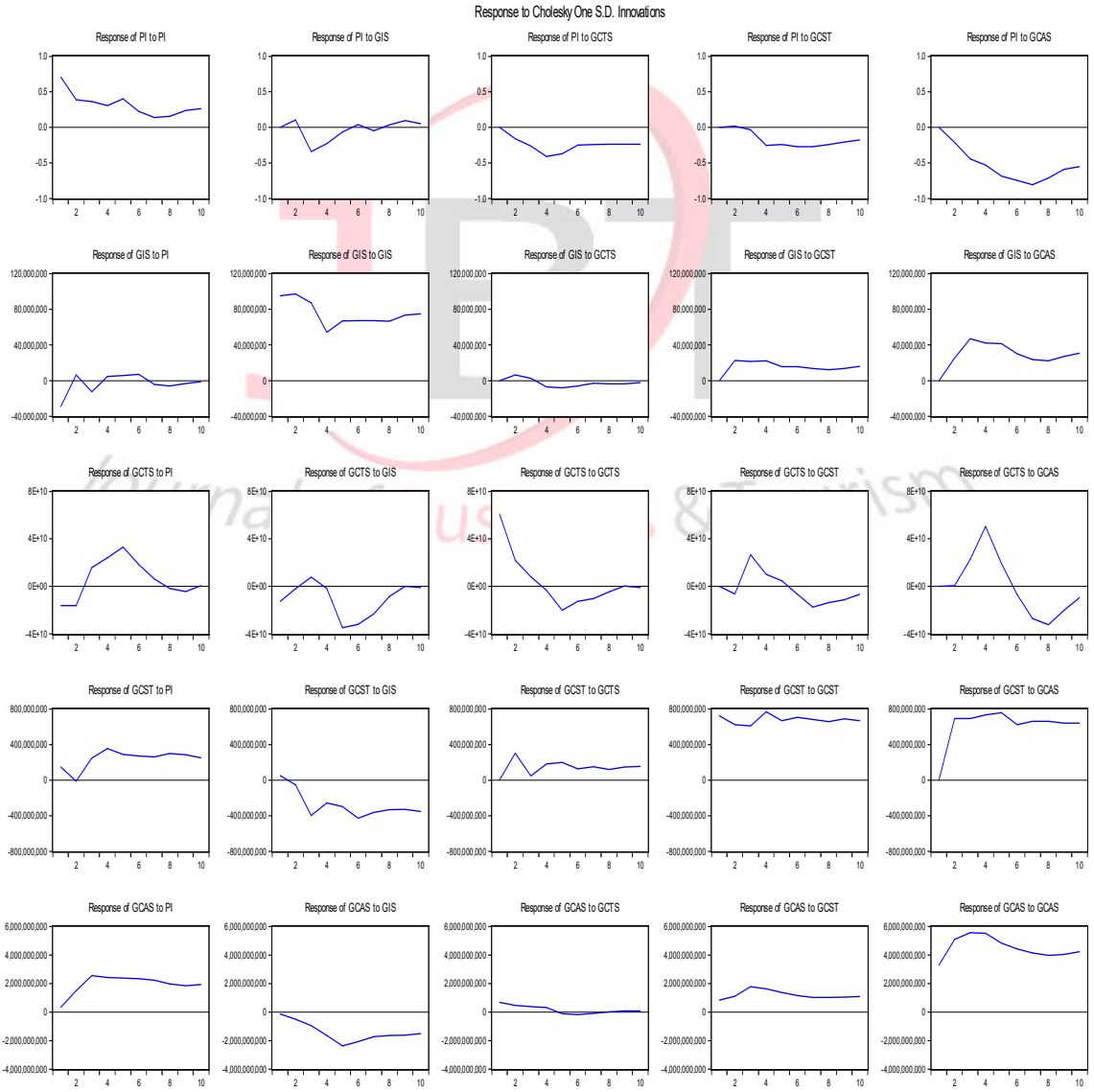


Figure 1: *Response to Choleskey One S.D Ators "Impulse Response Function"*

Figure 2: *Responses to Government Current Spending*

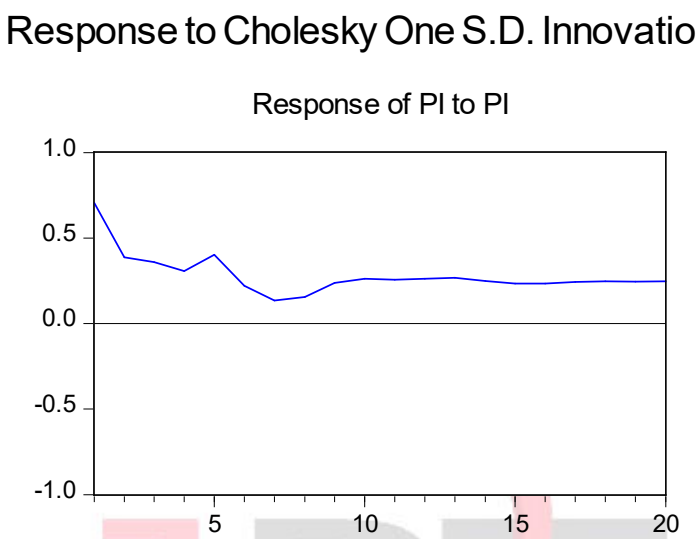


Figure 3: *SD to GIS response of "PI" is positive*

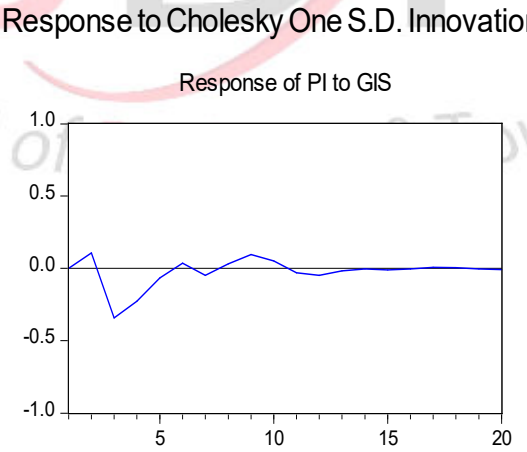


Figure 4: *SD to GCTS response of "PI" is negative*

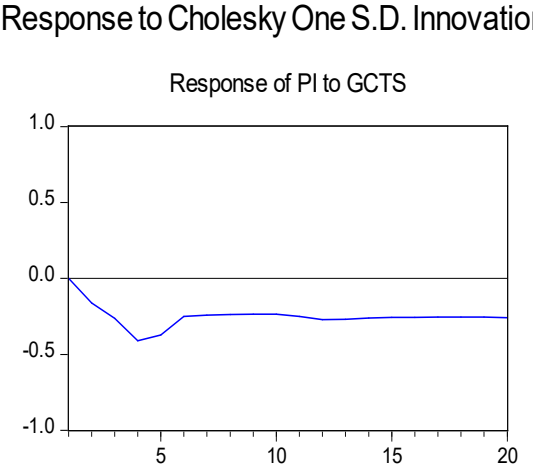


Figure 5: *SD to GCST response of "PI" is positive*

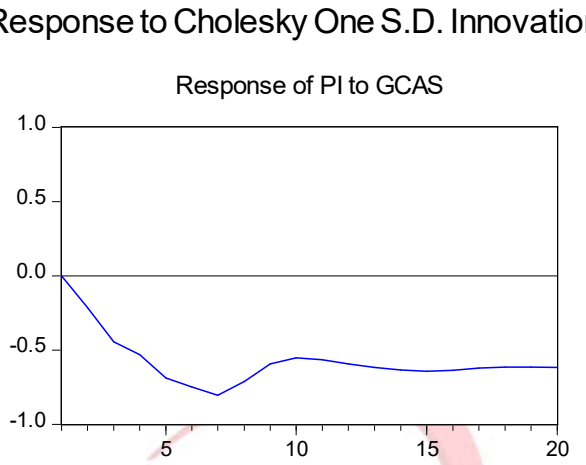


Figure 6: *When "SD" innovation is introduced to "GCAS", "PI"'s reaction is unfavorable.*

Variance Decomposition

The findings of the variance decomposition are presented in this section. The results are shown in Table 7. The table shows that up to the fourth period, "PI" responds to GCAS, after which the impact becomes constant and the variance term lasts for the fifth through tenth periods. Up until the sixth period, when the impact becomes constant and the variance term lasts from the seventh to the tenth, GIS shows the GCAS reaction. The GCST responds to the GCAS up to the fourth period, but from the fifth through the tenth, the impact is constant. The GCTS responds to the GCAS up until the sixth period; however, the impact is constant from the sixth through the tenth period. Up to the sixth period, the GCAS shows a response to the GCAS, but from the seventh through the tenth period, the impact is consistent.

Table 7. *The Outcomes of "Variance Decomposition Technique"*

Variance Decomposition of "PI":						
Period	S.E.	"PI"	GIS	GCST	GCTS	GCAS
1	0.8933	100.000	0.00000	0.00000	0.00000	0.00000
2	1.1040	93.3740	0.32333	0.05938	2.67459	3.56863
	1.2616	90.2395	0.28425	0.04870	6.56887	2.85861
4	1.3378	86.3539	0.26560	0.44662	10.3798	2.55391
5	1.3801	83.8973	0.26994	0.94466	12.4882	2.39987
6	1.3988	82.1739	0.58918	1.72496	13.1457	2.36621
7	1.4144	80.5406	1.52380	2.35199	13.1583	2.42519
8	1.4318	78.8460	2.96384	2.66793	12.9564	2.56566
9	1.4497	77.2372	4.57365	2.72936	12.7087	2.75102
10	1.4683	75.8615	6.04500	2.67311	12.4781	2.94217

Variance Decomposition of GIS:						
Period	S.E.	"PI"	GIS	GCST	GCTS	GCAS
1	88962230	1.30906	98.6909	0.00000	0.00000	0.00000
2	1.310E+08	10.5174	80.1794	5.38509	0.09732	3.82066
3	1.560E+08	11.1458	76.1053	6.30592	0.08895	6.35391
4	1.800E+08	17.4951	66.1508	9.07430	0.64272	6.63697
5	1.980E+08	21.5048	59.1819	11.2548	1.27542	6.78297
6	2.110E+08	24.3315	53.9328	12.9556	1.89132	6.88862
7	2.210E+08	26.2138	50.0995	14.2654	2.37835	7.04287
8	2.280E+08	27.4545	47.3095	15.2390	2.73659	7.26025
9	2.330E+08	28.3213	45.2191	15.9428	3.00411	7.51258
10	2.370E+08	28.9566	43.6312	16.4177	3.21698	7.77738
"Variance Decomposition of GCST":						
Period	S.E.	"PI"	GIS	GCST	GCTS	GCAS
1	7.460E+08	12.2010	2.56842	85.2305	0.00000	0.00000
2	9.840E+08	7.03421	2.04659	60.3068	1.00695	29.6053
3	1.180E+09	12.5055	3.14131	51.9375	1.50960	30.9060
4	1.42E+09	19.7818	7.65059	43.8165	2.44612	26.3048
5	1.61E+09	21.8878	13.3607	37.5611	3.44842	23.7419
6	1.79E+09	22.9552	19.0679	32.0609	4.45759	21.4582
7	1.96E+09	22.8698	24.4754	27.5702	5.25251	19.8320
8	2.11E+09	22.3100	29.1865	23.9800	5.86336	18.6599
9	2.24E+09	21.6081	33.0820	21.1670	6.33656	17.8062
10	2.37E+09	20.9343	36.1526	18.9988	6.73015	17.1840
Variance Decomposition of GCTS:						
Period	S.E.	"PI"	GIS	GCST	GCTS	GCAS
1	7.73E+10	5.80435	0.62159	6.38172	87.1923	0.00000
2	9.19E+10	6.74624	3.35157	6.51546	81.9782	1.40843
3	9.89E+10	18.6430	2.96096	6.03377	71.1441	1.21807
4	1.06E+11	25.1522	4.56253	5.25406	63.9569	1.07419
5	1.14E+11	28.0951	7.16173	4.55138	59.1110	1.08067
6	1.18E+11	27.4560	9.23812	4.66464	57.5027	1.13840
7	1.20E+11	26.6806	10.1317	5.48834	56.5528	1.14644
8	1.21E+11	26.3425	10.2594	6.58070	55.6897	1.12748
9	1.21E+11	26.1796	10.1500	7.54921	54.9972	1.12392
10	1.22E+11	26.0123	10.0802	8.22642	54.5337	1.14733
Variance Decomposition of GCAS:						
Period	S.E.	"PI"	GIS	GCST	GCTS	GCAS
1	2.80E+09	1.33056	0.03600	0.99880	0.41684	97.2177
2	4.66E+09	14.3241	0.88167	0.59545	2.78060	81.4181
3	6.67E+09	32.8090	3.23851	1.84614	6.92438	55.1819
4	8.40E+09	39.1388	6.22919	2.01102	9.51942	43.1014
5	9.94E+09	41.4759	8.92570	1.78689	11.4658	36.3455
6	1.13E+10	42.1076	11.2960	1.48629	12.8377	32.2722

7	1.25E+10	41.9097	13.2999	1.22165	13.7851	29.7834
8	1.36E+10	41.4298	14.9156	1.03936	14.4418	28.1731
9	1.46E+10	40.8992	16.1715	0.94075	14.9132	27.0752
10	1.56E+10	40.4258	17.1085	0.90995	15.2776	26.2780

Conclusions

Private and public investments make up the two wheels of moving vehicles in Pakistan. Despite the fact that governmental investment is almost usually more significant, private investment is essential for economic progress and employment creation. The primary aim of this inquiry is to analyze the "crowding-out" and "crowding-in" effects of "public investment" on "private investment" in Pakistan's economy. In terms of crowding out and crowding in, researchers also examined whether government investment had any direct or indirect effects on private investment. The short (long) terms contributions of public and private investment to Pakistan's economic development are also established. We made use of secondary time-series information from 1972 to 2015. The variables' stationary state and stationarity were examined using the Augmented Dickey-Fuller test. The results of the analysis show that the selected variables are non-stationary at this level. At the 5% level of significance, the null hypothesis and the non-stationary hypothesis were both accepted. The analysis of causation in both the short and long runs uses the VECM.

The results of this study show that government interest spending considerably increases private investment. Current transfer spending by the government has a considerable impact on private investments (excluding interest). This reveals that it also has an affirmative impact on "private investment". Government capital expenditures have a considerable impact on private investment. The null hypothesis states that "government spending" does not displace private investment. Because of the oversaturation of private investment, researchers reject the null hypothesis. Government spending, according to the null hypothesis, does not discourage private investment. They thus agreed with this null hypothesis.

These outcomes demonstrate that over the long run, private investment has a favorable impact on private investment. This will go on for a long time. Spending on government interest rates has a good effect as well, and this stability will last for a very long time. Private investment is currently negatively impacted by the government's transfer spending (excluding interest) and will remain so in the years to come. Current government expenditure transfers of private investment have negative long-term implications. For at least 20 years, government capital spending has a negative impact on private investment. Government capital spending will continue to have a detrimental effect on private investment for at least another 20 years.

Recommendations

Before imposing any interest policy on private investment, the Pakistani government should take into account the investment conditions. They ought to make an effort to balance their income and expenses. Large loans from regional financial markets should be avoided since they deter private investors. Spending more money on development projects will result in beautiful future earnings. More employment opportunities will be available to the general people if local and international

investors are encouraged to offer loans with low-interest rates. a practical setting with strong law and order for private investors.

Future Directions

In the sense that it can be used for future research, this study offers useful information for other researchers. Longer time series data and more sophisticated empirical and analytical methods can be used. To compare nations and their investment climates, researchers can utilize various time periods for various countries.

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