TITLE OF DISSERTATION: THE MACROECONOMIC DETERMINANTS OF PAKISTAN'S LONG RUN GROWTH

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DOCTOR OF PHILOSOPHY

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THE MACROECONOMIC DETERMINANTS OF PAKISTAN'S LONG RUN GROWTH

by

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Submitted to the Department of Economics
On August, 2022 in Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy in Economics

Abstract

This thesis aims to establish the determinants of Pakistan's long run GDP growth. Essays One, Two, and Three have focused on explaining the long run growth of output through its structural determinants in a General Equilibrium analysis.

Essay One observed a highly significant 2 percent drop in Pakistan's output growth between two time periods, pre 1992, and post 1992. Next we proceeded to establish which of the explanatory macro aggregates follows this pattern of high GDP growth in the pre 1992 period, and low GDP growth in the post 1992 period. Only the investment growth variable consistently explains GDP growth across the two time periods, pre 1992 and post 1992.

Using a nuanced Keynesian multiplier, shows that the pre 1992 period was more investment led, while the post 1992 period was more consumption led.

Essay two has focused on explaining the observed drop in Pakistan investment growth between the two time periods, pre 1992 and post 1992. It has done this by examining the impact on investment, of the macro aggregate determinants of investment.

The empirical results for the demand side determinants, public investment, and private investment, suggest that, the better explanatory variable, coinciding with the downward trend in investment growth post 1992 is public investment growth.

Therefore, in essay three of our thesis, we have attempted to explain the behavior of public investment over time in two parts. The first part, looks at a disaggregated analysis of public investment, in terms of its sub sectors. And the second part look at the impact of the regulatory policy environment on the observed drop in public investment post 1992.

Our results suggested that post 1992, the declining trend in the share of public investment is well explained by the declining trend in the share of public investment in the productive sectors.

We then explain the drop in public investment as a function of the regulatory policy environment. On average, there has been a significant drop in the observed fiscal deficits of Pakistan post 1992. This drop in observed fiscal deficits has resulted in a drop in government expenditures post 1992. Rather than an increase in tax revenues.

Moreover, the observed fiscal deficits seem to be driven by targeted fiscal deficits under the International Monetary Fund programs. Therefore, we suggest that as the regulatory policy environment became more austere, it added pressure to the observed fiscal deficit. And the government which did not have the capacity to increase its revenue base curtailed the fiscal deficit through government expenditure. Particularly, compressing development expenditures.

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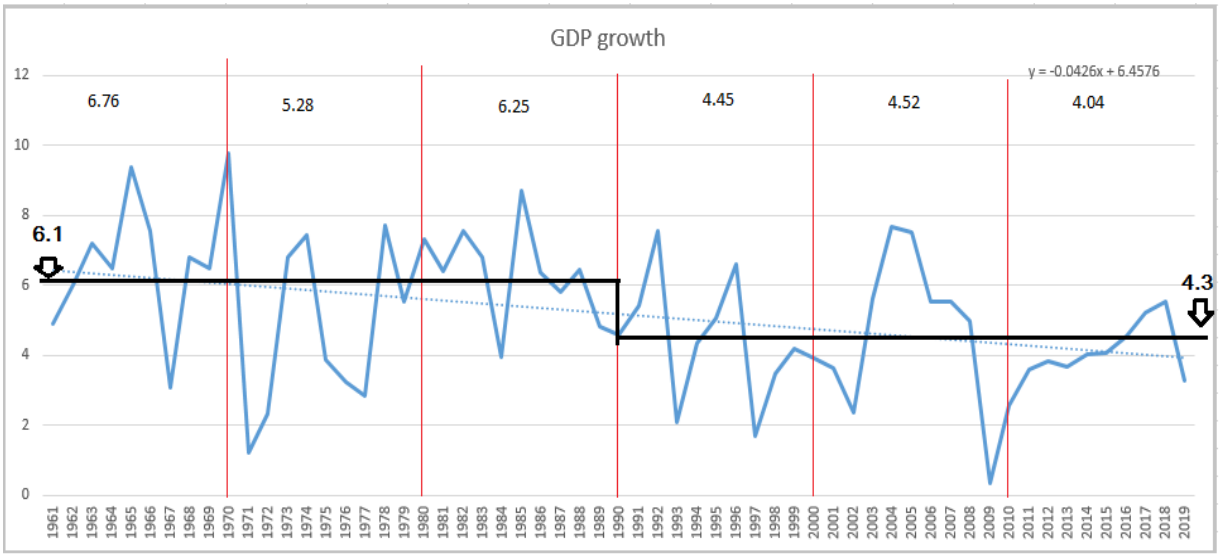
1. Introduction

Pakistan's growth has lowered on trend in the past three decades. The earlier decades of the 60s, 70s, and 80s saw trend GDP growth of over 6% per annum as Figure 1 shows. But from about 1990 onwards trend growth is observed to have lowered significantly to just above 4% per annum. This trend for Pakistan also runs contra the comparative trend in other developing countries, whose GDP growth rates have largely improved over time.

In addition to the concern of long run trend growth, Pakistan has been subject to shorter run shocks, with budgetary deficits creeping up to unsustainable levels, also fueling inflation. And equally unsustainable Current Account (CA) deficits, too have to be paid for by running down already scant reserves, and borrowing abroad, mounting up external debt. These imbalances on the budgetary and CA sides have required repeated recourse to the IMF Standby (SBA) and Extended Fund Facility (EFF) loans. The current BOP crisis brings a sharp and imperative need to understand the determinants of shorter run fluctuations in GDP.

Figure 1 shows that these short run fluctuations may well be increasing in frequency, intensity, and duration. If so, this cyclicality in short run GDP growth, may well be interacting with the longer run trend in GDP growth, dragging it down.

Figure 1: GDP Growth



So there is a paramount need for an examination of the macro determinants of Pakistan's GDP growth in the longer run, over both the highs and lows, to see what has worked to raise it earlier, and lower it more recently. And there is a need to examine the determinants of short run cyclicality in GDP growth, which make its budget and CA balances prone to crises and bailouts.

But the frequency of Pakistan's recourse to IMF bailouts, 23 and counting, has pushed the recent debate entirely to an examination of shorter run cyclicality in GDP. Putting on the back burner, the earlier debate about longer run structural determinants of GDP growth.

But we are arguing here is, that each concern has its imperative, explaining short run cyclicality and longer run structural determinants of GDP growth. But the short run cyclicality determinant has received considerable attention in research. While the structural determinant has not been examined of late.

That then is the objective of this thesis. To examine the long run structural determinants of Pakistan's GDP growth.

Essay One will focus on explaining long run growth of output through its structural determinants in a General Equilibrium analysis.

Essay Two will focus in turn on explaining the growth of structural determinants that explained the long run growth of output in Essay One

Essay Three will drill down for greater granularity in examining the regulatory policy environment which has shaped these structural determinants of long run output.

Essay One: Explaining the drop in Pakistan's long run GDP growth over time, by assessing the impact of the macro aggregate determinants of output growth.

Essay One will focus on explaining the observed drop in Pakistan output growth between two time periods, pre 1990, and post 1990. It will do this by examining the impact on output, of the macro aggregate determinants of output growth.

The theoretical framework chosen has been the Keynesian general equilibrium framework of estimating and analyzing aggregate demand. The alternative framework in the international and Pakistani literature is seen to be the decomposition of output through Swan Solow production functions. We have chosen the Keynesian decomposition of output into the macro aggregate components of aggregate demand, consumption, investment, government expenditures, exports, and imports. For two reasons.

One, the production function uses a more limited number of determinants of output, using only capital, labor, and productivity. Since the growth of the labor force is a very slow moving

and less policy amenable variable in the short to medium term, this puts all the determinant eggs into one basket, capital. Productivity itself we consider to be an outcome variable to be explained, merely being output indexed by labor. So it does not seem correct to pre judge the analysis by choosing just one determinant, capital, no matter how logically appealing. Compared to this, the Keynesian determinants, offer a larger choice, spread over several more markets than just the capital market. It additionally offers most importantly the goods market, the external tradeables market, and the public goods market.

The neoclassical production function of the Harrod Domar kind also has a theoretical shortcoming in not explaining the capital output ratio well. This is overcome in the Keynesian aggregate demand model by positing the Kahn Keynes multiplier based on consumption. Allowing us to posit a theoretical model of two major determinants of Pakistan's long run GDP growth, investment and consumption. Further, since higher consumption reduces savings, and therefore potentially domestic investment, the two determinants are posited as tradeoffs. So GDP growth can be investment led. Or consumption led.

Our theoretical framework adopted gives three sets of hypotheses to explain Pakistan's GDP growth in the long run. Data considerations, of consistency and comparability, have made us choose our period of analysis to be 1973 to 2017.

The analytical strategy we have used is to establish first whether there has been a discrete drop in GDP growth at a particular break date. Establishing this break data allows us to define two periods of GDP growth, a higher growth period, followed by a lower growth period. The determinants of GDP growth can then be established, by looking for such correlated changes in their behavior between the two time periods.

Hypothesis 1: There has been a discrete reduction in GDP growth over the time period 1973-2017.

Hypothesis 2a: There has been a significant drop in investment growth over the time period 1973-2017.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

Hypothesis 3: Growth in output will be better explained episodically, some cycles being more investment led, others more consumption led, and still others following more balanced growth paths.

Hypothesis 3a: High GDP growth in phase one, will not be equally explained by high investment growth and high consumption growth. If high GDP growth in phase one is explained well by high investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth, in this phase will be low.

Hypothesis 3b: Low GDP growth in phase two, will then equally not be explained by both low investment growth and low consumption growth. If low GDP growth in phase two is explained by low investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth in this phase will be high.

Essay 1 establishes investment growth as the main driver of GDP growth.

We, therefore, explain in Essay Two the determinant of investment in turn.

Essay Two: What are the determinants of the main driver of growth in Pakistan, investment?

Having established in our first essay, a known break date at year 92 in our series for investment growth gives us two time periods, pre 1992 with on average high investment growth, and post 1992 with significantly lowered investment growth.

In essay two we provide a theoretical and empirical framework to explain the discrete drop in investment and its determinants over the long run period 1973-2019. This is examined by observing the behavior of supply side determinants of investment, and demand side determinants of investment.

The supply side determinants of investment are savings and capital inflows.

Based on our theoretical model of supply side determinants and the literature examining the relationship between savings, capital inflows, and investment, points to two possibilities;

I. Savings and inflows are complements for developing countries, like Pakistan.
II. The Griffin and Enos Model raises the alternative possibility that inflows may actually reduce savings.

Similarly, the demand side determinants of investment, public investment and private investment, are posited by two alternative economic models.

III. A Ricardian Model posits that public investment will crowd out private investment and therefore, weaken aggregate investment.
IV. Alternatively, a Keynesian model posits that public investment can actually crowd in private investment and therefore raise aggregate investment.

The essay establishes the empirical methodology to test the above possibilities. And explains the behavior of investment and its determinants through a series of hypotheses and econometric tests, including structural break analysis, trend analysis and regression analysis. Data considerations, of consistency and comparability, make us choose our period of analysis to be 1973 to 2019, as in Essay One.

The public investment comes out to be a key demand side determinant explaining aggregate investment growth in Pakistan. Therefore, in essay three of our thesis, we attempt to explain the behavior of public investment over time in terms of its sub sectors and in terms of the regulatory policy environment.

Essay Three: Explaining the behavior of Public investment in Pakistan from 1973-2019

Our concern in essay three is to empirically analyze the behavior of public investment in Pakistan over the years 1973-2019. Essentially, our research objective in essay three is, to determine the factors that explain the observed declining trend in the share of public investment over time. And, specifically to explain the drop in the growth of public investment variable post 1992. The essay seeks to achieve these objectives in two parts. In the first part, we carry out a disaggregated analysis of the components of the public investment variable. Where the public investment is analyzed as a function of its subsectors. In the second part, we examine the impact of the regulatory policy environment governing the behavior of public investment in Pakistan. Introducing the impact of the regulatory policy environment in our essay is critical to our study. The regulatory impact will be estimated using a key policy variable, the targeted fiscal deficit agreed under the international monetary fund (IMF) program. This long run series for the targeted fiscal deficits has been compiled for the first time, to our knowledge. The data for the

targeted deficits has been taken from the documents and texts of lending arrangements between Pakistan and the IMF since 1973.

There has been and continues to be, a rigorous debate in the literature concerning whether and how public investment is affected under the regulations of governing institutions. In our case, for the economy of Pakistan, where we face limited budgetary resources and competing spending needs, the involvement of the IMF has been increasing since 1973. By increasing involvement we mean not only the amount of funds that Pakistan has borrowed increased over time but also the conditions on which Pakistan has been given the loan amount have become more stringent over time.

Numerous studies in this regard have presented stylized facts on how IMF programs have affected growth in Pakistan and other economies. Some of these studies focus on IMF programs and imposed conditionalities and targets on the fiscal and current accounts of countries. And how far the conditionalities have proven successful or detrimental for these economies. The most common target that indebted economies have to meet on the fiscal account is to curtail the fiscal deficit. This, in turn, is expected to be achieved either using a tax increase or an expenditure cut, or a mix of the two. Of which, the expenditure cut has been seen to be the preferred option adopted in most cases. And of these expenditure cuts under the IMF programs that governments end up cutting are mainly observed to be public investment and development expenditures rather than compressing current expenditures to curtail fiscal balance.

We, introduce a key policy variable on the fiscal side, which is "the agreed target of the fiscal deficit under IMF Program from 1973-2019" to estimate the effect of a key policy variable on public investment expenditures. However, the effect of the targeted fiscal deficit on public investment will not be direct. It will work through an indirect effect of the observed fiscal deficit.

The targeted fiscal deficit under the fund program will affect the determination of the observed fiscal deficit. Which will then have an effect on the public investment expenditures. Theoretically, a stringent targeted fiscal deficit will lower the observed fiscal deficit. In turn, leading to a cut in public investment expenditures.

Therefore this Essay Three seeks to explain the behavior of public investment in two parts. Part one carries out a disaggregated analysis of the public investment. And part two examines the regulatory policy environment shaping the behavior of public investment. The empirical methodology is based on a series of econometric tests, including structural break analysis, trend analysis, and regression analysis.

2. Essay One: Explaining the drop in Pakistan's long run GDP growth over time, by assessing the impact of the macro aggregate determinants of output growth.

2.1 Statement of the problem

Pakistan's growth has lowered on trend in the past three decades. The earlier decades of the 60s, 70s, and 80s saw trend GDP growth of over 6% per annum as Figure 1.1 shows. But from about 1990 onwards trend growth is observed to have lowered significantly to just above 4% per annum. This trend for Pakistan also runs contra the comparative trends in other developing countries, whose GDP growth rates have largely improved over time.

In addition to the concern of long run trend growth, Pakistan has been subject to shorter run shocks, with budgetary deficits creeping up to unsustainable levels, also fueling inflation. And equally unsustainable Current Account (CA) deficits, too have to be paid for by running down already scant reserves, and borrowing abroad, mounting up external debt. These imbalances on the budgetary and CA sides have required repeated recourse to the IMF Standby (SBA) and Extended Fund Facility (EFF) loans. The current BOP crisis brings a sharp and imperative need to understand the determinants of shorter run fluctuations in GDP.

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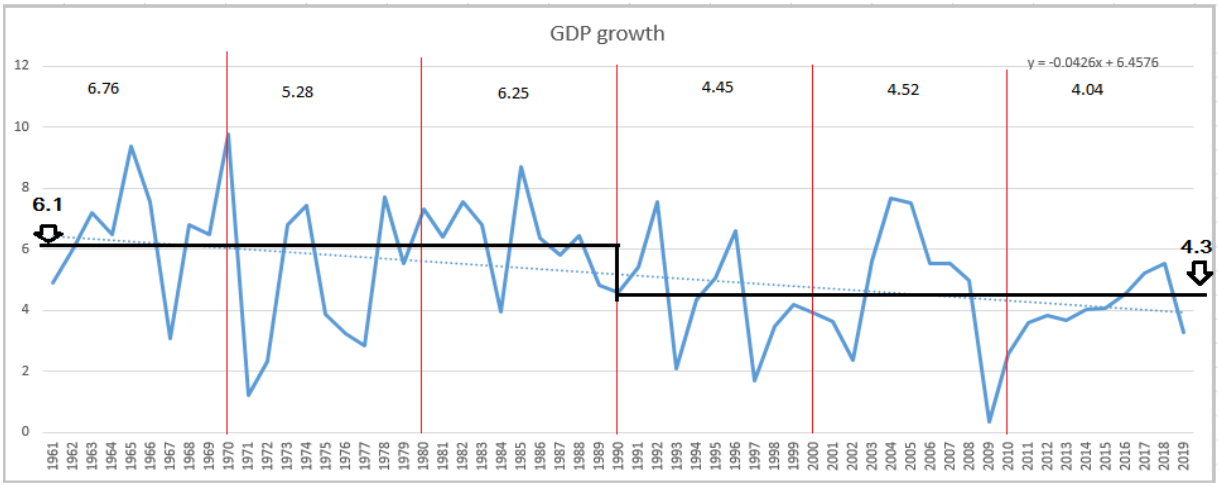

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Indeed the frequency of Pakistan's recourse to IMF bailouts, 23 and counting, has pushed the recent debate entirely to an examination of shorter run cyclicality in GDP. Putting on the back burner, the earlier debate about longer run structural determinants of GDP growth.

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2.2 Review of international literature and literature on Pakistan on the macro determinants of growth of output

The literature encompasses two broadly competing models seeking to explain output growth at a macro level, a structural model and a cyclical model. A structural model intends to explain long run growth of output in terms of macro variables that are considered to be slow movers over time, relatively less policy amenable in the short run, and therefore determinants of long run output and growth. A cyclical model explains output growth in terms of variables that are more responsive to policy changes in the shorter run. The international literature considers the budget balance whereas the literature on Pakistan considers both the budget balance and the current account balance as policy variables explaining cyclicality in GDP growth.

This Essay One focuses on establishing the structural determinants of Pakistan's long run GDP growth. But there is a theoretical need here to examine the literature on both sets of determinants, structural and cyclical, to be able to distinguish between them

Structural Literature

International Structural Literature

The structural literature takes two distinct approaches to explain the long run pattern of output growth over time. Each approach uses a different set of structural variables. One approach is based on the supply side growth accounting methodology, a production function approach, which uses the growth of input availability and total factor productivity growth to explain long run output growth. Another approach is based on the Keynesian decomposition of demand into macro aggregates.

The production function approach is represented very well by Antolin_Diaz et al., 2017 which track the slowdown of GDP growth in the US and other advanced economies. The functional form adopted explains output growth as positive functions of growth in labor productivity and growth in employment. The paper shows that the decline in the growth rate of labor productivity entirely accounts for the slowdown in GDP growth.

There are two ways to explain output growth. One is a production function approach. The other is a decomposition of aggregate demand into its macro aggregates. For the purpose of our study, the production function approach appears less comprehensive than the Keynesian approach of decomposing demand into macro aggregates. This is because the production function approach uses a very broad variable of productivity. But we feel that productivity itself is a variable to be determined by other macro aggregates. Therefore, we have a preference for choosing the more comprehensive Keynesian approach of decomposing demand into macro aggregates.

The Keynesian approach of decomposing demand into macro aggregates can be summed up by a series of articles.

Oreiro et al., 2011 identify the macroeconomic constraint to output growth of the Brazilian economy. The empirical paper represents output growth as a positive function of the growth of investment, exports, and government consumption. And a negative function of exchange rate misalignment. The paper finds exchange rate misalignment to be the major constraint on the sustainability of long run output growth. A key missing variable is a private consumption.

The paper estimates the natural rate of growth using Okun's Law and Thirlwall's equation. The empirical technique to estimate growth regressions are based on ordinary least squares and an instrumental variable approach.

Oreiro et al., 2012 estimate the demand led growth model for the Brazilian economy based on a Keynesian framework. The functional form adopted explains real GDP growth as a function of exports, investment, government consumption, and money supply. All the variables are significant. 85% of real GDP growth is explained by export growth and government consumption growth. Due to prevalent financial crises, the paper further suggests discontinuation of the government led growth model and adoption of the export led growth model. Key missing variables from the analysis are the budget balance and the current account balance.

The paper uses all the variables in log-level form, integrated to the first order. The empirical technique to estimate a demand led growth model is based on an autoregressive distributive lagged model.

Prasad, 2011 attempts to compare the growth paths across developing countries in Asia. The functional form adopted makes real GDP, and GDP growth, of selected Asian countries, a function of government consumption, private consumption, investment, the current account

balance and growth in employment. The paper finds that China has been following an investment led growth path. Employment growth has been faster in India and Vietnam. The paper misses a key variable which is a cyclicality determinant of budget balance.

Denizer et al., 1990, formulate a model that identifies the major macroeconomic constraints to maintain sustainable growth for the Chilean economy. The model is parameterized using the macro aggregates under three different constraints. These are savings, a fiscal, and foreign exchange constraints. A reduced form takes output growth as a function of the real exchange rate, capacity utilization, and growth in potential GDP. Each variable affects growth in GDP under different constraints. A key variable missing is consumption in the parameterized functional form.

Clementi et al., 2015 and Freitas et al., 2013 give the most comprehensive set of determinants to explain output growth. Both the papers represent output growth as a function of consumption, investment, government expenditures, exports and imports. In the case of Brazil, Freitas et al., 2013 show government expenditures to be the major driver of economic growth, contributing almost 2 percentage points to GDP. This characterizes the economy as being 'government demand-led'. For the Italian economy, Clementi et al., 2015 show long run output growth to be driven mainly by two drivers. These are growth of consumption, which contributes around 61%, and growth of investment, which contributes around 27.7% to output growth.

The paper analyses the long run dynamics of Italian economic growth by identifying structural breaks in GDP growth rate using Bai and Perron's (1998,2003) methodology. Based upon a standard growth contributory framework, the paper specifies the share of various supply and demand components of economic growth. The demand components included in the paper are consumption, investment, government, exports, and imports. The supply side components are the

share of factor productivity in agriculture, manufacturing, and the services sector. The paper also presents an analysis of the cyclical component of Italian GDP using both the classical and modern definitions of the business cycle.

Freitas et al., 2013 use a similar standard growth contributory framework for the Brazilian economy. However, the author adds disaggregated shares of each demand component in the growth model.

The most comprehensive analysis of output growth using both structural and cyclical variables in structural literature is given by Freitas et al., 2013 and Clementi et al., 2015. However, both are missing a key cyclical determinant which is a budget balance.

The Development and Structural Literature on Pakistan

The development literature on Pakistan precedes and has been wider ranging than the structural literature on Pakistan. As such, the development literature raises the right questions about growth and development in the country. But lacks somewhat the conceptual focus to investigate the causal determinants of growth and development. The later structural literature has a more general equilibrium conceptual framework. Although we find that even this structural literature is missing key variables to explain the growth in Pakistan. So we proceed to set up a more comprehensive general equilibrium framework to explain the growth in Pakistan.

We begin by first summarily examining the development literature, and then the structural literature, to ascertain what variables have been used to explain the growth in Pakistan, to identify gaps, in order to be able to build our own conceptual framework which can help fill in some of these gaps.

The Development Literature on Pakistan

The development literature on Pakistan is very broad ranging, which may well be apt to encompass development objectives, but lacks the macro framework of general equilibrium, to establish the determinants of growth of output.

The development literature oscillates between the policy objectives of growth, distribution, and human development, and the tradeoffs between them. The pursuit of one objective by a policy regime has meant the neglect of others. Followed by a dialectical reaction in pursuit of another objective by a successive policy regime. Therefore, the development debate has been caught up in this dialectic between policy objectives rather than a more detailed examination of the determinants of growth.

Hussain's (2009) characterization of Pakistan's economic policy regimes, can be used here to illustrate this dialectic between policy objectives.

The Golden Sixties, from 1958 to 1969, under General Ayub, pursued growth of GDP, because allegedly there was no point in redistributing the abiding mass of poverty. So the growth of output had to precede redistribution. In fact, an argument was made to foster functional inequality, directing more income towards the upper income deciles, whose higher savings rate compared to lower income deciles, was needed to increase investment and output growth.

If there was a macro model for this policy regime, it was a two gap model, identifying a larger savings gap in the goods market, and a smaller foreign exchange gap in the tradeables market. Both needed to enhance investment, (Chenery & Strout 1968; McKinnon 1964).

GDP growth in this decade jumped to an average annual rate of 6 percent from 3 percent in the 1950s. The manufacturing sector expanded by 9 percent. Agriculture grew at 4 percent with the introduction of Green Revolution technology. Governance improved with a major expansion in

the government's capacity for policy analysis, design and implementation, as well as the far-reaching process of institution building. By 1969, Pakistan's manufacturing growth rate even went higher than Thailand, Malaysia, and Indonesia. However, the economic policies that were meant to create development through a 'trickledown effect', led to increasing disparity in incomes across regions and provinces, creation and concentration of economic and monopoly powers in few hands, failure of real wages to increase for the low income class, and substantial increase in the personal inequalities (Ahmed & Amjad, 1984; Hussain, 2009; Zaidi, 2005; Amjad & Mahmood, 1982; Amjad, 2014). Hence, despite the great achievement on the economic side, Mahbub ul Haq, the chief economist of the Planning Commission raised serious concern about the growing social inequality in 1973.

Overwhelming policy reaction to the mono pursuit of the objective of growth of output, and neglect of distribution and poverty, led to the Socialist Seventies as characterized by Hussain (2009), from 1971 to 1977. Bhutto's populist policies of nationalizing industries, banks, insurance companies, and land reforms in agriculture, redistributed income significantly but lowered GDP growth. The East Asian countries that were lagging behind Pakistan in growth in the late 1960s not only overtook it but also became poster Asian tigers. The oil price shock of the 1970s as well as droughts, floods, and the withdrawal of external assistance did not help the situation, either. GDP growth rate in the 1970s fell to 3.7 percent per annum from 6 percent in the 1960s.

Right wing reaction to the policy objective of redistribution, and slumping of growth, led in turn to the policy regime characterized by Hussain (2009) as the Revivalist Eighties, led by General Zia ul Haq, from 1977 to 1988. Redistribution policies ended. Religious fundamentalism allied

Pakistan with the US led war against Soviet Afghanistan, with huge and far reaching economic and social blowback.

GDP grew at 6.6 percent annually, with agriculture at 4 percent and the manufacturing sector at 9 percent. Fiscal deficits, however, widened to 8 percent of GDP despite a decline in development expenditure. Domestic borrowing to finance these deficits did not weaken growth immediately but had serious repercussions for public finances and macroeconomic stability in the 1990s. As a consequence, Pakistan had to approach the International Monetary Fund (IMF) for assistance in 1988.

The policy regime succeeding the revivalist 80s has been characterized by Hussain (2009) as the Muddling Nineties, from 1988 to 1999. Because nine different governments (four interim-appointed, four elected, and one following the military coup of October 1999) ruled Pakistan in this period. However, we would like to characterize this policy regime from a more economic point of view, as the Liberalizing Nineties.

The persistence of fiscal deficits above 7 percent of GDP, and external deficits of 4 to 5 percent of GDP. This led to the accumulation of large levels of domestic and external debt throughout the decade. Total external debt levels became unsustainable, rising from $20 billion in 1990 to $43 billion (47.6 percent of GDP) in 1998. Which implied repeated recourse to the IMF for assistance in meeting external payments (See Essay Three Figure 3.5). This assistance came with the conditionality of liberalization of the economic regulatory environment. But whose outcomes became difficult to sustain, sometimes having to be reversed temporarily.

The most far-reaching liberalization reforms were introduced in 1991, with the opening up of the capital account (Khan, 2009; Zaidi, 2015). Domestic Foreign Currency Deposits were allowed.

But then become unsustainable and had to be frozen. Leading to a huge loss in domestic investor confidence. Tariff liberalization was led by a reduction in import tariffs. Which led to a surge in imports, against weak exports. Not improving the already weak Current Account (Amjad, 2014). There was significant privatization of State Owned Enterprises and opening up of newer sectors like energy to the private sector. But these agreements had to be revised, again weakening investor confidence, especially for foreign investors.

Political instability, coupled with this policy regime to reduce GDP growth to 4 percent. While the agriculture sector recorded higher output, growth of the manufacturing sector was low. The investment ratio fell to 13.9 percent between 1998 and 1999 as foreign savings, which formerly bridged the gap between national savings and investment, dried up in May 1998. Development expenditures took a major hit and GDP dropped to 3 percent from 8 percent in the first half of the 1980s. Social sector expenditures were squeezed to accommodate higher debt service and defense expenditures. The incidence of poverty nearly doubled from 18 to 34 percent, and the unemployment rate rose as well. Social indicators lagged behind other countries in the region. The Human Development Index of the United Nations Development Programme ranked Pakistan in one of its lowest development categories.

Hussain (2009) characterizes the succeeding policy regime from 1999 to 2018, as the Reforming Hundreds. We would like to qualify this as the Social Reforming Hundreds. Reaction to the rising poverty and weak social indicators have led to the prioritization of social policy over this last policy regime.

The political regimes themselves have been mixed over this last period. With General Musharraf's regime from 1999 to 2007, and then civilian regimes from 2008 to 2019. The growth of GDP has been more volatile over this period. Beginning very low 1999 to 2001 at 3%

per annum, peaking at 7% for 2002 to 2007, then lowered by the global financial crisis from 2008-13 down to 2.5%. With some recovery 2014-19, to 4%.

While the prioritization of social policies and welfare programs has resulted in a major reduction in the poverty headcount from 31% in 2000 to 4% by 2018 (Mahmood & Tanvir, 2018). A remarkable social outcome, unparalleled in the region.

But macroeconomic instability in the fundamentals of the economy has continued to dog this period, especially from the onset of the global financial crisis in 2008, (Amjad, Din, & Qayyum, 2011; Haque, 2011; Hussain, 2009). Current Account deficits have mounted. The exchange rate has depreciated as a consequence. And budget deficits have mounted in turn. Leading to an increasing recourse to the IMF's Extended Fund Facilities (EFFs) and Stand By Arrangements (SBAs).

The Gap in the Development Literature on Pakistan

So the development literature moves only in a dialectic logic, from one policy objective, like GDP growth, through an extreme reaction, to another policy objective like redistribution, inspiring yet another policy reaction back to GDP growth. Or from GDP growth without poverty reduction or social development, to poverty reduction and social development without growth.

Which does not lead the development literature to construct a macroeconomic general equilibrium framework to account for GDP growth. The two gap models of the sixties identified only two macro variables causing growth, savings, and foreign exchange. Two huge missing variables in that model being consumption, and government expenditure. The Socialist Seventies identified the major causal variable of GDP growth to be government investment and consumption. Missing private investment and tradeables. The Revivalist Eighties returned to a

growth model led by private investment, ignoring consumption and government expenditure. The Liberalizing Nineties and the Social Reforming Hundreds have sought to increase private investment by liberalizing regulatory structures, without examining investment outcomes in the real economy, all the while reducing government development expenditures. Additionally, analyses of growth over the last two periods have identified just one major constraint on GDP growth, foreign exchange, harking back to the two gap model.

Our argument in analyzing this development literature is that, while each of these variables identified in different policy regimes, determining GDP growth, may be necessary, but is not sufficient by itself. This is termed partial equilibrium analysis, based on examining one particular market. What is better is to examine all these variables put together in a conceptual framework called general equilibrium analysis. Which is an analysis of all the major markets, goods, money, labor, tradeables, and global capital flows.

The structural literature moves towards such a general equilibrium analysis a bit better.

The Structural Literature on Pakistan

The structural literature on Pakistan's growth moves from partial equilibrium analysis based on one market to examining several markets. However, we find that there still remain some gaps in moving towards general equilibrium analysis in all key markets.

For Pakistan, the review of the structural literature shows a large explanatory bias towards the exogenous demand variables and the monetary variables, rather than domestic demand variables to explain long run growth (Shahbaz et al., 2008; Khan & Jawad, 2019; Mahmood & Arby, 2012). The decomposition of domestic demand variables, into consumption and investment, is consistently missing in the literature except in a paper by Chaudhry, Khan,

and Pasha (2013, 2017). But which then misses government expenditure. The structural model has long antecedents, in identifying constraining gaps on growth in Pakistan. Studies began with simple two gap models, with savings being shy of investment, and foreign exchange gaps to import needed capital goods. These argued for foreign aid to gradually first fill the lesser foreign exchange gap, and then the larger savings gap. More recent studies have incorporated a third gap in the government's budget, running deficits between expenditures and revenues (Iqbal et al., 1995), Iqbal et al., 2000). These studies still miss key structural variables and therefore do not provide a very comprehensive explanation for output growth.

Cyclical Literature

International Cyclical Literature

The cyclical literature relates long run output growth to cyclicality in multiple ways, which are summed up in a series of representative articles.

Aghion et al., 2007 make output growth a function of cyclicality in budgetary policies. The long run output growth is represented as a positive function of countercyclical budgetary policy, a positive function of financial development, and a negative function of the level of financial development interacting with countercyclical budgetary policy. The paper finds that the cyclicality of budget deficit significantly explains GDP growth. The more countercyclical the budgetary policy the higher the country's GDP growth. The paper misses the key cyclical determinant of the current account balance.

Fatas, 2000 makes persistence in output fluctuations a function of long run output growth. The empirical evidence based on a large sample of countries suggests that there is indeed a correlation between the persistence of short run fluctuations and the long term growth rates of

GDP. The paper is a very partial analysis because it uses neither cyclical nor structural variables in explaining fluctuations in output growth.

A key paper by Summers and Carroll, 1987 raises the issue of Ricardian equivalence for the US economy. This paper raises a critical relationship between two sets of right hand side determinants of output. That is it examines the impact of cyclical variables on structural variables. Ricardian equivalence implies that budget deficits will dampen the structural variables of consumption and investment, in fact increasing leakages in aggregate demand which is savings. The functional form makes the saving rate a function of the budget deficit, the gap in output, inflation, capital gains, and time trend. The paper rejects the Ricardian effect that government budget deficits increase savings, in fact showing that savings fell. The paper provides a very good test of the impact of the budget deficit on structural variables of consumption, investment, and saving. However, it misses examining the impact of another cyclical variable, which is the current account balance on the structural variables.

The review of the international cyclical literature shows that cyclicality is not tested comprehensively. The literature tests well for budget balances but misses out the impact of current account balances. Further, the cyclical literature does not combine cyclical determinants with structural determinants.

Pakistan Cyclical Literature

The cyclicality literature for Pakistan is based largely on tests of Ricardian Equivalence. That unfinanced budget deficits will crowd out increases in consumption and investment as shown by Haque and Montiel, 1993 and Qureshi, 2011. Also, unfinanced budget deficits become unsustainable because they do not generate additional growth to finance them in the future. So

short run cyclicality actually constrains longer run growth. Further, the cyclicality literature also examines the interrelationship between the two cyclicality determinants, the budget balance and the current account balance. Khan and Saeed, 2012 show that budget deficits in Pakistan are financed through current account balances.

Overall analysis of both sets of literature, cyclical and structural, shows that each does not include the other comprehensively. The cyclicality literature is very weak in incorporating structural variables. The structural literature does not comprehensively incorporate the cyclical factors, the budget balance, and the current account balance. Therefore, there is theoretical space to explain output through a marrying of both sets of explanatory variables, cyclical and structural.

The only methodology that stands out from the literature as the most comprehensive is by Freitas et al., 2013 and Clementi et al., 2015. We aim to formulate our theoretical framework using their established methodology. And then attempt to overcome some of their limitations. And try to capture in our theoretical framework, both structural and cyclical determinants, simultaneously in General Equilibrium.

2.3 A General Theoretical Framework

Freitas et al., (2013) and Clementi et al., (2015), both share our objective here, of observing the macro drivers of long run country growth. Their methodology stands out from the literature as the most comprehensive. Albeit with limitations of their own, in not capturing sufficiently, the determinants of cyclicality. We attempt to overcome some of their limitations. And try to capture in our theoretical framework, both structural and cyclical determinants, simultaneously in General Equilibrium.

So we begin with the Freitas et al.,'s (2013) and Clementi et al.,'s (2015) standard textbook mother equation in macroeconomics:

$$Y = C + I + G + X - M \qquad (1)^2$$

The more comprehensive literature is largely content to run essentially this equation, with consumption C and investment I, representing the structural determinants of output Y. And government expenditure G, and net exports, or the CA balance, representing the cyclical determinants of output Y.

(i) Assessing the impact of the quantum of the macro aggregates, on output Y.

First, on the right hand side of the equation, the quantums of private consumption C, private investment I, government expenditure G, exports X, and imports M, will determine on the left hand side of the equation, the quantum of output Y.

But the more complex relationships further lie on the right hand side of the equation, between the determining variables themselves. It is these interactions between the determining variables, which give the final quantum on the right hand side, determining on the left hand side of the equation the quantum of output.

(ii) Examining the relationship between the long run structural determinants themselves: consumption C, and investment I.

So the second relationship is between the right hand side of the equations determinants of private consumption C and private investment I. These are the two

[2] All equation numbers are unique to each of essay one, essay two and essay three.

structural determinants of output Y. In that the literature considers them to be slow movers over time, relatively less policy amenable in the short run, and therefore determinants of long run output and its growth.

Now investment I determines output growth ΔY, as given by the Harrod-Domar model (Harrod, 1939 and Domar, 1946), through a Capital Output ratio K/Y. So:

$$\Delta Y = I / K/Y \qquad (2)$$

But the Capital Output ratio K/Y is not well explained by the Harrod Domar model. In that, the size of the ratio is not well determined. It is simply attributed to the amount of capital stock K in the economy. And the capital stock K, in turn, is some function of the accumulation of investment over time t:

$$Kt_n = fnI \sum (It_1 + It_2 + \dots It_{n-1}) \qquad (3)$$

So it is not only the current level of investment but also the past levels of investment, that determine output growth ΔY. As such the cumulative function of I, fnI, is not well defined. In that we do not know what portion of I_t is to be cumulated. So we have insufficient determination of the capital stock Kt_n.

Indeed in the Cambridge Capital controversy, Joan Robinson (1971) questioned the notion of the neoclassical construct of capital. In the neoclassical model, the marginal product of capital is used to determine its price, given by the interest rate. But the problem for Joan Robinson was that the construct of capital has to be an

accumulation of capital stock. And this accumulation of capital stock has to be through aggregated physical capital. Which in turn has to be priced, to be aggregated. Requiring a price of capital given by the interest rate. So the dilemma of the neoclassical model is that it requires an interest rate, to aggregate capital, to determine its marginal product, to determine in turn the interest rate.

The bearing of the Cambridge Capital controversy for us here is that as the interest rate r varies over time t_1 to t_n. So the capital output ratio K/Y, has to adjust contra to r, to make it equal to output growth ΔY. so we recall equation (2):

$$\Delta Y = I / K/Y \qquad (2)$$

$$\Delta Y = I / K(r) / Y \qquad (4)$$

As the interest rate r goes up, for example, capital K will go up, as will the capital output ratio K/Y go up. So the growth rate of output ΔY will drop. So the capital output ratio K/Y will go up and down with the interest rate r. Yet the capital output ratio K/Y is meant to be a much more stable fraction fnI of accumulated investment over time as in equation (2). In which case it cannot be as volatile as the interest rate r.

So the neoclassical construct of the capital output ratio, as given by the Harrod Domar model is not well defined.

But Lord Kahn and Keynes (Keynes, 1937) neatly step in here to add another macro variable to explain output Y and its growth over time ΔY. Which is consumption C. And consumption C is used to estimate a more specific determination of a multiplier k. Such that investment I times a multiplier k, gives output Y.

$$Y = I * k \qquad (5)$$

The Kahn-Keynes model uses the marginal propensity of consumption MPC, to determine k, such that:

$$k = 1 \ / \ 1 - MPC \qquad (6)$$

Which gives the Kahn-Keynesian alternative to the Harrod Domar model for determining output Y.

$$Y = I * (1 / 1 - MPC) \qquad (7)$$

So investment I determines output Y, but is constrained by the share of incremental income that is consumed, which is the MPC. So for example if all the output is saved rather than being consumed, the multiplier becomes just 1. Implying that $1 of investment I, will generate only $1 of output Y. But if a half of output Y is

consumed, giving a marginal propensity to consume, MPC of 0.5, the multiplier rises to 2. Now implying that $1 of investment I, will generate output Y of $2.

The Kahn-Keynes multiplier model thereby poses an interesting tradeoff between consumption driven growth and investment driven growth.

Where investment I, determines output Y, but is constrained by consumption C. So a higher investment I will lead to a higher output Y. But the higher output Y, will be constrained by the lower consumption C, through a lower multiplier k. So Consumption C and investment I, are tradeoffs.

In fact these two long run structural determinants of output Y, consumption C, and investment I, give three possible growth paths. Growth of output ΔY, can be an investment I led, or consumption C led, or balanced between these two drivers consumption C and investment I.

2.4 Theoretical Framework for Essay One

Essay One: Explaining the drop in Pakistan's long run GDP growth over time, by assessing the impact of the macro aggregate determinants of output growth.

Essay one will focus on explaining the observed drop in Pakistan output growth between two time periods, pre 1990, and post 1990. It will do this by examining the impact on output, of the macro aggregate determinants of output growth. So Essay One will focus on examining the two relationships defined above by equations (1) to (6).

(i) The first relationship examined will be assessing the impact of the quantum of the macro aggregates, on output Y.

On the right hand side of Equation (1), the quantum of private consumption C, private investment I, government expenditure G, exports X, and imports M, will determine on the left hand side of the equation the quantum of output Y.

Equations (1) expresses the economic notion in terms of output and its macro aggregates at one point in time say t_o. But we wish to be able to distinguish ΔY in order to compare it between two time periods, say t_o and t_1, and therefore we need the decomposition of ΔY into the change in its macro aggregates. Accordingly, we need the equation in terms of ΔY and its decomposition into changes in macro aggregates, ΔC, ΔI, ΔG, ΔX, and ΔM

Writing equation (1) in terms of ΔY, gives:

$$\Delta Y/Y = \Delta C/C + \Delta I/I + \Delta G/G + \Delta X/X - \Delta M/M \quad (8)$$

Now we can examine the change in which the quantum of determinants on the right hand side of Equation (8) explains the higher output growth pre 1990 and lower output growth post 1990, on the left hand side.

(ii) Examining the relationship between the long run structural determinants themselves: consumption C, and investment I, and their complex impact on output Y.

So the second relationship is between the right hand side of the equations determinants of private consumption C and private investment I. And their complex and joint determination of output Y.

Equations (5) to (7) develop this complex and joint determination by investment I, and consumption C, of output Y.

Equation (7) actually says that change in output Y on the left hand side will be determined jointly through a complex interaction between the change in the quantum of investment I and the share of consumption C, on the right hand side.

Requiring Equation (1) to be expressed in shares, at one point in time.

$$Y/Y = C/Y + I/Y + G/Y + (X - M)/Y \qquad (9)$$

While change over time in these shares is given by Clementi (2015) which gives us equation (1) in the following form:

$$g_t^y = g_t^C \frac{C_{t-1}}{Y_{t-1}} + g_t^I \frac{I_{t-1}}{Y_{t-1}} + g_t^G \frac{G_{t-1}}{Y_{t-1}} + g_t^X \frac{X_{t-1}}{Y_{t-1}} - g_t^M \frac{M_{t-1}}{Y_{t-1}} \qquad (10)$$

The share of each factor is calculated as the own growth rate of each factor in time t multiplied by its previous year's contribution to the previous year's total output.

Now we can examine change in which of the shares of determinants on the right hand side of Equation (10) explains the higher output growth pre 1990, and lower output growth post 1990, on the left hand side.

In sum, in this first essay, our central problem is to explain the drop in output growth in Pakistan, from 6% pa. in the 60s, 70s and 80s, to 4% from the 90s onwards. To explain this drop in growth of output, equations (8) to (10) can be run separately for each of the two time periods. Showing change in output over the period, on the left hand side of the equations, as determined by change in the quantum of macro aggregates, on the right hand side of the equations, as in equation (8). And also, change in output over the period, on the left hand side of the equations, as determined by change in the shares of the macro aggregates in output, on the right hand side of the equations, as in equation (9) and (10).

This theoretical framework adopted gives a set of testable hypotheses. But in order to make these hypotheses very specific, especially with regard to time frames, a word is needed on data limitations, comparability, and consistency over time, and according to data choices.

2.5 Data

The time series data for the macroeconomic aggregates for Pakistan, 1960-2017, has been obtained from the following sources:

- Pakistan Bureau of Statistics (PBS)
- State Bank of Pakistan (SBP)

It would have been good to be able to analyze the whole time series available from 1960 to 2017. But the data for pre 1971/72 includes two wings of the country, West Pakistan and East Pakistan. Whereas the data from 1972/73 onwards includes just what was West Pakistan. While it would have been possible to separate out the West Pakistan data pre 1971/72, to make it consistent and comparable to the post 1971/72 data. However, we would still be comparing a

structurally very different economy for West Pakistan pre 1971/72, integrated into East Pakistan, with the West Pakistan economy post 1971/72, no longer connected to East Pakistan/Bangladesh.

Therefore, for this reason of comparability, we have begun our analysis from 1972/73. Considering the time series up to 2017.

Further, we have used the time series provided by the PBS and made consistent by the Ministry of Finance of the Government of Pakistan (GOP)[3]. This time series also coincides with the series adopted by the International Monetary Fund's World Economic Indicators (IMF WEI).

2.6 Hypotheses explaining the drop in long run growth between the two time periods

Research Question and Hypotheses for Essay one.

The central problem of the paper is to analyze and explain the long run trend of GDP growth. The long run trend of GDP growth has been decreasing over time (Figure 1.1). Therefore, the need is to examine whether there has been a discrete reduction in GDP growth over time and identify the timing when the reduction has occurred. The first hypothesis is aimed at identifying the trend break in GDP growth.

Hypothesis 1: There has been a discrete reduction in GDP growth over the time period 1973-2017.

If there is a significant reduction in GDP growth, the next step will be to identify the timing of the discrete reduction. We refer to the discrete reduction in GDP growth at a particular time as a structural trend break in GDP growth.

[3] We are thankful to Dr. Kalim Hyder at State Bank of Pakistan for providing us with the consistent time series of the macro indicators of Pakistan.

Based on our theoretical framework, GDP growth can be explained using Keynesian macro aggregates. The macro aggregates considered in our theoretical framework are consumption growth, investment growth, government expenditure growth, export growth and import growth. Of these variables we will test to examine which of these macro aggregates significantly explain the drop in GDP growth. Particularly we would like to test the hypothesis that high investment growth explains high GDP growth in the first phase of GDP growth, and a drop in investment growth explains the drop in GDP growth in the second phase of GDP growth.

Hypothesis 2a: There has been a significant drop in investment growth over the time period 1973-2017.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

Our Keynesian theoretical framework further drives GDP growth through two channels. One channel is through the quantum of investment. But the impact of investment on GDP growth is determined through a second channel. The extent of the impact of investment on GDP growth is seen to be determined by the multiplier, specified through the Kahn-Keynes model. This multiplier is based on consumption. A rise in the share of consumption in total GDP raises the multiplier, and so the extent of the impact of investment on GDP growth. So we now have two major determinants of GDP growth. The quantum of investment determines GDP growth. But not unaided. The share of consumption determines the extent of the impact of the quantum of investment on GDP growth.

But our theoretical framework argues that consumption and investment must not be taken as simple complements in an apparent Keynesian identity. Because a rise in the share of

consumption, while raising the multiplier, simultaneously lowers the share of savings. And savings are a major determinant of investment, potentially lowering the quantum of investment. Which gives an interesting tradeoff between the two major drivers of growth, consumption, and investment. Making it conceivable that GDP growth could be led episodically, some phases led more by consumption growth, and other phases led more by investment growth.

Hypothesis 3: Growth in output will be better explained episodically, some cycles being more investment led, others more consumption led, and still others following more balanced growth paths.

Hypothesis 3a: High GDP growth in phase one, will not be equally explained by high investment growth and high consumption growth. If high GDP growth in phase one is explained well by high investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth, in this phase will be low.

Hypothesis 3b: Low GDP growth in phase two, will then equally not be explained by both low investment growth and low consumption growth. If low GDP growth in phase two is explained by low investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth in this phase will be high.

Therefore, these sets of hypotheses will help us examine whether the first phase of growth is investment led, investment contributing significantly more to GDP growth. And whether the second phase of GDP growth is consumption led, the marginal propensity to consume, and the consumption share in GDP, and its growth, contributing significantly more to GDP growth.

2.7 Empirical Methodology for Testing Hypotheses

2.7.1 Empirical Methodology for testing Hypothesis 1

We begin with the empirical methodology for our first hypothesis.

Hypothesis 1: There has been a discrete reduction in GDP growth over the time period 1973-2017.

This requires us to formulate a methodology that can detect abrupt changes in the data series, called breaks. For that, we need to examine the mean shift in the series. Therefore, we apply two distinct techniques from the literature. One is structural break analysis based on linear regressions to detect the discrete mean shifts in GDP growth. The second is a regime switching framework, based on non-linear regressions, to compare mean shifts of GDP growth in different regimes across different time periods.

2.7.1.1 Structural break analysis

We propose to start our empirical analysis with the structural break analysis, using the procedures proposed by Bai and Perron (1998, 2003), henceforth BP, Andrews (1993), and Chow (1960), and lastly, using a dummy regression. A key feature of BP's procedure is that it allows us to test for multiple shifts in average growth at unknown dates. As compared to Andrews (1993) methodology which tests for a single shift at an unknown date and Chow (1960) which tests for an abrupt mean shift at a known date in the data. Our aim is to detect a discrete change, nevertheless, it is also feasible to check if the discrete change in series occurred once or at multiple times.

A structural break model for GDP growth

All three procedures, BP, Andrews (1993) and Chow (1960) can be applied using a multiple linear regression model for multiple breaks. For that we consider the structural change model specified by Clementi et al (2015) based on the established methodology by BP with m breaks (or, equivalently, m+1 growth regimes) as,

$$g_t^Y = \beta_j + u_t, \qquad t = T_{j-1} + 1, \ldots., T_{j,} \quad j = 1, \ldots., m+1, \qquad (11)$$

Where T is the sample size as $T_o = 0$ and $T_{m+1} = T$. The model represents the annual growth of GDP, g_t^Y , equals the regime-specific mean growth rate β_j plus a stationary error term u_t. The aim of the analysis is to determine the optimal number and location of the structural breaks, along with estimating the mean shift parameter. Before we apply any procedure to determine the optimal number of breaks, we need to run a standardized test to confirm whether structural change analysis is applicable to the GDP growth model in equation (11). For which we need to run a CUSUM test.

CUSUM test for a structural break

The cumulative sum test (CUSUM test) for parameter stability is used to test for the presence of structural change in the series. The CUSUM test statistic is constructed from the cumulative sum of either the recursive residuals or the ordinary least-squares (OLS) residuals. In order to perform CUSUM test in our case, the instability of the parameter β_j in equation (11) will be tested against the null posit of having no structural change. For that if β_j changes from one period to the next, the forecast error will be greater than zero and will indicate instability in the

model. So, the greater the CUSUM test statistic, the greater will be the forecast error and the greater the chance of detecting the structural change in the model.

Bai and Perron's test for identifying multiple breaks at an unknown time

Bai and Perron's method provides an extensive analysis to estimate the number and points of breaks in the data. The method is adequate, in general, but recommendations need to be followed when using a particular specification. We implement the technique suggested by BP using a cohesive package 'strucchange' provided by the statistical software R and developed by Zeileis et al (2002,2003), Zeileis and Kleiber (2005).

Based on the recommendations, provide by BP (2003, pg.15) we assign certain values for our specification, the search utilizes a trimming parameter of ε=0.15, corresponding to the minimal size of h=5 yearly observations; this amounts to allowing simultaneous calculation for up to m=5 breaks. A high value for the trimming parameter takes care of serial correlation and heterogeneity in error terms across different regimes.

We begin with finding the optimal number of breaks in the series. By default, when implementing BP's technique, it selects the optimal number of breaks as the one achieving the minimum Bayesian Information Criteria (BIC) score. This BIC score provides a consistent estimate of the number of breaks; that is, under regularity conditions, the probability of underestimating and overestimating the true number of breaks becomes zero. However, BIC tends to underperform if the model has a problem of serially correlated error terms. It also cannot take into account potential heterogeneity across segments. In that case, BP suggests a method

based on the sequential estimates of the breaks. For which $SupF_t$ (m) and $expF_t$(m) sequential tests are used to test for no structural break versus multiple numbers of breaks.

Andrews (1993) test for identifying a single break at an unknown time

Unlike BP, Andrews (1993) procedure works to detect a single mean shift at an unknown time. The major difference between the two is that the BP tests the null posit of no break versus an alternative of multiple breaks. However, Andrews (1993) procedures test for an alternative of a single break in the data at an unknown time. And in this case, if more than one structural break is present in the series, the break identified using this procedure will be biased. For this reason, BP performs better than any other method because it accounts for all the possible breakpoints while identifying the significant break.

Chow's test for a single break at a known time

We follow the Chow (1960) procedure to test the significance of a known break date. Unlike BP and Andrew's methodology, this procedure works a bit differently. It tests the null hypothesis that there is no structural break against the alternative that there is a known structural break at a specified time. The test considers a linear model split into samples at a predetermined break point and tests the equality of parameters across subsamples.

Dummy regression to test for a known break date

The break identified in the previous section can be tested using an intercept dummy in our structural change model, equation (1), using the following specification,

$$g_t^Y = \beta + \theta DU_t + u_t, \tag{12}$$

Where, g_t^Y represents real GDP growth and DU_t is the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. Equation (12) allows us to check whether GDP growth exhibits a downwards or upwards trend at the identified break point.

So these tests will give us a known break point in the GDP growth series, call it tB. Which will allow us to divide our entire series for GDP growth into say two time periods, pre tB and post tB. Since Figure 1.1 shows a downwards trend, and a conceivable break point, we can presume that our empirically identified break tB, can so give us a time period pre tB which has high GDP growth, and the following time period post tB, with lower GDP growth.

The establishing of these two time periods, pre tB with high growth, and post tB with lowered growth, then becomes the foundation for our further investigation into seeking macro aggregates that correlate to the drop in GDP growth between these two time periods.

2.7.1.2 Regime Switching Analysis

Recalling Figure 1.1, GDP growth series shows considerable fluctuations along its long run growth path, in both periods, pre tB, and post tB. While our argument in Essay One, and our Hypothesis 1 is based on demonstrating just an average drop in GDP growth post tB. But, the argument is further strengthened if the fluctuations in GDP growth pre tB, lower growth by less, than the fluctuations post tB. To test this, we use a Markov switching regime model.

The essence of the model is that, in our case for GDP growth, it sets up two regimes, high GDP growth, and low GDP growth. The discrete drop in GDP growth at the break point of tB observed above, allows us to divide our time series for GDP growth into these two time periods,

or phases, pre tB, and post tB. So we now have within each time period, pre tB and post tB, a high growth regime and a low growth regime.

Referred to as, a regime switching model, and based on non-linear regressions, this technique estimates parameters for different regimes, gives the transitional probabilities to stay in the regime, and the probability to shift out of and move to the other regime, and gives the duration to persist in a particular regime.

A Markov regime switching model for GDP growth

Under the various categories of regime switching models, we apply the Markov regime switching model to our GDP growth series. Markov models are suitable for series that exhibit distinct dynamic patterns during different time periods.

So we use the original variant of the Markov switching model, given by Hamilton (1988,1989), the one that examines the mean behavior in series. Making use of the original model, we can model the two regime GDP growth model as;

$$g_t^y = \begin{cases} \beta_0 + \varepsilon_t, & s_t = 0 \\ \beta_0 + \beta_1 + \varepsilon_t, & s_t = 1 \end{cases} \quad (13)$$

s_t , denotes an unobservable state variable assuming the value one or zero. g_t^Y, denotes GDP growth rate. The average GDP growth rate takes the value β_0 when $s_t = 0$. And when the regime switch takes place, s_t changes from zero to one, while the average GDP growth rate takes the value $\beta_0 + \beta_1$. Here, the unobservable state variable captures the effect of regime shift in the model.

2.7.2 Empirical Methodology for testing Hypothesis 2

After having established a known break date at point tB in our series for GDP growth will have given us two time periods, pre tB with high GDP growth, and post tB with significantly lowered GDP growth.

We now need to provide an empirical methodology to explain the drop in GDP growth using the macro aggregates from our theoretical framework, of consumption, investment, government expenditure and exports.

Our Hypothesis 2a expects, however, that of the explanatory macro aggregates of consumption, investment, government expenditure, and exports, it is investment growth that will follow the pattern of the drop in GDP growth.

Hypothesis 2a: There has been a significant drop in investment growth over the time period 1973-2017.

To test this hypothesis requires a functional form that uses growth in each explanatory macro aggregate, consumption, investment, government expenditure, exports and imports, and tests each for breaks, using structural break analysis. That is indeed our aim, to test whether the break in investment growth coincides with the break in GDP growth.

Our Hypothesis 2b goes on further to specify that of the explanatory macro aggregates, it is investment growth that will explain high GDP growth in the first pre tB period, and a drop in this investment growth will explain the drop in GDP growth post tB.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

2.7.2.1 Structural break test in the growth of all the explanatory macro aggregates

Our aim will be to examine whether the structural break in our key explanatory growth variables, investment growth, consumption growth, government growth and export growth, coincides with the break in GDP growth. Based on our hypothesis 2a, we particularly expect a possible break date in investment growth to coincide with the break date in GDP growth. Recalling tB has been identified as the significant break date for the drop in GDP growth. Therefore, we will test our explanatory growth variables for the single most significant mean shift at a known break date, for the year tB, or fairly approximate to it.

Accordingly, one statistical test we will use will be based on a classical Chow (1960) test to check the shift in the series at a known break date. A second econometric test will be based on a dummy regression analysis, to test for the significance of the year 1992, as a break dummy in the growth series.

Structural break test at a known break date for all explanatory macro aggregates

In order to test our explanatory variables series for the single mean shift at a known break date, we use the model specified for GDP growth given by equation (12) above, which was for an unknown break date. This equation (12) can now be specified for a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \tag{14}$$

Where y_{it} represents growth in variable i in time period t. β_{ij} is regime specific mean growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \quad (15)$$

For this model we test the null hypothesis that mean shift parameter do not vary over the subsamples defined by the specified known break date. The known break date *TB,* is taken as the year tB identified by the tests above. As specified earlier in section 2.7.1.1, under the structural change analysis for GDP growth. The next step is to apply the model to each of our explanatory growth variables.

Chow's test for a known break date for all explanatory macro aggregates

The Wald test for the known break date using Chow (1960)'s procedure will be performed, to determine a break in the growth of the explanatory variables. The explanatory variables are investment growth, consumption growth, government expenditure growth, and export growth. We are dropping import growth as a lesser suspect. We apply the test using Stata software.

Dummy regression for testing a known break date in investment growth

The dummy regression model to test for the intercept break is specified for the investment growth variable. We will repeat the same exercise performed for GDP growth, now for the investment growth variable. The model is given as;

$$g_t^I = \beta + \theta DU_t + u_t, \quad (16)$$

Where, g_t^I represents real investment growth and DU_t is the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise.

Specification (16) allows us to check whether investment growth exhibits a downward or upward trend.

2.7.2.2 A test of GDP growth as a function of growth in all the explanatory macro aggregates, consumption, investment, government expenditure, exports, and imports

Having provided statistical evidence in support of Hypothesis 2a, there has been a significant drop in investment growth, coinciding exactly with a significant drop in GDP growth. We can proceed to test our Hypothesis 2b, which further specifies that GDP growth is explained well by investment growth.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

We test this hypothesis using equation (8) from our theoretical framework above.

$$\Delta Y/Y = \Delta C/C + \Delta I/I + \Delta G/G + \Delta X/X - \Delta M/M \quad (8)$$

Where GDP growth, on the left hand side, is explained on the right hand side by investment growth, consumption growth, government expenditure growth, export growth and import growth. We expect higher investment growth to explain higher GDP growth in the first phase, pre tB. And a statistically significant drop in investment growth explains the drop in GDP growth in the second phase, post tB.

An Empirical Model for Growth

Denoting equation (8) for brevity as GDP growth g_t^Y, as a function of growth in macro aggregates. The macro aggregates are consumption growth g_t^C, investment growth g_t^I, government growth g_t^G, export growth g_t^X, and import growth g_t^M.

$$g_t^Y = f(g_t^C, g_t^I, g_t^G, g_t^X, g_t^M)$$

The functional form will be estimated using the double log form as following;

$$logy_t = \alpha_0 + \alpha_1 logrealC_t + \alpha_2 logrealI_t + \alpha_3 logrealG_t + \alpha_4 logrealX_t + \alpha_5 logrealM_t + \epsilon_t \quad (17)$$

where, $logy_t$ represents log of real GDP, $logrealC_t$ represents log of real consumption, $logrealI_t$ represents log of real investment, $logrealG_t$ represents log of real government, $logrealX_t$ represents log of real export, and $logrealM_t$ represents log of real import. The double log form coefficients for equation (17) represents the same effect as if the equation was run as a growth equation. For example, α_1, shows the effect of consumption growth on GDP growth. We can run this equation independently for pre tB and post tB. The coefficients of the model are then tested for equality across the two time periods, pre tB and post tB.

Since our aim in this section is to explain the drop in GDP growth. And, since the break in investment growth coincided with the break in GDP growth. We would want our investment growth variable to siginficantly explain the drop in GDP growth variable, as stated in our Hypothesis 2b. Therefore, while estimating equation (17) we would expect the following propositions to hold:

a. The investment growth coefficient α_2, should be positive and significant for both the phases, pre tB and post tB.

b. The investment growth coefficient α_2, should have a higher value pre tB as compared to post tB.

c. The investment growth coefficient α_2, should significantly differ between the two phases.

2.7.3 Empirical Methodology for testing Hypothesis 3

Now recalling, our theoretical framework takes the economic argument for the determination of GDP growth further, beyond just investment growth. It pairs investment growth with the share of consumption, specifically the Marginal Propensity to Consume (MPC).

This pairing is added by Hypothesis 3, and further nuanced. Because the hypothesis expects that long run GDP growth is better explained through the quantum of investment growth, paired with the marginal propensity to consume. Further, this Keynesian multiplier can be expected to work inversely with the quantum of GDP growth. The marginal propensity to consume is relatively lower when the quantum of investment growth is high. And the marginal propensity to consume is relatively higher when the quantum of investment growth drops. Therefore, Hypothesis 3 expects that high GDP growth in the first phase will be explained by high investment growth, paired with a relatively lower marginal propensity to consume on average. While the drop in GDP growth in the second phase will be explained by a drop in the quantum of investment growth, paired with a relatively higher marginal propensity to consume on average.

Hypothesis 3: Growth in output will be better explained episodically, some cycles being more investment led, others more consumption led, and still others following more balanced growth paths.

Hypothesis 3a: High GDP growth in phase one, will not be equally explained by high investment growth and high consumption growth. If high GDP growth in phase one is explained well by high investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth, in this phase will be low.

Hypothesis 3b: Low GDP growth in phase two, will then equally not be explained by both low investment growth and low consumption growth. If low GDP growth in phase two is explained by low investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth in this phase will be high.

To further clarify, we are now positing that GDP growth is determined through two major channels, an investment channel, and a consumption channel. The investment channel will have been corroborated empirically by testing Hypothesis 2. Allowing us to test Hypothesis 3 on the consumption channel.

The consumption channel can first be tested conventionally as the established literature does, using the shares of the explanatory macro aggregates in GDP

2.7.3.1 The significance of the consumption share in determining GDP

For the estimation of shares in GDP to test Hypothesis 3, we will use two distinct estimation techniques from the literature. The first technique is based on equation (9) of our theoretical model. According to that, we estimate GDP growth using the following mathematical form,

$$g_{it}^{y} = \alpha_{i0} + \alpha_{i1} sharec_t + \alpha_{i2} sharei_t + \alpha_{i3} shareg_t + \alpha_{i4} sharex_t + \alpha_5 sharem_t + \epsilon_{it} \qquad (18)$$

where *i* represents two phases, pre tB and post tB. g_{it}^{y} represents the annualized real GDP growth rate. $sharec_t$ represents the share of consumption in GDP, $sharei_t$ represents the share

of investment in GDP, $shareg_t$ represents the share of government expenditure in GDP, $sharex_t$ represents the share of exports in GDP, and $sharem_t$ represents the share of imports in GDP.

We can then proceed to the second functional form for estimation of growth in shares in GDP. The mathematical form is specified by Clementi's (2015) methodology as discussed above in our theoretical framework, and given by equation (10):

$$g_t^y = g_t^C \frac{C_{t-1}}{Y_{t-1}} + g_t^I \frac{I_{t-1}}{Y_{t-1}} + g_t^G \frac{G_{t-1}}{Y_{t-1}} + g_t^X \frac{X_{t-1}}{Y_{t-1}} - g_t^M \frac{M_{t-1}}{Y_{t-1}} \qquad (10)$$

Where the g_t^y represents real GDP growth, $g_t^C \frac{C_{t-1}}{Y_{t-1}}$ represents the contribution of the consumption share in GDP growth, $g_t^I \frac{I_{t-1}}{Y_{t-1}}$ represents the contribution of the investment share in GDP growth, $g_t^G \frac{G_{t-1}}{Y_{t-1}}$ represents the contribution of the government share in GDP growth, $g_t^X \frac{X_{t-1}}{Y_{t-1}}$ represents the contribution of the export share in GDP growth, and $g_t^M \frac{M_{t-1}}{Y_{t-1}}$ represents the contribution of the import share in GDP growth.

We calculate the contribution of the shares for each variable in each year. For the whole time series running over both time periods. We then test this share series for structural breaks.

2.7.3.2 Marginal Propensity to Consume and the determination of GDP

We think that using contributory shares to GDP growth are an imperfect representation of our theoretical framework. Recalling from equation (7) in our theoretical framework, that GDP growth is determined by the quantum of investment growth and the Marginal Propensity to

Consume. Therefore, our test for Hypothesis 3 has now to be based on estimating the MPC across two phases of GDP growth, pre tB with its high GDP growth, and post tB with its drop in GDP growth.

Estimating the Marginal Propensity to Consume

The MPC is estimated by running the regression of real consumption as a function of real GDP. The regression can be run independently for two time periods, pre tB and post tB. The coefficient of real GDP in each regression gives us the average value for the MPC for each time period, pre tB and post tB. The specification is given as:

$$realC_t = \alpha_{i0} + \gamma_{i1} realGDP_t + \epsilon_{it} \quad (19)$$

Where i represents two time periods, pre tB and post tB, *realC* represents real consumption and *realGDP* represents real GDP. Since, we will estimate the equation for two time periods, pre tB and post tB. We will have two estimated values for MPC, represented as, $\gamma_{pretB,1}$ and $\gamma_{posttB,1}$. Where pre tB is considered as the high growth phase and post tB is considered as the low growth phase.

Accordingly, to support our hypotheses 3a and 3b, we would expect the following propositions to hold true.

a. The estimated MPC value for pre tB, high growth phase, should be lower than the estimated MPC value for post tB, low growth phase. That is $\gamma_{pretB,1} < \gamma_{posttB,1}$.
b. In addition to a proposition (a), the estimated MPC value pre tB should be significantly different from the estimated MPC value post tB. That is $\gamma_{pretB,1} \neq \gamma_{posttb,1}$

2.8 Empirical Results

How we propose to test our hypotheses

So our central problem of explaining the determinants of Pakistan's long run GDP growth, and the theoretical framework adopted, has given us three testable hypotheses, as set out in Part I of this paper above:

Hypothesis 1: There has been a discrete reduction in GDP growth over the time period 1973-2017.

Hypothesis 2a: There has been a significant drop in investment growth over the time period 1973-2017.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

Hypothesis 3: Growth in output will be better explained episodically, some cycles being more investment led, others more consumption led, and still others following more balanced growth paths.

Hypothesis 3a: High GDP growth in phase one, will not be equally explained by high investment growth and high consumption growth. If high GDP growth in phase one is explained well by high investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth, in this phase will be low.

Hypothesis 3b: Low GDP growth in phase two, will then equally not be explained by both low investment growth and low consumption growth. If low GDP growth in phase two is

explained by low investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth in this phase will be high.

The hypotheses proceed with sequential and intuitive logic.

Hypothesis 1 seeks to establish that the central problem of this thesis, that there has been a reduction in Pakistan's GDP growth in the long run, is statistically significant, and therefore a non trivial problem to be posed and answered.

Having established that there has indeed been a statistically significant drop in Pakistan's GDP growth in the long run, Hypothesis 2 posits that the better explanatory variable for the drop in GDP growth will be investment growth. Higher investment growth explains higher GDP growth in the first phase. And a statistically significant drop in investment growth explains the drop in GDP growth in the second phase. And that this investment growth variable explains both phases of GDP growth, better than growth in the macro aggregate variables posited by our theoretical framework, of consumption, government expenditure, and exports.

But our theoretical framework pairs another macro aggregate variable with investment, which is consumption, in explaining long run GDP growth. This pairing is added by Hypothesis 3, and further nuanced. Because the hypothesis expects that long run GDP growth is better explained through the quantum of investment growth, paired with the marginal propensity to consume. Further, this Keynesian multiplier can be expected to work inversely with the quantum of GDP growth. The marginal propensity to consume is relatively lower when the quantum of investment growth is high. And the marginal propensity to consume is relatively higher when the quantum of investment growth drops. Therefore hypothesis 3 expects that high GDP growth in the first phase will be explained by high investment growth, paired with a relatively lower

marginal propensity to consume on average. While the drop in GDP growth in the second phase, will be explained by a drop in the quantum of investment growth, paired with a relatively higher marginal propensity to consume on average.

Each hypothesis is tested using equations derived from our theoretical framework, specifying a functional form that can be tested, and choosing a number of econometric and statistical tests to run on this functional form.

Part II.1 of this Essay One tests Hypothesis 1. Part II.2 tests Hypothesis 2. Part II.3 tests Hypothesis 3.

In order to test our hypotheses, we need two tools. One, we need a functional form, derived from the theoretical equations set out in our analytical framework. For example, to test Hypothesis 3, we can posit that GDP growth is a function primarily of investment growth and consumption growth:

$$(Y_{t1} - Y_{to}) / Y_{t0} = fn\ (I_{t1} - I_{to}) / I_{t0} + (C_{t1} - C_{to}) / C_{t0} \quad (20)$$

Two, this functional form needs to be tested econometrically and statistically, to determine the coefficients, their signs, and their significance, and the fit of the whole equation. For which a number of econometric and statistical tests have to be specified.

We will use these two tools, for empirical analysis of our main variable of interest, GDP growth, and the macro aggregates specified in our theoretical framework, investment, consumption, government expenditure, and exports.

The logic of our empirical analysis in this Essay One is that we begin with the basic functional form of analyzing the variables individually. So we begin by analyzing GDP growth

on its own. Using two econometric tests. These are structural breaks, and regime switching. Then we examine our posited explanatory macro aggregates, for structural breaks. A coincidence in breaks between GDP growth, and its posited explanatory macro aggregates, becomes the first test of the relationship. Which warrants more stringent testing.

We then proceed to the next level, of using a functional form that specifies that GDP growth on the left side of the equation, is well explained by growth in investment, consumption, government expenditure and exports. This functional form is tested using several econometric and statistical techniques. This will establish the relatively greater explanatory power of some macro aggregates over others. Warranting further focus on them.

The results from our empirical exercise will thus provide us with possible explanations for the drop in long run GDP growth.

2.8.1: Discrete reduction in GDP growth over the time period 1973-2017.

We begin with our main variable, real GDP growth, observed over the years 1973 to 2017. We seek to provide econometric and statistical evidence for our first hypothesis in this section.

Hypothesis 1: There has been a discrete reduction in GDP growth over the time period 1973-2017.

This requires us to formulate an empirical strategy that may detect abrupt changes in the data series, called breaks. For that, we need to examine the mean shifts in the series. Therefore, we apply two distinct techniques from the literature. One is the structural break analysis based on

linear regressions to detect the discrete mean shifts in GDP growth. The second, is a regime switching framework, based on non-linear regressions, to compare mean shifts of GDP growth in different regimes across different time periods.

2.8.1.1 Structural break analysis

Recalling from our methodology section 2.7 above, we start our empirical analysis with the structural break analysis, using the procedures proposed by Bai and Perron (1998, 2003), henceforth BP, Andrews (1993), and Chow (1960), and lastly, using a dummy regression. A key feature of BP's procedure is that it allows us to test for multiple shifts in average growth at unknown dates. As compared to Andrews (1993) methodology which tests for a single shift at an unknown date and Chow (1960) which tests for an abrupt mean shift at a known date in the data. Though our aim is to detect a discrete change, nevertheless, it is also feasible to check if the discrete change in series occurred once or at multiple times.

A structural break model for GDP growth

All three procedures, BP, Andrews (1993) and Chow (1960) can be applied using a multiple linear regression model for multiple breaks. For that we consider the structural change model specified by Clementi et al (2015) based on the established methodology by BP with m breaks (or, equivalently, m+1 growth regimes) as,

$$g_t^Y = \beta_j + u_t, \qquad t = T_{j-1} + 1, \ldots., T_{j,} \quad j = 1, \ldots., m+1, \qquad (11)$$

Where T is the sample size as $T_o = 0$ and $T_{m+1} = T$. The model represents the annual growth of GDP, g_t^Y , equals the regime-specific mean growth rate β_j plus a stationary error term

u_t. The aim of the analysis is to determine the optimal number and location of the structural breaks, along with estimating the mean shift parameter. Before we apply any procedure to determine the optimal number of breaks, we need to run a standardized test to confirm whether structural change analysis is applicable on the GDP growth model in equation (11). For which we need to run a CUSUM test.

CUSUM test for a structural break

The cumulative sum test (CUSUM test) for parameter stability is used to test for the presence of structural change in the series. The CUSUM test statistic is constructed from the cumulative sum of either the recursive residuals or the ordinary least-squares (OLS) residuals. In order to perform CUSUM test in our case, the instability of the parameter β_j in equation (11) will be tested against the null posit of having no structural change. For that if β_j changes from one period to the next, the forecast error will be greater than zero and will indicate instability in the model. So, the greater the CUSUM test statistic, the greater will be the forecast error and the greater the chance of detecting the structural change in the model.

Table 1.1 shows the result for the CUSUM test for our GDP growth model represented by equation (1). The test statistic takes the value 1.57 and is therefore highly significant. This rejects the null posit of having parameter stability and indicates a structural change in the data. This test provides partial support to our hypothesis. As it indicates that the decline in long run trend of GDP growth has not been gradual and in fact there exists a discrete drop in GDP growth series at some point in time.

Therefore, CUSUM test identifies the existence of structural change for us but does not identify the particular location where the change might have taken place. Hence, our next set of analyses apply three different procedures, based on BP, Andrews (1993) and Chow (1960), which identify the location and number of optimal break points.

Bai and Perron's test for identifying multiple breaks at an unknown time

Bai and Perron's method provides an extensive analysis to estimate the number and points of breaks in the data. The method is adequate, in general, but recommendations need to be followed when using a particular specification. We implement the technique suggested by BP using a cohesive package 'strucchange' provided by the statistical software R and developed by Zeileis et al (2002,2003), Zeileis and Kleiber (2005).

Based on the recommendations, provide by BP (2003, pg.15) we assign certain values for our specification, the search utilizes a trimming parameter of $\varepsilon=0.15$, corresponding to the minimal size of h=5 yearly observations; this amounts to allowing simultaneous calculation for up to m=5 breaks. A high value of trimming parameter takes care of serial correlation and heterogeneity in error terms across different regimes.

We begin with finding the optimal number of breaks in the series. By default, when implementing BP's technique, it selects the optimal number of breaks as the one achieving the minimum Bayesian Information Criteria (BIC) score. BIC score provides a consistent estimate of the number of breaks; that is, under regularity conditions the probability of underestimating and overestimating the true number of breaks becomes zero. However, BIC tends to underperform if the model has a problem of serially correlated error terms. They also cannot take into account

potential heterogeneity across segments. In that case, BP suggest a method based on the sequential estimates of the breaks. For which $SupF_t(m)$ and $expF_t(m)$ sequential tests are used to test for no structural break versus multiple number of breaks.

The results can be visualized in Figure 1.2, which plots the BIC scores and the residual sum of squares (RSS). We set the command to search up till m = 6 breaks. The BIC score is minimum at one break i-e score of 184.39. Therefore, the program itself chooses one break point, the break date as year 1992, and exhibits the significant drop in the average GDP growth rate from 5.89 percent to 4.04 percent.

The sequential test statistics, $supF_t(m)$ and $expF_t(m)$ values are reported in the table. Here, the $supF_t(m)$ for m=1, where m are the number of breaks, takes the value 12.84 and is therefore highly significant for the presence of one break in the series. Similarly, $expF_t(m)$ takes the value 3.67 and is significant. Both the forms of sequential tests are highly significant and significantly choose one breakpoint in the data, even after accounting for the possibility of multiple breakpoints. For better understanding, the sequential F-statistics can be plotted for each year.

Figure 1.3 shows the sequential F-statistics plot. The maximum value of the F-statistics 12.84 is indicated by the peak in the plot. The value lies significantly above the critical region and identifies the year 1992, as the most significant break date in the series. Again, the sequential test results favor our first hypothesis of observing a discrete change in GDP growth.

Therefore, the series of tests under BP's technique, all identify a single most significant regime-specific mean shift in GDP growth in the year 1992. And they show that average GDP

growth dropped from 5.89 percent between 1973 and 1992 to 4.04 percent post 1992. BP's technique entirely supports our hypothesis of having a discrete drop in GDP growth. Accordingly, Figure 1.4 illustrates our hypothesis, showing the discrete drop in average GDP growth in the year 1992. And shows that average GDP growth drops from a higher value of 5.89 percent in the period 1973 to 1992, to a lower value of 4.04 percent post 1992. The discrete drop is well within the 95 percent confidence as shown by the interval line around the break date.

Andrews (1993) test for identifying a single break at an unknown time

Unlike BP, Andrews (1993) procedure works to detect a single mean shift at an unknown time. The major difference between the two is that the BP tests the null posit of no break versus an alternative of multiple breaks. However, Andrews (1993) procedures test for an alternative of a single break in the data at an unknown time. And in this case, if more than one structural break is present in the series, the break identified using this procedure will be biased. For this reason, BP performs better than any other method because it accounts for all the possible breakpoints while identifying the significant break. We now validate our single break date result from the previous section using Andrews (1993) procedure.

Andrews (1993) suggested using supremum tests based on the maximum sample tests to detect a single break date. We use Stata software to run this test. Based on the maximum sample test value, the software identifies the year 1993 as a break date. Corresponding to the break date, the sup-Wald test statistic reported in Table 1.1 has a value 12.84 and is highly significant. The break date chosen here can be taken as a very close approximation of the break date identified under BP's method. The results using the supremum test to detect a single break date further support our hypothesis of a discrete change in average GDP growth.

Having performed these tests to determine an unknown break date in GDP growth, we now proceed to test for the identified know break date at 1992.

Chow's test for a single break at a known time

We follow the Chow (1960) procedure to test the significance of a known break date. Unlike BP and Andrew's methodology, this procedure works a bit differently. It tests the null hypothesis that there is no structural break against the alternative that there is a known structural break at a specified time. The test considers a linear model split into samples at a predetermined break point and tests the equality of parameters across subsamples.

To apply the procedure in our case, we specify the break date as the year 1992 and run the LR test. The reported LR test in Table 1.1 has a value 8.97 and is highly significant. Therefore, the Chow (1960) type test confirms Year 1992 as a significant structural break in GDP growth series. The results further add to support our first hypothesis of observing a discrete drop in GDP growth.

Dummy regression to test for a known break date

The break identified in the previous section can be tested using an intercept dummy in our structural change model, equation (1), using the following specification,

$$g_t^Y = \beta + \theta DU_t + u_t, \qquad (\mathbf{12})$$

Where, g_t^Y represents real GDP growth and DU_t is the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise.

Specification (12) allows us to check whether GDP growth exhibits a downwards or upwards trend.

Table 1.2 reports the results for specification (12). The dependent variable is the GDP growth, and the explanatory variable is the break dummy for the year 1992. The coefficient of the break dummy variable, θ takes the value -1.84 and is highly significant. The coefficient shows that after 1992, on average the GDP growth drops by 1.84 percent. Our break dummy result remains robust to the inclusion of a lagged GDP growth variable as an additional explanatory variable in the break dummy model. Again, the dummy regression significantly supports our first hypothesis and we may conclude that there has been a structural break and a drop in GDP growth after the year 1992.

The extensive application of three procedures, BP, Andrews (1993) and Chow (1960) and the dummy regression analysis consistently choose the year 1992 as a break date in GDP growth. And they show that after 1992, GDP growth dropped significantly by 1.84 percent. Therefore, our first set of results in this section significantly support our first hypothesis. And we can conclude that there has been a discrete drop in GDP growth in the year 1992. And that pre 1992 can be considered as a high growth phase and post 1992 can be considered a low growth phase.

2.8.1.2 Regime Switching Analysis

Our tests for Hypothesis 1 in Section 2.7.1 above, have supported the hypothesis based on average GDP growth rates. Shows that on average GDP growth drops significantly by 1.84% post 1992.

However, recalling Figure 1.1, the GDP growth series shows considerable fluctuations along its long run growth path, in both periods, pre 1992, and post 1992. While our argument in Essay One, and our Hypothesis 1 is based on demonstrating just an average drop in GDP growth post 1992. But, the argument is further strengthened if the fluctuations in GDP growth pre 1992 lower growth by less than the fluctuations post 1992. To test this, we use a Markov switching regime model.

The essence of the model is that, in our case for GDP growth, it sets up two regimes, high GDP growth, and low GDP growth. The discrete drop in GDP growth at 1992 observed above, allows us to divide our time series for GDP growth into these two time periods, or phases, pre 1992, and post 1992. Referred to as, a regime switching model, and based on non-linear regressions, this technique estimates parameters for different regimes, gives the transitional probabilities to stay in the regime, and the probability to shift out of and move to the other regime, and gives the duration to persist in a particular regime.

A Markov regime switching model for GDP growth

Under the various categories of regime switching models, we apply the Markov regime switching model to our GDP growth series. Markov models are suitable for series that exhibit distinct dynamic patterns during different time periods.

Recalling from our methodology section 2.7 above, we use the original variant of the Markov switching model, given by Hamilton (1988,1989), the one that examines the mean behavior in series. Making use of the original model, we can model the two regime GDP growth model as;

$$g_t^y = \begin{cases} \beta_0 + \varepsilon_t, & s_t = 0 \\ \beta_0 + \beta_1 + \varepsilon_t, & s_t = 1 \end{cases} \qquad (\mathbf{13})$$

s_t , denotes an unobservable state variable assuming the value one or zero. g_t^Y, denotes GDP growth rate. The average GDP growth rate takes the value β_0 when $s_t = 0$. And when the regime switch takes place, s_t changes from zero to one, while the average GDP growth rate takes the value $\beta_0 + \beta_1$. Here, the unobservable state variable captures the effect of regime shift in the model.

Estimating the Markov regime switching model

For estimating the Markov regime switching model for GDP growth as represented by equation (13), we make use of the break result found in the previous section. The break year specified as Year 1992, allows us to divide our whole sample, from 1973-2017, into two sub samples, pre 1992 and post 1992. Again, recalling from the previous section findings, Pre 1992 is characterized as high growth phase and post 1992 is characterized as low growth phase. We run the regime switching model separately on these two samples.

Regime specific Average growth rates

Table 1.3 gives the results for the Markov regime switching model for GDP growth for two sub samples, Pre 1992 and Post 1992. The dependent variable in both the samples is real GDP growth rate. For each of the samples, we can have two switching regimes for GDP growth. Regime 1 is the low growth and Regime 2 is the high growth regime. Following that, a low growth regime 1 has a low average growth rate. And a high growth regime 2 has a high average

growth rate. Recalling our first set of tests, a significantly higher GDP growth pre 1992 and a lower GDP growth post 1992. We would expect the following:

In the pre 1992 period, an average higher GDP growth rate should imply even its low growth fluctuations, now called low growth regimes, will still have higher average GDP growth rates. And in the post 1992 period, a lower average GDP growth rate should imply that its low growth fluctuations, now called low growth regimes, will have lower average GDP growth rates.

And vice versa. On average, a high GDP growth value pre 1992, should imply that its high growth fluctuations, now called high growth regimes, will have higher average GDP growth rates. And in the post 1992 period, a lower average GDP growth rate should imply that its high growth fluctuations, now called high growth regimes, will have lower average GDP growth rates.

That is indeed the case as shown by the estimated values in Table 1.3. Even the low growth regime in the pre 1992 period, has a higher average GDP growth rate of 4.6%, compared to the low growth regime in the post 1992 period with a lower average growth rate of 3.2%.

And the high growth regime in the pre 1992 period, has a higher GDP growth rate of 7.3%, compared to the high growth regime in the post 1992 period with a lower GDP growth rate of 5.7%.

So both the average highs and average lows, are higher pre 1992, compared to post 1992.

Regime specific transitional probabilities

Then, having established the results for the average GDP growth rates for the two regimes, we next examine the probabilities of switching, from a low growth to low growth

regime, and from a low growth to high growth regime. Again based upon our first set of results, we would expect that the probability of going from low to low would be lower Pre 1992 and the probability of going from low to high would be higher Pre 1992. Again, that is exactly the case as shown by Table 1.3. The Low to Low growth probability is much lower at 0.52 pre 1992, against 0.86 post 1992. And the probability of going from low to high growth is much higher pre 1992, at 0.47, as compared to 0.13 post 1992.

For the remaining set of probabilities, we would expect a higher probability of going from a high to high growth rate regime for Pre 1992. And a lower probability of going from a high to a low growth regime for Pre 1992. However, the results in this case are contra our expectations. As our estimates show, there is a lower probability of 0.45, to remain in a high growth regime pre 1992, compared to a higher probability of 0.75 post 1992. And there is a higher probability of 0.54, of going from a high to a low growth regime pre 1992, compared to a lower probability 0.24 0. for post 1992.

Regime specific duration

Lastly for duration estimates, we expect the low growth duration to be lower Pre 1992 as compared to post 1992. That is indeed the case for our values. Estimated duration for low growth regime Pre 1992 is 2.1 years in comparison to Post 1992 low growth duration for which the value is 7.5 years. These results also add support to our first set of results

Additionally, we would expect the high growth duration to be higher Pre 1992 as compared to Post 1992. The estimated values came contrary to our expectations. As the high growth duration Post 1992 is estimated as 4.5 years as compared to Pre 1992 value of 1.8 years.

Therefore, many of the results under the regime switching analysis accorded with our expectations. The average highs and the lows in GDP growth rates were both higher pre 1992, compared to post 1992. The probability of staying low was lower pre 1992, compared to post 1992. And the probability of going from low to high was higher pre 1992, compared to post 1992. While the duration of lows was shorter pre 1992, compared to post 1992.

Summarizing section 2.8, we tested our first hypothesis of having a discrete reduction in GDP growth. We used two techniques, structural change and regime switching. Both techniques gave us consistent and parallel results. We significantly identified and tested the structural break in the Year 1992. That enabled us to analyze GDP growth for two time periods, Pre 1992 and Post 1992. The average GDP growth significantly dropped from 5.89 percent Pre 1992 to 4.04 percent Post 1992. On the basis of average growth rates, we categorized Pre 1992 as high growth phase and Post 1992 as low growth phase. The next step in our analysis is to econometrically and statistically test our second hypothesis. That the drop in GDP growth can be better explained by the drop in investment growth Post 1992. For that, the proceeding section seeks to explain the second set of hypotheses.

2.8.2 Discrete reduction in GDP growth explained by the macro aggregate of investment

Having established in the previous section 2.8.1 that there has indeed been a statistically significant drop in Pakistan's GDP growth from 1992. We now seek to explain the drop in GDP growth using the macro aggregates from our theoretical framework, of consumption, investment, government expenditure and exports. The series for the macro aggregates will therefore also be observed over the time period 1973-2017, as our GDP growth series.

Our Hypothesis 2a expects, however, that of the explanatory macro aggregates of consumption, investment, government expenditure, and exports, it is investment growth that will follow the pattern of the drop in GDP growth.

Hypothesis 2a: There has been a significant drop in the investment growth over the time period 1973-2017.

To test this hypothesis requires a functional form that uses just growth in each explanatory macro aggregate, and tests each for breaks, using structural break analysis. That is indeed our aim in this section 2.8.2.1, to test whether the break in investment growth coincides with the break in GDP growth.

Our Hypothesis 2b goes on further to specify that of the explanatory macro aggregates, it is investment growth that will explain high GDP growth in the first pre 1992 period, and a drop in this investment growth will explain the drop in GDP growth post 1992.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

To test this hypothesis now requires a distinctly separate functional form. This is based on equation (8) above from our theoretical framework.

$$\Delta Y/Y = \Delta C/C + \Delta I/I + \Delta G/G + \Delta X/X - \Delta M/M \quad (8)$$

So GDP growth, on the left hand side, is explained by the right hand side variables of investment growth, consumption growth, government expenditure growth, export growth and import growth. And based on our Hypothesis 2b, we expect higher investment growth to explain higher GDP growth in the first phase. And a statistically significant drop in investment growth

explains the drop in GDP growth in the second phase. And that this investment growth variable explains both phases of GDP growth, better than growth in the macro aggregate variables posited by our theoretical framework, of consumption, government expenditure, and exports.

2.8.2.1 Structural break test in the growth of all the explanatory macro aggregates

Our aim in this section is to examine whether the structural break in our key explanatory growth variables, investment growth, consumption growth, government growth and export growth, coincides with the break in GDP growth. Based on our hypothesis 2a, we particularly expect a possible break date in investment growth to coincide with the break date in GDP growth. Recalling from section 2.8.1, 1992 has been identified as the significant break date for the drop in GDP growth. Therefore, in this section we will test our explanatory growth variables for the single most significant mean shift at a known break date, for the year 1992, or fairly approximate to it.

Recalling from our methodology section 2.7 above, one statistical test we will use will be based on a classical Chow (1960) test to check the shift in the series at a known break date. A second econometric test will be based on a dummy regression analysis, to test for the significance of the year 1992, as a break dummy in the growth series.

A structural break test at a known break date for all explanatory macro aggregates

In order to test our explanatory variables growth series for the single mean shift at a known break date, we use the model specified in section 2.1 for GDP growth given by equation (11) above, which was for an unknown break date. This equation (14) can now be specified for a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \qquad (14)$$

Where y_{it} represents growth in variable i in time period t. β_{ij} is regime specific mean growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If *TB* is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \qquad (15)$$

For this model we test the null hypothesis that mean shift parameters do not vary over the subsamples defined by the specified known break date. The known break date *TB*, is taken as the year 1992. As specified earlier in section 2.1, under the structural change analysis for GDP growth. The next step is to apply the model to each of our explanatory growth variables.

Chow's test for a known break date for all explanatory macro aggregates

The Wald test for the known break date using Chow (1960)'s procedure will be performed, to determine a break in growth of the explanatory variables. The explanatory variables are investment growth, consumption growth, government expenditure growth and export growth. We are dropping import growth as a lesser suspect. We apply the test using Stata software. Since, Stata in section 2.8.1, under the heading, Andrew's procedure for an unknown break date, specified year 1993 as the break date for GDP growth. We will use the same date to test if the structural break in the explanatory variables coincides with that of GDP growth.

Table 1.4 reports the findings for the Wald test at a known break date. Of all the explanatory variables, only the investment variable rejects the null posit of having no structural break. The Wald statistics takes the value 2.64 and is significant at a 10 percent level. Which

shows that investment growth has a significant break in the year 1993. For robustness we take another variant of the investment growth variable. It is called as investment growth^2 in Table 1.4, and is calculated as growth in real investment excluding inventories. The Wald test statistics for investment growth^2 is also highly significant, taking a value 3.48. Similarly, the test statistic shows that the investment growth^2 has a significant break in the year 1993. Overall, we can conclude that under Chow (1960)'s testing procedure, the investment growth series showed a significant structural break in the year 1993.

The above exercise provides a valid statistical analysis in support of our hypothesis 2a, that there has been a significant break in the investment growth series. And that the break in the investment growth series coincides with the break in GDP growth.

Dummy regression for testing a known break date in investment growth

The dummy regression model to test for the intercept break is specified for the investment growth variable. We repeat the same exercise performed for GDP growth in section 2.8.I, now for the investment growth variable. The model is given as;

$$g_t^I = \beta + \theta DU_t + u_t, \qquad (16)$$

Where, g_t^I represents real investment growth and DU_t is the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. Specification (17) allows us to check whether investment growth exhibits a downwards or upwards trend.

Table 1.5 reports the results for specification (16). The dependent variables are the investment growth and investment growth2, and the explanatory variable is the break dummy for the year 1992. For investment growth regression, the coefficient of the break dummy variable, θ takes the value -3.11 percent and is significant. The coefficient shows that after 1992, on average the investment growth drops by 3.11 percent. Our break dummy result remains robust to run the same model under the other variant of investment growth variable. Again, the dummy regression significantly supports our hypothesis 2b and we may conclude that there has been a significant drop in investment growth after the year 1992.

Summarizing, the break in investment growth coincided with the break in GDP growth. And our findings from section 2.8.2.1 suggested that on average we observed GDP growth to drop by 1.84 percent after Year 1992. Interestingly, we observed the similar trend for investment growth. As the investment growth dropped on average 3.11 percent after the year 1992. Hence, we can say that the better explanatory variable, coinciding with the downward trend in GDP growth is the investment growth. Since, both the series, GDP growth and the investment growth had a significant drop Post 1992. We may estimate the correlation between the two series across two phases. That are Pre 1992 and Post 1992. If that is the case, we expect higher investment growth to explain higher GDP growth in the first phase, Pre 1992. And a statistically significant drop in investment growth explaining the drop in GDP growth in the second phase, Post 1992. This is a test of our Hypothesis 2b.

2.8.2.2 A test of GDP growth as a function of growth in all the explanatory macro aggregates, consumption, investment, government expenditure, exports and imports

Having provided statistical evidence in support of Hypothesis 2a, there has been a significant drop in investment growth, coinciding exactly with a significant drop in GDP growth. We proceed to test our Hypothesis 2b, which further specifies that GDP growth is explained well by investment growth.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

We test this hypothesis using equation (8)

$$\Delta Y/Y = \Delta C/C + \Delta I/I + \Delta G/G + \Delta X/X - \Delta M/M \quad (8)$$

Where GDP growth, on the left hand side, is explained on the right hand side by investment growth, consumption growth, government expenditure growth, export growth and import growth. We expect higher investment growth to explain higher GDP growth in the first phase, pre 1992. And a statistically significant drop in investment growth explains the drop in GDP growth in the second phase, post 1992.

Empirical Model for Growth

Recalling from our methodology section 2.7 above, denoting equation (8) for brevity as GDP growth g_t^Y, as a function of growth in macro aggregates. The macro aggregates are consumption growth g_t^C, investment growth g_t^I, government growth g_t^G, export growth g_t^X, and import growth g_t^M.

$$g_t^Y = f(g_t^C, g_t^I, g_t^G, g_t^X, g_t^M)$$

The functional form will be estimated using the double log form as following;

$$logy_t = \alpha_0 + \alpha_1 logrealC_t + \alpha_2 logrealI_t + \alpha_3 logrealG_t + \alpha_4 logrealX_t + \alpha_5 logrealM_t + \epsilon_t \quad (17)$$

where, $logy_t$ represents log of real GDP, $logrealC_t$ represents log of real consumption, $logrealI_t$ represents log of real investment, $logrealG_t$ represents log of real government, $logrealX_t$ represents log of real export, and $logrealM_t$ represents log of real import. The double log form coefficients for equation (17) represents the same effect as if the equation was run as a growth equation. For example, α_1, shows the effect of consumption growth on GDP growth. We run this equation independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

Since our aim in this section is to explain drop in GDP growth. And, since the break in investment growth coincided with the break in GDP growth. We would want our investment growth variable to significantly explain the drop in GDP growth variable, as stated in our Hypothesis 2b. Therefore, while estimating equation (17) we would expect the following propositions to hold:

a. The investment growth coefficient α_2, should be positive and significant for both the phases, pre 1992 and post 1992.
b. The investment growth coefficient α_2, should have a higher value pre 1992 as compared to post 1992.
c. The investment growth coefficient α_2, should significantly differ between the two phases.

Results for the Growth Model

The results for running equation (17) for the two phases, pre 1992 and post 1992, are reported in Table 1.6. The left hand side variable is the natural logof real GDP. And the right hand side variables are logof real consumption, the log of real investment, the log of real government expenditure, the log of real exports and the logof realimports. The coefficients are interpreted as the growth coefficients in this functional form. For the consumption growth variable logrealc, a 1 percent increase in consumption growth is associated with a 0.77 percent change in GDP growth pre 1992 and a 0.75 percent change in GDP growth post 1992. Although the two coefficients are significant in each phase, the change between the two coefficients does not differ significantly between the two phases. For the government expenditure growth variable logrealg, a 1 pecent increase in government expenditure growth is associated with a .08 percent growth in GDP pre 1992 and a 0.11 percent growth post 1992. The increase in the coefficient value does not differ significantly between the two phases. Similarly, the coefficients for the other variables, export growth and import growth do not significantly differ between the two phases, and so are not able to provide an explanation for the drop in GDP growth. Finally testing the investment growth variable logreali for the three propositions a,b and c. The investment growth variable, logreali coefficient shows that a 1 percent increase in investment growth is associated with a 0.24 percent increase in GDP growth pre 1992. The coefficient of investment growth drops post 1992 and is associated with 0.17 percent increase in GDP growth. Both the coefficients are significant and positive in both the phases. The investment growth coefficient has a higher value in the first phase pre 1992, and a lower value in the second phase post 1992. And the drop in investment growth coefficient is highly significant between the two phases, pre 1992 and post 1992. All the propositions for investment growth hold true for Hypothesis 2b.

That: *Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.*

Therefore, we conclude in this section 2.8 that, there is strong empirical support for our Hypothesis 2a and 2b:

There has been a significant drop in investment growth over the time period 1973-2017.

And that:

Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

2.8.3 Explaining the trajectory of GDP growth

In our previous sections we posed an explanation to our central problem that there has been a drop in long run GDP growth. Specifically in section 2.8.2 we analyzed GDP growth on its own. We were able to statistically and econometrically determine a structural break in GDP growth in the year 1992. And also that the GDP growth significantly dropped by 1.8 percent post 1992. That enabled us to examine GDP growth under two phases, a high growth phase pre 1992 and a low growth phase post 1992. Following that, our next section 2.8.3 identified investment growth, as the most significant explanatory variable to explain the drop in GDP growth post 1992. As the break in the investment growth variable coincided with the break in GDP growth. Also, the investment growth variable significantly dropped post 1992. But the clinching econometric evidence has come from, high investment growth significantly determining the high GDP growth in the first phase, pre 1992. And low investment growth significantly determining the low GDP growth in the second phase, post 1992.

So far, our analysis was based on the growth of macro aggregates to explain GDP growth. Of those macro aggregates including consumption growth, government expenditure growth, export growth and import growth, investment growth came out to be the most significant determinant of GDP growth.

Now recalling, our theoretical framework takes the economic argument for the determination of GDP growth further, beyond just investment growth. It pairs investment growth with the share of consumption, specifically the Marginal Propensity to Consume (MPC).

This pairing is added by Hypothesis 3, and further nuanced. Because the hypothesis expects that long run GDP growth is better explained through the quantum of investment growth, paired with the marginal propensity to consume. Further, this Keynesian multiplier can be expected to work inversely with the quantum of GDP growth. The marginal propensity to consume is relatively lower when the quantum of investment growth is high. And the marginal propensity to consume is relatively higher when the quantum of investment growth drops. Therefore hypothesis 3 expects that high GDP growth in the first phase, will be explained by high investment growth, paired with a relatively lower marginal propensity to consume on average. While the drop in GDP growth in the second phase, will be explained by a drop in the quantum of investment growth, paired with a relatively higher marginal propensity to consume on average.

Hypothesis 3: Growth in output will be better explained episodically, some cycles being more investment led, others more consumption led, and still others following more balanced growth paths.

Hypothesis 3a: High GDP growth in phase one, will not be equally explained by high investment growth and high consumption growth. If high GDP growth in phase one is explained well by high investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth, in this phase will be low.

Hypothesis 3b: Low GDP growth in phase two, will then equally not be explained by both low investment growth and low consumption growth. If low GDP growth in phase two is explained by low investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth in this phase will be high.

To further clarify, we are now positing that GDP growth is determined through two major channels, an investment channel, and a consumption channel. The investment channel has been strongly corroborated empirically in section 2.8 above. We now wish to test Hypothesis 3 on the consumption channel.

The consumption channel can first be tested conventionally as the established literature does, using the shares of the explanatory macro aggregates in GDP. Equations (10) and (11) from our theoretical framework above do that:

Recalling from our methodology section 2.7 above, one functional form specifies GDP growth as a function of the shares of the explanatory macro aggregates in GDP, at one point in time as:

$$\Delta Y/Y = C/Y + I/Y + G/Y + (X - M)/Y \quad (9)$$

While change over time in these shares gives us the contribution of each share in GDP growth under a standard functional form as:

$$g_t^y = g_t^C \frac{C_{t-1}}{Y_{t-1}} + g_t^I \frac{I_{t-1}}{Y_{t-1}} + g_t^G \frac{G_{t-1}}{Y_{t-1}} + g_t^X \frac{X_{t-1}}{Y_{t-1}} - g_t^M \frac{M_{t-1}}{Y_{t-1}}$$

(10)

The share of each factor is calculated as own growth rate of each factor in time t multiplied by its previous year contribution to the previous year's total output.

These functional forms are tested econometrically in section 2.8.3

But our theoretical framework goes on to further specify the consumption channel, not just in terms of the share of consumption in GDP, but the Marginal Propensity to Consume (MPC), which is the share of consumption in the incremental unit of GDP. This is given by equation (7) from above:

$$Y = I * (1 / 1 - MPC) \quad (7)$$

So investment I determines output Y, but constrained by the share of incremental income that is consumed, which is the MPC.

Our hypotheses 3a and 3b go on further to test the argument established in our theoretical framework, to test this relationship between MPC, investment, and GDP growth. The relationship posited between the two major explanatory macro aggregates of investment and consumption, is an inverse one. Since a high MPC lowers the Marginal Propensity to Save (MPS), and therefore potentially investment. While higher investment, based on a higher MPS, will tend to lower the MPC.

And this inverse relationship between the investment and consumption channels, gives a complex determination of GDP growth in equation (7). With GDP growth, $\Delta Y/Y$, being

determined by the quantum of investment growth, times the Kahn-Keynes multiplier given by the expression 1/(1-MPC).

$$\Delta Y/Y = \Delta I/I * (1 / 1 - MPC) \quad (7a)$$

Now the first part of equation (7a) has already been well established in section II.2 above, as a strongly significant positive relationship. So it is the inverse relationship between investment growth and the MPC that needs to be established. Ultimately giving, for the high GDP growth phase pre 1992, which is investment led, to have a significantly lower value of MPC. And in the lower growth GDP phase post 1992, with an investment drop, to have a higher value of MPC.

This functional form will be tested econometrically in section 2.8.3.1.

2.8.3.1 The significance of the consumption share in determining GDP

Recalling from our methodology section 2.7 above, for the estimation of shares in GDP to test hypothesis 3, we will use two distinct estimation techniques from the literature. The first technique is based on the equation (9) of our theoretical model. According to that, we estimate GDP growth using the following mathematical form,

$$g_{it}^{y} = \alpha_{i0} + \alpha_{i1} sharec_t + \alpha_{i2} sharei_t + \alpha_{i3} shareg_t + \alpha_{i4} sharex_t + \alpha_5 sharem_t + \epsilon_{it} \quad (10)$$

where *i* represents two phases, pre 1992 and post 1992. g_{it}^{y} represents the annualized real GDP growth rate. $sharec_t$ represents the share of consumption in GDP, $sharei_t$ represents the share of investment in GDP, $shareg_t$ represents the share of government expenditure in GDP, $sharex_t$ represents the share of exports in GDP, and $sharem_t$ represents the share of imports in GDP.

Reiterating the main aim of the section that we have to explain GDP growth in two phases. We estimate equation (9), independently for two periods, pre 1992 and post 1992. The results are reported in Table 1.7. The coefficients using this simplified functional form to capture shares in GDP, do not perform according to our expectations.

We then proceed to the second functional form for estimation of growth in shares in GDP. The mathematical form is specified by Clementi's (2015) methodology as discussed above in our theoretical framework, and given by equation (9):

$$g_t^y = g_t^C \frac{C_{t-1}}{Y_{t-1}} + g_t^I \frac{I_{t-1}}{Y_{t-1}} + g_t^G \frac{G_{t-1}}{Y_{t-1}} + g_t^X \frac{X_{t-1}}{Y_{t-1}} - g_t^M \frac{M_{t-1}}{Y_{t-1}} \quad (10)$$

Where the g_t^y represents real GDP growth, $g_t^C \frac{C_{t-1}}{Y_{t-1}}$ represents the contribution of the consumption share in GDP growth, $g_t^I \frac{I_{t-1}}{Y_{t-1}}$ represents the contribution of the investment share in GDP growth, $g_t^G \frac{G_{t-1}}{Y_{t-1}}$ represents the contribution of the government share in GDP growth, $g_t^X \frac{X_{t-1}}{Y_{t-1}}$ represents the contribution of the export share in GDP growth, and $g_t^M \frac{M_{t-1}}{Y_{t-1}}$ represents the contribution of the import share in GDP growth.

We calculate the contribution of the shares for each variable in each year. For the whole time series running over both time periods. We then test this share series for structural breaks. The result is given in Table 1.8. Which shows that only the investment share has a significant break, and that too in 1992.

To test the direction of the break in 1992, we run the entire series with a dummy for the year 1992. The result in Table 1.9 shows again that of all the contributory shares, the average contribution of the investment share is significantly different across the two time periods. The

investment shares contribution to GDP growth is on average 1.4 percent pre 1992. And then, this contribution significantly drops by 0.9 percent post 1992. The results for all the other shares are not significantly different across the two time periods.

So the use of this established methodology in estimating contributory shares to GDP growth has only served to reinforce the role of investment, in contributing to the higher GDP growth observed pre 1992, and the drop in GDP growth post 1992. We had hoped that it would bring out the role of the second channel contributing to GDP growth, and consumption. But the consumption share and its contribution to GDP growth turns out to be an imperfect expression of the working of this channel.

For which our theoretical framework has gone on to specify that the consumption channel works through not the consumption share but the consumption share in incremental output. Which is the MPC. Which the next section 2.8.3.2 examines.

2.8.3.2 Marginal Propensity to Consume and the determination of GDP

We think that using contributory shares to GDP growth are an imperfect representation of our theoretical framework. Recalling from equation (7) in our theoretical framework, GDP growth is by the quantum of investment growth and the Marginal Propensity to Consume. In section 2.8.3.2 above, we have already established the significance of the quantum of investment growth in explaining GDP growth. However, in our equation (7), we have paired the quantum of investment growth with consumption, by introducing the multiplier term of the MPC. Therefore, our test for Hypothesis 3 has now to be based on estimating the MPC across two phases of GDP growth, pre 1992 with its high GDP growth, and post 1992 with its drop in GDP growth.

Estimating the Marginal Propensity to Consume

Recalling from our methodology section 2.7 above, the MPC is estimated by running the regression of real consumption as a function of real GDP. The regression will be run independently for two time periods, pre 1992 and post 1992. The coefficient of real GDP in each regression gives us the average value for the MPC for each time period, pre 1992 and post 1992. The specification is given as:

$$realC_t = \alpha_{i0} + \gamma_{i1} realGDP_t + \epsilon_{it} \qquad (19)$$

Where *i* represents two time periods, pre 1992 and post 1992, *realC* represents real consumption and *realGDP* represents real GDP. Since, we estimate the equation for two time periods, pre 1992 and post 1992. We will have two estimated values for MPC, represented as, $\gamma_{pre1992,1}$ and $\gamma_{post1992,1}$. Based on the results in section 2.8.3.1. Pre 1992 is considered as high growth phase and Post 1992 is considered as low growth phase.

Accordingly, to support our hypothesis 3a and 3b, we expect the following propositions to hold true.

a. The estimated MPC value for Pre 1992, high growth phase, should be lower than the estimated MPC value for Post 1992, low growth phase. That is $\gamma_{pre1992,1} < \gamma_{post1992,1}$.
b. In addition to proposition (a), the estimated MPC value pre 1992 should be significantly different from the estimated MPC value post 1992. That is $\gamma_{pre1992,1} \neq \gamma_{post1992,1}$

Table 1.10 shows the estimated results for equation (19). The MPC in the high growth phase pre 1992, takes the value 68.5 percent and is highly significant. And the MPC, in the low growth phase post 1992, takes a higher value 76.4 percent and is again highly significant. The estimated values for MPC in the two phases show that the proposition (a) holds. And that the MPC value in the high growth phase is lower than the MPC value in the low growth phase. This result goes to

support our hypotheses 3a and 3b. To test proposition (b), we perform a Chi square test to confirm that the two values are significantly different across the two phases of GDP growth, pre 1992 (MPC = 0.68) and post 1992 (MPC = 0.76). The Chi square test statistic significantly shows that the two coefficients, representing MPC values, are significantly different. This result, supports proposition (b).

Therefore, we can conclude that:

High GDP growth in first phase, pre 1992, is explained by high investment growth. And that the Marginal Propensity to Consume in this phase is low. Making this high GDP growth phase investment led. And that the Low GDP growth in the second phase, post 1992, is again explained by low investment growth. And the Marginal Propensity to Consume, in this phase is higher. Making this phase consumption led.

2.9. Conclusions

2.9.1 Statement of the problem

This thesis aims to establish the determinants of Pakistan's long run GDP growth. The problem of establishing the determinants of GDP growth is a perennial one for all economies to be able to choose their policy levers and gauge their impact more precisely. The problem becomes more acute and even existential for Pakistan, because of an observable long run decline in GDP growth rates. The 60s, 70s and 80s, appear to have had higher growth rates on trend, nearer 6% per annum, compared to the 90s onwards, nearer 4% per annum. Not least the past three years appear to have sunk GDP growth even lower than this 4% trend.

Further, Pakistan's GDP growth also appears to be subject to periodic cycles of instability. Characterized by budget deficits pressuring inflation, and requiring some form of

inflows, also raising debt. Which in turn pressures Current Account deficits. Also not helped by persistent trade deficits. The twin deficits have required periodic recourse to multilateral support to tide over the deficits. Pakistan has entered 23 agreements of support by the IMF to date.

Policy debate, and multilateral and donor advice, we find focus more on the shorter run cyclical concerns and policy variables. These are no doubt important, but they do not address longer run structural factors, such as investment.

Therefore, this Ph.D. thesis attempts to address the long run determinants of trend GDP growth.

This Essay One has focused on explaining the long run growth of output through its structural determinants in a General Equilibrium analysis.

Essay Two will focus on explaining in turn, the growth of the output through its precisely identified structural determinants.

Essay three will drill down for greater granularity in examining the regulatory policy environment which has shaped the precisely identified structural determinants of long run output.

2.9.2 The theoretical framework adopted

Essay One: Explaining the drop in Pakistan's long run GDP growth over time, by assessing the impact of the macro aggregate determinants of output growth.

This Essay one has focused on explaining the observed drop in Pakistan output growth between two time periods, pre 1990, and post 1990. It has done this by examining the impact on output, of the macro aggregate determinants of output growth.

The theoretical framework chosen, has been the Keynesian general equilibrium framework of estimating and analyzing aggregate demand. The alternative framework in the international and Pakistani literature was seen to be the decomposition of output through Swan Solow production functions. We have chosen the Keynesian decomposition of output into the macro aggregate components of aggregate demand, of consumption, investment, government expenditures, exports and imports. For two reasons.

One, the production function uses a more limited number of determinants of output, using only capital, labor, and productivity. Since the growth of the labor force is a very slow moving and less policy amenable variable in the short to medium term, this puts all the determinant eggs into one basket, capital. Productivity itself we consider to be an outcome variable to be explained, merely being output indexed by labor. So it does not seem correct to prejudge the analysis by choosing just one determinant, capital, no matter how logically appealing. Compared to this, the Keynesian determinants, offer a larger choice spread over several more markets than just the capital market. It additionally offers most importantly the goods market, the external tradeables market, and the public goods market.

The neoclassical production function of the Harrod Domar kind also has a theoretical shortcoming in not explaining the capital output ratio well. This is overcome in the Keynesian aggregate demand model by positing the Kahn Keynes multiplier based on consumption. Allowing us to posit a theoretical model of two major determinants of Pakistan's long run GDP growth, in investment and consumption. Further, since higher consumption reduces savings, and therefore potentially domestic investment, the two determinants are posited as tradeoffs. So GDP growth can be investment led. Or consumption led.

Our theoretical framework adopted gives three sets of hypotheses to explain Pakistan's GDP growth in the long run. Data considerations, of consistency and comparability, have made us choose our period of analysis to be 1973 to 2017.

The analytical strategy we have used is to establish first whether there has been a discrete drop in GDP growth at a particular break date. Establishing this break data allows us to define two periods of GDP growth, a higher growth period, followed by a lower growth period. The determinants of GDP growth can then be established, by looking for correlated changes in their behavior between the two time periods.

Hypothesis 1: There has been a discrete reduction in GDP growth over the time period 1973-2017.

Hypothesis 2a: There has been a significant drop in investment growth over the time period 1973-2017.

Hypothesis 2b: Investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

Hypothesis 3: Growth in output will be better explained episodically, some cycles being more investment led, others more consumption led, and still others following more balanced growth paths.

Hypothesis 3a: High GDP growth in phase one, will not be equally explained by high investment growth and high consumption growth. If high GDP growth in phase one is explained well by high investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth, in this phase will be low.

Hypothesis 3b: Low GDP growth in phase two, will then equally not be explained by both low investment growth and low consumption growth. If low GDP growth in phase two is explained by low investment growth, then the Marginal Propensity to Consume, and the consumption share in GDP, and its growth in this phase will be high.

2.9.3 Results

Hypothesis 1.

To test Hypothesis 1 that there has been a discrete reduction in GDP growth between 1973 and 2017, we used the methodology of searching for a break in the series for real GDP growth rates.

A structural break model for GDP growth

We started our empirical analysis with the structural break analysis, using the procedures proposed by Bai and Perron (1998, 2003), henceforth BP, Andrews (1993), and Chow (1960), and lastly, using a dummy regression. A key feature of BP's procedure is that it allowed us to test for multiple shifts in average growth at unknown dates. As compared to Andrews (1993) methodology which tests for a single shift at an unknown date and Chow (1960) which tests for an abrupt mean shift at a known date in the data. Though our aim was to detect a discrete change, nevertheless, it is also feasible to check if the discrete change in series occurred once or at multiple times.

All three procedures, BP, Andrews (1993), and Chow (1960) could be applied using a multiple linear regression model for multiple breaks. For that, we used the structural change

model specified by Clementi et al (2015) based on the established methodology by BP with m breaks.

In support of Hypothesis 1, we found a significant structural break for the year 1992. Running a dummy regression for this known break date, found that GDP growth dropped by 1.84% after 1992.

Markov switching regimes to examine cyclicality in GDP growth

While the structural break procedures have been based on examining the average change in GDP growth rates, both the periods identified, of high growth and low growth were observed to have considerable cyclicality. What would strengthen and supplement the argument for the distinction between the two time periods, would be a demonstration that in the high growth period, both the highs and the lows in GDP growth rates, have been higher than in the highs and the lows in the low growth period. To demonstrate this we have used a Markov Switching Regime Model.

The essence of the model is that, for each of the two time periods, high GDP growth pre 1992, and low GDP growth post 1992, it sets up two regimes, high GDP growth, and low GDP growth. That is, within the high GDP growth period pre 1992, there is now a high growth regime and a low growth regime. The same for the low growth period post 1992, with its high growth regime and its low growth regime. Referred to as, a regime switching model, and based on non-linear regressions, this technique estimates parameters for different regimes, gives the transitional probabilities to stay in the regime, and the probability to shift out of and move to the other regime, and gives the duration to persist in a particular regime.

Most of the results have supported our characterization of pre 1992 as a high growth period and post 1992 as a low growth period. In the high growth period pre 1992, the highs and lows have both been higher than the highs and the lows in the low growth post 1992 period. Further, the probability of switching from a low growth regime to a high growth regime has also been higher in the pre 1992 high growth period, compared to the post 1992 low growth period.

Hypothesis 2: The discrete reduction in GDP growth can be better explained by the macro aggregate of investment

A break in the growth of our explanatory macro aggregates

Hypothesis 2 proceeds in two stages. Support for Hypothesis 1 having established two distinct time periods, pre 1992 marked by high GDP growth, and post 1992 marked by low GDP growth. Our analytical strategy is to establish which of the explanatory macro aggregates follows this pattern of high GDP growth in the pre 1992 period, and low GDP growth in the post 1992 period.

Which implies using the same structural break methodology applied to GDP growth, now for a known break date of 1992, for our explanatory macro aggregates of consumption, investment, government expenditure, exports and imports.

The Wald test for the known break date using Chow (1960)'s procedure was performed, to determine a break in the growth of the explanatory variables. Of all the explanatory variables, only the investment variable rejected the null posit of having no structural break.

Then a dummy regression model to test for the intercept break was specified for the investment growth variable. We repeated the same exercise performed for GDP growth now for the investment growth variable.

For investment growth regression, the coefficient of the break dummy variable, took the value -3.11 percent and is significant. The coefficient shows that after 1992, on average the investment growth drops by 3.11 percent. the break in investment growth coincided with the break in GDP growth. And our findings from section 2.9.1 suggested that on average we observed GDP growth to drop by 1.84 percent after Year 1992. Interestingly, we observed a similar trend for investment growth. As the investment growth dropped on average 3.11 percent after the year 1992.

GDP growth explained by growth in our macro aggregates

Having established that of all the explanatory macro aggregates only investment growth had a significant drop post 1992, following the drop in GDP growth, we proceeded to the next step of testing whether GDP growth was indeed a function of its explanatory macro aggregates, as in Hypothesis 2b.

Where GDP growth, on the left hand side, is explained on the right hand side by investment growth, consumption growth, government expenditure growth, export growth and import growth. The hypothesis expected higher investment growth to explain higher GDP growth in the first phase, pre 1992. And a statistically significant drop in investment growth explains the drop in GDP growth in the second phase, post 1992.

The functional form was estimated using a double log form as follows;

$$logy_t = \alpha_0 + \alpha_1 logrealC_t + \alpha_2 logreallI_t + \alpha_3 logrealG_t + \alpha_4 logrealX_t + \alpha_5 logrealM_t + \epsilon_t \quad (17)$$

where, $logy_t$ represents log of real GDP, $logrealC_t$ represents log of real consumption, $logreallI_t$ represents log of real investment, $logrealG_t$ represents log of real government, $logrealX_t$ represents log of real export, and $logrealM_t$ represents log of real import. The double log form coefficients for equation (17) represent the same effect as if the equation was run as a growth equation. For example, α_1, shows the effect of consumption growth on GDP growth. We ran this equation independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

Since our aim in this section was to explain a drop in GDP growth. And, since the break in investment growth coincided with the break in GDP growth. We wanted our investment growth variable to significantly explain the drop in GDP growth variable

a. The investment growth coefficient α_2, should be positive and significant for both the phases, pre 1992 and post 1992.
b. The investment growth coefficient α_2, should have a higher value pre 1992 as compared to post 1992.
c. The investment growth coefficient α_2, should significantly differ between the two phases.

As expected, only the investment growth variable consistently explains GDP growth across the two time periods, pre 1992 and post 1992. The investment growth variable, logreali coefficient showed that a 1 percent increase in investment growth was associated with a 0.24 percent increase in GDP growth pre 1992. The coefficient of investment growth dropped post

1992 and was associated with 0.17 percent increase in GDP growth. Both the coefficients were significant and positive in both time periods. The investment growth coefficient had a higher value in the first phase pre 1992, and a lower value in the second phase post 1992. And the drop in investment growth coefficient was highly significant between the two phases, pre 1992 and post 1992. All the propositions for the investment growth variable held true to prove Hypothesis 2b.

Hypothesis 3: The trajectory of GDP growth is even better explained episodically, with a high growth phase led by the quantum of investment, and a low growth phase led by consumption.

Having established that the drop in Pakistan's GDP growth between the two time periods pre 1992 and post 1992, is well explained by the drop in investment growth. This essay has attempted to go further. The theoretical framework adopted of the Kahn Keynes investment multiplier being based on Marginal Propensity to Consume (MPC), implied that there could be two channels working to determine long run GDP growth, the investment channel and the consumption channel.

A further nuance was added by the implication of the two channels having a possible tradeoff. If the MPC rises, savings fall, and therefore also domestic investment and potentially total investment. Which gives the possibility that different episodes of GDP growth could be investment led, or consumption led.

Given our findings so far, a period of high GDP growth pre 1992 was strongly correlated to high investment growth, while the following period of low GDP growth post 1992 was again strongly correlated to lower investment growth, then implied the following for Hypothesis 3.

Essentially, the high GDP growth period pre 1992 would be investment led, with a weaker consumption channel. While the low GDP growth period post 1992 would be consumption led, with a stronger consumption channel.

Decomposition of GDP growth into contributing shares of the explanatory macro aggregates

The question remained, of how to test the consumption channel. The international literature does not actually test for this tradeoff between investment and consumption, which to our knowledge is uniquely being posited in this essay. But does estimate contributory shares to growth.

A simpler functional form specified GDP growth as a function of the shares of the explanatory macro aggregates in GDP, at each point in time. This did not prove useful empirically. A more complex form given by the international literature allowed estimation of the share of each factor to be calculated as the own growth rate of each factor in time t multiplied by its previous year's contribution to the previous year's total output.

We calculated the contribution of the shares for each variable in each year. For the whole time series running over both time periods. We then tested this share series for structural breaks. The result showed that only the investment share had a significant break and that too in 1992.

To test the direction of the break in 1992, we ran the entire series with a dummy for the year 1992. The result in Table 1.9 shows again that of all the contributory shares, the average contribution of the investment share was significantly different across the two time periods. The investment share's contribution to GDP growth was on average 1.4 percent pre 1992. And then,

this contribution significantly dropped to 0.48 percent post 1992. The results for all the other shares were not significantly different across the two time periods.

So the use of this established methodology in estimating contributory shares to GDP growth, served only to reinforce the role of investment, in contributing to the higher GDP growth observed pre 1992, and the drop in GDP growth post 1992. We had hoped that it would bring out the role of the second channel contributing to GDP growth, consumption. But the consumption share, and its contribution to GDP growth turned out to be an imperfect expression of the working of this channel.

Estimating the Marginal Propensity to Consume

However, our theoretical framework based on the Kahn Keynes multiplier offered a better functional form for the estimation of the consumption channel. That GDP growth is determined by the quantum of investment growth and the Marginal Propensity to Consume. We had already established the significance of the quantum of investment growth in explaining GDP growth. Therefore, our test for Hypothesis 3 had now to be based on estimating the MPC across two phases of GDP growth, pre 1992 with its high GDP growth, and post 1992 with its drop in GDP growth.

The MPC was estimated by running the regression of real consumption as a function of real GDP. The regression was run independently for two time periods, pre 1992 and post 1992. The coefficient of real GDP in each regression gives the average value for the MPC for each time period, pre 1992 and post 1992. Recalling the specification:

$$realC_t = \alpha_{i0} + \gamma_{i1} realGDP_t + \epsilon_{it} \qquad (19)$$

Where *i* represents two time periods, pre 1992 and post 1992, *realC* represents real consumption and *realGDP* represents real GDP. We estimated the equation for two time periods, high GDP growth pre 1992, and lower GDP growth post 1992. We got two estimated values for MPC, represented as, $\gamma_{pre1992,1}$ and $\gamma_{post1992,1}$.

Accordingly, to support our hypotheses 3a and 3b, we expected that:

a. The estimated MPC value for Pre 1992, high growth phase, should be lower than the estimated MPC value for Post 1992, low growth phase. That is $\gamma_{pre1992,1} < \gamma_{post1992,1}$.
b. In addition to proposition (a), the estimated MPC value pre 1992 should be significantly different from the estimated MPC value post 1992. That is $\gamma_{pre1992,1} \neq \gamma_{post1992,1}$

The estimated results showed that the MPC in the high growth phase pre 1992, was 68.5 percent and highly significant. And the MPC, in the low growth phase post 1992, was 76.4 percent and again highly significant. We then ran a Chi square test which confirmed that the two coefficients, representing MPC values, were significantly different.

Therefore, we can conclude that:

High GDP growth in first phase, pre 1992, is explained by high investment growth. And that the Marginal Propensity to Consume in this phase is low. Making this high GDP growth phase investment led. And that the Low GDP growth in the second phase, post 1992, is again explained by low investment growth. And the Marginal Propensity to Consume, in this phase is higher. Making this phase consumption led.

2.9.4 The value added of this essay to the international and domestic literature

Hypothesis 1 and findings for it:

This essay establishes empirically that Pakistan's long run GDP growth between 1973 and 2017, falls into two distinct time periods. A high GDP growth period from 1973 to 1992. And a lower GDP growth rate period post 1992, when the growth rate significantly falls by 1.84% per annum on average.

The publicly available literature on Pakistan does not either pursue such a characterization of Pakistan's long run GDP growth or empirically estimate it. Our use of structural break methodology appears to be a first in the growth literature on Pakistan.

We have not been able to find a paper extensively performing structural break analysis for the GDP growth of Pakistan. In fact, identifying structural breaks and controlling for the break in the growth series holds major significance in international literature and in time series econometrics. Especially estimating relationships between economic variables and forecasting economic series. Not incorporating the structural breaks while estimating the relationships may end up giving spurious correlations. And in case of forecasting GDP for policy purposes, not incorporating breaks can lead to unreliable results and inaccurate forecasting.

In this regard, the test for our first hypothesis that there has been a discrete reduction in the GDP growth rate of Pakistan is significant. On the basis of the structural change analysis, we were able to detect a regime change and were able to analyze the economy, logically under two growth phases. A high growth phase and a low growth phase. The structural break result on its own is a very useful tool for econometricians working with GDP growth series. Using our results, while controlling for the break can improve the efficiency and reliability of economic forecasts.

Hypothesis 2 and findings for it:

This essay establishes empirically that the two distinct time periods, of high GDP growth, pre 1992, and significantly lowered GDP growth post 1992, are strongly and significantly correlated to high investment growth pre 1992, and significantly lowered investment growth post 1992.

The literature on Pakistan does not provide such an empirically well-established determinant of its long run GDP growth, explaining both its high growth and low growth phases.

The literature on Pakistan broadly looks at the determinants of growth. What is missing in the literature is an explanation of the central problem of GDP growth dropping discretely from an average of 6 percent per annum to an average of 4 percent per annum. We think that the answer to that ultimately lies in our findings for hypothesis 2. Using, two sets of analysis, coincidence in structural breaks and growth regressions, we uniquely identified investment growth as a key determinant explaining the discrete drop in GDP growth. Though the existing literature identifies investment as an important explanatory variable for GDP growth, however, our empirical strategy to identify investment as the single most important explanator becomes significant addition to the literature. We were able to show, that the structural break in investment growth coincided with the break in investment growth and that investment growth significantly explains high GDP growth in the first phase and a drop in investment growth explains the drop in GDP growth in the second phase.

We would venture that even in the international literature, this analysis becomes important. According to time series econometricians, identifying a break in the series is not regarded as a very complex task since there are tests and procedures available to perform that. What is complex in this regard is identifying the key determinants that explain the identified break in the series. And our findings suggest that we have been able to explain the break.

Hypothesis 3 and findings for it:

This essay theoretically pairs two channels as determinants of GDP growth in general, investment and consumption. And it theoretically posits an inverse relationship between these two channels.

This essay then empirically demonstrates the working of these two channels, and their tradeoff to explain Pakistan's long run GDP growth. It shows that Pakistan's GDP growth can be explained episodically. The pre 1992 high GDP growth period was led by investment growth. And the post 1992 lower GDP growth period was led by elevated consumption in the form of the Marginal Propensity to Consume.

Our survey of the theoretical literature on growth does not show such a pairing of the explanators of the investment and consumption channels. Nor does the international literature posit a tradeoff between the investment and consumption channels. Nor have seen we seen an empirical estimation of this posited tradeoff between the investment and the consumption channels.

2.10 Tables and Figures

Table 1.1: Structural break In Real GDP Growth Series 1973-2017

Result Using R 'strucchange' Package			
Unknown Break Date	Tests Statistics and Probability		
	Test	Statistics	P-Value
Year 1992	$supF_t$ (1)	12.84***	0.0073
Year 1992	$expF_t$ (1)	3.67***	0.0056
	CUSUM	1.57***	0.0104
	BIC selection	One Break selected : **Year 1992**	Intercept Change: 1974-1992: 5.89% 1993-2017: 4.04%
	Recursive F statistics	Maximum at Year 1992	

Results Using Stata				
Unknown Break date	Break at Year 1992±1	Test Statistics and Probability		
		Test	Statistics	P-Value
Year 1993		swald	12.84***	0.0069
	Year 1992	LR	8.97***	0.0028

Figure 1.2: BIC and Residual Sum of Squares

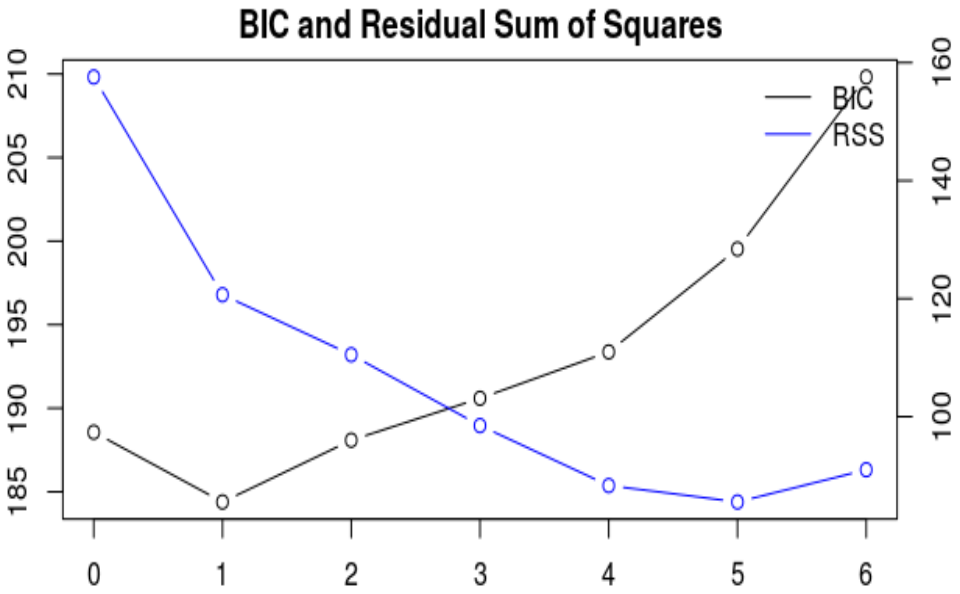


Figure 1.3: Recursive F-statistics

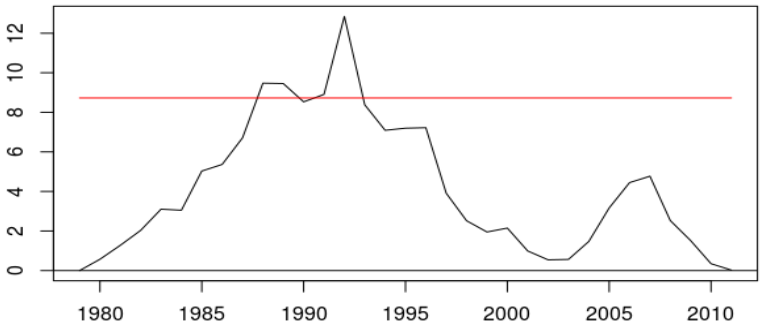


Figure 1.4: Structural Break in GDP growth

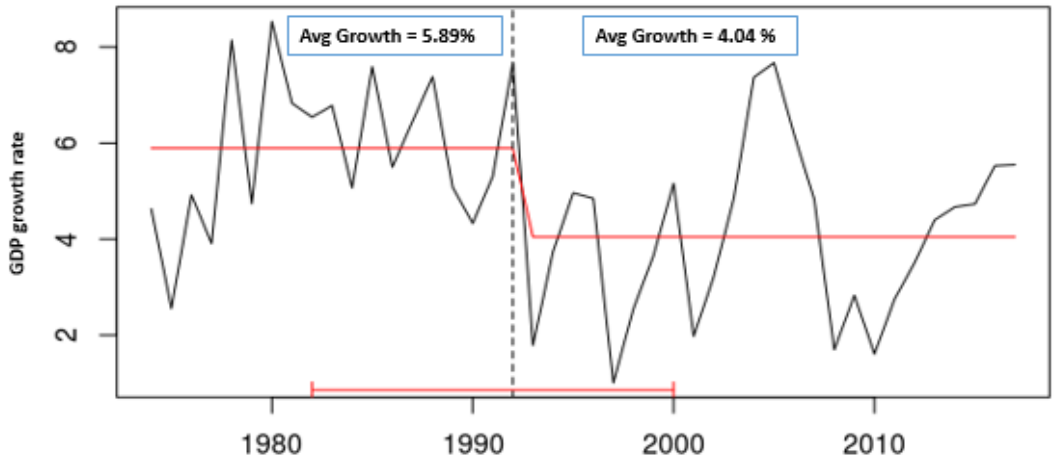


Table 1.2: Dummy regression for testing a known break date

VARIABLES	(1) Dependent Variable GDP growth	(2) Dependent Variable GDP growth
Dummy1992	-1.849***	-1.524**
	(0.516)	(0.572)
$GDP\ growth_{t-1}$		0.238
		(0.148)
Observations	44	43
R-squared	0.234	0.291

a. Robust errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable $Dummy1992_t$ =1, for t >1992, DU_t =0 otherwise. GDP growth t-1 is one time period lag of Real GDP growth

Table 1.3: Markov Switching Regime Model

	Pre 1992	**Post 1992**
Regime 1: Low Growth Average GDP growth rate	4.6	3.2
Regime 2: High Growth Average GDP growth rate	7.3	5.7
Probability Low Growth-Low Growth	0.52	0.86
Probability High Growth-High Growth	0.45	0.75
Probability Low Growth-High Growth	0.47	0.13
Probability High Growth-Low Growth	0.54	0.24
Duration: Low Growth	2.1 years	7.5 years
Duration High Growth	1.8 years	4.1 years

Table 1.4: A break in the growth of our explanatory macro aggregates

Variable Description	Break at the year1992 ± 1	Tests and Probability		
		Test	Statistics	P-Value
Real GDP Growth	**1992**	**$\chi^2(1)$**	**8.97****	**0.0028**
Real Consumption Growth	1992	$\chi^2(1)$	0.29	0.5829
Real Investment Growth	**1993**	$\chi^2(1)$	**2.64***	**0.0906**
Real Investment growth[2]	**1993**	$\chi^2(1)$	**3.19***	**0.0621**
Real Government Growth	1992	$\chi^2(1)$	1.64	0.2001
Real Export Growth	1992	$\chi^2(1)$	1.06	0.3024
Real Import Growth	1992	$\chi^2(1)$	0.0027	0.9584

Real Investment Growth[2]=Real Investment Growth-Inventories

Table 1.5: Dummy regression for testing a known break date in investment growth

VARIABLES	(3) Real investment growth	(4) Real investment growth^2
Dummy 92	-3.11* (1.80)	-3.46* (1.94)
Observations	44	44
R-squared	0.059	0.071

a. Robust Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable $Dummy92_t$ =1 for T>1992, $Dummy92_t$ =0,otherwise.

Table 1.6: Empirical Estimation for Growth

VARIABLES	(1) Dependent Variable log(realGDP) Pre 1992	(2) Dependent Variable log(realGDP) Post 1992	Difference
log(consumption)	0.778***	0.755***	0.023
	(0.0159)	(0.00692)	
log(investment)	0.239***	0.171***	0.068***
	(0.0166)	(0.00919)	
log(government)	0.0855***	0.117***	-0.025
	(0.0101)	(0.00473)	
log(exports)	0.130***	0.137***	-0.007
	(0.00248)	(0.00572)	
log(imports)	-0.230***	-0.165***	-0.07***
	(0.0106)	(0.00899)	
Observations	20	25	
D-watson	2.44	2.41	
KPSS on residuals	0.396	0.171	
KPSS 5% critical value	0.463	0.463	
R-squared	1.000	1.000	

a. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
b. The coefficients of the model are consistent in the case of FMOLS (fully modified OLS) and DOLS (dynamic OLS).
c. D-Watson value provides no evidence of autocorrelation.
d. All the variables in the model are integrated to order one, hence the variables are conitegrated and the OLS regression yields consistent results.
e. Johanson multivariate cointegration shows we cannot reject the hypothesis of a cointegrating rank at 5% confidence interval

Dependent variable: GDP growth

Table 1.7: Growth regressions with Shares

	(1)	(2)
VARIABLES	pre92	post92
Sharei	0.324	-0.236
	(0.323)	(0.149)
sharec	0.350	0.0392
	(0.233)	(0.309)
shareg	0.663	-0.162
	(0.462)	(0.457)
sharex	0.933	0.148
	(0.571)	(0.361)
Observations	19	25
R-squared	0.184	0.120

a. Robust Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 1.8: Structural Break in Contribution to Real GDP growth rate 1973-2017

Results Using Stata Software					
Variable Description	Unknown Break Date	Break at the year1992 ± 1	Tests and Probability		
			Test	Statistics	P-Value
c	1986		SupW	4.68	0.2827
		1992	$\chi^2(1)$	0.69	0.4038
i	1994		SupW	6.04	0.1504
		1992	$\chi^2(1)$	**3.74****	**.0501**
g	1990		SupW	3.61	0.4363
		1992	$\chi^2(1)$	1.64	0.2001
x	2011		SupW	2.42	0.6821
		1992	$\chi^2(1)$	0.23	0.6315
m	1981		SupW	4.38	0.3198
		1992	$\chi^2(1)$	0.30	0.5792

Note: c represents "contribution of consumption share in real GDP growth", i represents "contribution of investment share in real GDP growth", g represents "contribution of government share in real GDP growth", x represents "contribution of exports share in real GDP growth", and m represents "contribution of import share in real GDP growth".

Table 1.9: Dummy regressions for contribution of investment share to Real GDP growth

	(1)
VARIABLES	i
Dummy92$_t$	-0.925**
	(0.378)
Constant	1.408***
	(0.285)
Observations	44
R-squared	0.125

a. Robust Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 1.10: Regression Result for Marginal Propensity to Consume

Dependent Variable: Real Consumption

VARIABLES	(1) Dependent Variable Real Consumption Pre 1992	(2) Dependent Variable Real Consumption Post1992	(3) Dependent Variable Real Consumption Post 1992 – Pre 1992
RealGDP	0.686*** (0.0248)	0.765*** (0.0159)	.079***
Observations	20	25	
KPSS on residuals	0.261	0.129	
KPSS 5% critical value	0.463	0.463	
R-squared	0.980	0.992	

a. Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
b. The difference reported in column (3) is highly significant p<.001.

3. Essay Two: What are the determinants of the main driver of growth in Pakistan, investment

3.1 Recapping Essay One

Essay one established that investment growth explained the high growth of GDP.

When output and investment growth were high, the other major driver of output growth was low: the Marginal Propensity to Consume (MPC)

When output and investment growth were low, the MPC rose.

This trade-off between investment and consumption is predicted by the Keynesian model of the two determinants of output growth being investment and the multiplier. The multiplier is based on the MPC which is a reciprocal of the Marginal Propensity to Save (MPS). Since the MPS will be positively correlated to investment, hence the MPC can be expected to be negatively correlated to investment; which implies an expected trade-off between investment and consumption as the two main drivers of growth of output.

This was empirically observed.

Therefore, Essay 1 established the two main drivers of growth: investment and consumption. We now need to examine the determinants in turn of these two main drivers, investment and consumption.

The determinants of investments and consumption will be examined through two notions:

1. Supply side determinants in partial equilibrium.
2. Demand side determinants in partial equilibrium.

3.2 Theoretical Framework

3.2.1 Supply side determinants of investment and consumption

To capture the supply side determinants of investments and consumption, we take our mother macro equation:

$$Y = C + I + G + NX \qquad (1)$$

Where the current account (CA) is open, but the capital account (KA) is closed. So goods are traded globally, between Pakistan and the rest of the world, NX. But there are no claims to assets by the rest of the world investing in Pakistan, or Pakistan investing in the rest of the world

Following Christina and David Romer, and Mankiw, we can now open the KA thus, with Net Outflows CF :

$$Y = C + I + G + CF \qquad (2)$$

Where, Net Outflows CF, are given by Capital Outflows CO, minus Capital Inflows CI:

$$CF = CO - CI \qquad (3)$$

Expanding (2) with (3) gives:

$$Y = C + I + G + CO - CI \qquad (4)$$

Cyclicality literature uses a derivation of income equaling consumption plus savings plus taxes.

$$Y = C + S + T \qquad (5)$$

Substituting (5) in (4):

$$\cancel{C} + S + T = \cancel{C} + I + G + CO - CI \qquad (6)$$

$$S + T = I + G + CO - CI \qquad (7)$$

$$I = S + (T - G) - CO + CI \qquad (8)$$

$$I = S - CO + CI + (T - G) \qquad (9) \qquad \text{or}$$

$$I = S - CO + CI + (D)$$

(9) is now a good test of both the supply side determinants of I and the demand side determinants.

Investment is expected to be a positive function of savings, a negative function of capital outflows, a positive function of capital inflows; and a positive function of the deficit.

In fact, correctly stated equation (9) should be written as:

$$I = Sd - CO + CI + (D) \qquad (10)$$

Where the investment is a positive function of domestic savings S_d, a negative function of capital outflows, a positive function of capital inflows, and a positive function of the deficit.

Note that the deficit D will actually be a negative term denoting excess of government expenditure G over taxation T, given by the term (T – G). But the size of the negative term D is expected to be positively correlated to investment I.

We can now similarly derive the supply and demand determinants of consumption.

Recalling (5)

$$Y = C + S + T \qquad (5)$$

But rewriting S now as total savings St

$$Y = C + St + T \qquad (11)$$

where in a closed KA, total savings St are given by domestic savings Sd. But in an open KA total savings St are given by domestic savings Sd, reduced by capital outflows CO, and enhanced by capital inflows CI:

$$St = Sd - CO + CI \qquad (12)$$

Or total savings St, are given by domestic savings Sd, reduced by net outflows CF.

$$St = Sd - CF \qquad (13)$$

Where net outflows CF, are in turn given by capital outflows CO, minus capital inflows CI as in (6).

Substituting in (13) in (11) we get:

$$Y = C + (Sd - CF) + T \qquad (14)$$

But keeping to the reduced form of (11)

$$Y = C + St + T \qquad (11)$$

Manipulating (11) we get:

$$C = Y - St - T \qquad (15)$$

So in (15), consumption is expected to be a positive function of income, and a negative function. of total savings St. And finally taxes T reduce consumption.

The demand and supply side determinants of consumption in (15) can now be contrasted to the demand and supply side determinants of investment in (10).

$$I = Sd - CO + CI + (D) \qquad (10)$$

Our theoretical framework from Essay One, argued that the two major determinants of output growth, investment and consumption would have a tradeoff. The theoretical argument was based on the Keynesian determination of output growth, by investment on the one hand, and on the other hand by its multiplier given by the Marginal Propensity to Consume (MPC). But the two drivers of output growth would be opposed to each other. The tradeoff could be expected based on role of savings. Investment would be driven up by savings. Whereas consumption would be driven down by savings.

Essay One found statistically significant empirical support for the existence of the tradeoff. With high GDP growth pre 1992 being driven by high investment. And lower GDP growth post 1992 being driven by lowered investment but a raised MPC.

Mathematically the tradeoff between investment and consumption is so apparent, that there is a need to only examine investment. Or for that matter only consumption. But we choose to examine investment, since Essay One has established it as the main driver of GDP growth. Driving up GDP growth pre 1992. And driving down GDP growth post 1992.

This mathematical tradeoff between investment and consumption can be seen, by putting the determinants of investment and the determinants of consumption into common terms to make them more comparable.

Recalling the determinants of investment and consumption, from equation (10) for investment, and equation (15) for consumption.

$I = Sd - CO + CI + (D)$ (10)

$C = Y - St - T$ (15)

Substituting equation (12) in (10) gives the reduced form for (10)

$I = St + (D)$ (16)

Rearranging (16) gives

$St = I - (D)$ (17)

Substituting (17) into (15) gives

$C = Y - I + D - T$ (18)

Or

$C = (Y - T) - I + D$ (19)

Where consumption is a positive function of disposable income, a negative function of investment, and a positive function of the budget deficit.

In order to put the determinants of investment into common terms with consumption.

Rearranging (15)

$St = Y - C - T$ (20)

Substituting (20) into (16) gives

$I = Y - C - T + (D)$ (21)

Or

$$I = (Y - T) - C + (D) \qquad (22)$$

So equation (19) gives the determinants of consumption, and equation (22) gives the determinants of investment are now directly comparable because they have common terms.

Consumption (C) is a positive function of disposable income, (Y-T), a negative function of investment (I), and a positive function of the budget deficit (D).

Whereas, investment (I) is a positive function of disposable income, (Y-T), a negative function of consumption (C), and a positive function of the budget deficit (D).

Ergo, investment and consumption are direct tradeoffs. So rather than testing both investment and consumption for their determinants, we can simply test just investment.

And we will examine investment, sequentially, first for its supply side determinants, as set out above. And then for its demand side determinants as set out below.

3.2.2 Demand side determinants of investment

The Ricardian vs. Keynesian debate captures the demand side determinants very well.

The Ricardian argument (Seater 1993, Ricciuti 2003) is that government expenditure G, unfinanced by revenues T, giving budgetary deficits D, will lower investment and consumption. Because investors and consumers will anticipate a future rise in taxation to cover the current deficit.

The alternative Keynesian argument (Musgrave 1987, Feldstein 2009) is that given excess capacity, a budget deficit can be used to raise investment and consumption through the accelerator. That elevated government expenditure will enhance employment, incomes, consumption, aggregate demand and therefore private investment.

This gives a general expression to begin with, that investment will be function of the budget deficit, whether negative according to the Ricardian argument, or positive according to the Keynesian argument.

$$I = (G - T) = D \qquad (23)$$

Or

$$I = -fn(G - T) = -fn(D) \qquad (23a)$$

A negative correlation will imply that an increase in deficit D will drive out/down investment I. This is the crowding out hypothesis according to Ricardo.

$$I = +fn(G - T) = +fn(D) \qquad (23b)$$

A positive correlation will imply that an increase in deficit D will crowd in investment I. This is the crowding in hypothesis according to Keynesian.

Aggregate investment, It, can itself be split up into government investment Ig, and private investment, Ip.

$$I = Ig + Ip \qquad (24)$$

Then a good test of the Ricardian crowding out hypothesis would be whether private investment, Ip, is a negative function of the government's budget deficit

$$Ip = -fn(G - T) = -fn(D) \qquad (25a)$$

And a good test of the alternative Keynesian crowding in hypothesis would be whether private investment, Ip, is a positive function of the government's budget deficit

$$Ip = +fn(G - T) = +fn(D) \qquad (25b)$$

A further test of the Ricardian crowding out hypothesis would be whether private investment, Ip, is a negative function of public investment, Ig

$$Ip = -fn\,(Ig) \qquad (26a)$$

While an equivalent test of the Keynesian crowding in hypothesis would be whether private investment Ip, is a positive function of public investment Ig.

$$Ip = +fn\,(Ig) \qquad (26b)$$

3.3 Data Description

Our macro aggregate series for essay one and essay two has been provided by the State Bank of Pakistan. The macro aggregate series used by us comes under National Income accounts. They are in real terms, as indexed for inflation by the State Bank of Pakistan. The macro aggregate series is observed over the time period 1973-2019.

All our macro aggregates have been estimated as observed data values, by the State Bank of Pakistan, taken from the Pakistan Bureau of Statistics. One macro aggregate is not an observed value but is estimated through national income accounts by the SBP.

This variable is savings.

The estimation of the variable savings is as a residual from the national income accounts identity;

$S_p = G + I_p + I_g + X – M – T$ (27)

Where S_p is private savings, G is government expenditure, I_p is private investment, I_g is government investment, X is exports, M is imports and T is taxes.

From Equation (24) in the theoretical model we know,

$I = I_p + I_g$ (24)

Substituting total investment, I for private investment I_p and government investment I_g. And rearranging the terms of equation (27) gives;

$S_p = (G – T) + I + (X – M)$ (28)

$S_p – I = (G – T) + (X – M)$ (29)

Where (G – T) represents budget balance, and (X-M) represents current account balance.

$S_p – I$ = Budget balance + Current Account balance (30)

From macroeconomic identity, we know the gap between private savings S_p and investments I are inflows i;

$S_p – I = -i$ (31)

Or I = Sp + I

Therefore,

-i = CA balance + Budget balance (32)

This is the neo classical equation that the budget balance and the current account balance sum up to inflows. If the current account balance plus the budget balance are positive, the inflows will be negative. If the current account balance plus budget balance are negative, the inflows will be positive.

So, the SBP is able to estimate inflows i from its two balances in equation (32)

From equation (31),

$S_p = I - i$ (31a)

SBP estimates I and i to get S_p in (31a).

We cannot test the shares in output for the variables in (31a), because they are true by definition in the identity (31a). But it is legitimate to test growth for the variables in (32a).

A second issue arises whether we can test the Griffin Enos hypothesis (Griffin and Enos 1970), the relationship between savings and inflows, using (31a). According to the Griffin and Enos hypothesis, foreign capital inflows substitute for domestic savings distorting the composition of investment, and possibly lowering the growth of output.

Expressing equation (31a) in terms of growth,

$\Delta S_p = \Delta I - \Delta i$ (31b)

If $\Delta I = 0$

Then, $\Delta S_p = 0 - \Delta i$ (31c)

Or $\Delta S_p = - \Delta i$

So only if $\Delta I = 0$, does equation (31c) result as a definitional inverse relationship. But if $\Delta I >$ or < 0. Then (31b) holds and (31c) does not hold. And ΔS_p is not definitionally inverse to Δi. So, the Griffin and Enos hypothesis can be empirically tested.

Therefore, deriving savings as a residual does not constrain us from examining its behavioral relationship to investment and other macro aggregates.

3.4 Empirical Methodology and Results

Having established in our first essay, a known break date at year 92 in our series for investment growth will have given us two time periods, pre 1992 with on average high investment growth, and post 1992 with significantly lowered investment growth.

We now need to provide an empirical methodology to explain the discrete drop in investment and the behavior of investment and its determinants over the long run period 1973-2019. This will be examined by observing the behavior of supply side determinants of investment, and demand side determinants of investment.

The **supply side determinants** of investment are savings and capital inflow.

Based on our theoretical model of supply side determinants and the literature examining the relationship between savings, capital inflows, and investment points to two possibilities;

I. Savings and inflows are complements for developing countries, like Pakistan (Oladipo 2010, Idrees, Khan, Raees and Saeed 2020, Elekkad and Hussein 2021)

II. The Griffin and Enos Model raises the alternative possibility that inflows may actually reduce savings (Hasan 2002, Djankov, Montalvo and Reynal Querol 2006).

Similarly, the **demand side determinants** of investment, public investment and private investment, are posited by two alternative economic models.

III. A Ricardian Model posits that public investment will crowd out private investment and therefore, weaken aggregate investment (Gupta 1992, Blanchard 1991).

IV. Alternatively, a Keynesian model posits that public investment can actually crowd in private investment and therefore raise aggregate investment (Cwik and Weiland 2011, Clift 2019).

Our aim in this section is to establish the empirical methodology to test the above possibilities and explain the behavior of investment and its determinants. For this, we proceed in a sequential way. First, the empirical methodology and results are presented for the supply side determinants. And, then we proceed to present the empirical methodology and results for the demand side determinants.

3.4.1 Empirical Methodology to test the supply side determinants

We begin with formulating an empirical methodology for our supply side determinants of investment growth. Based on our theoretical framework and hypothesis for the supply side determinants, which are savings and inflows, we will use the following five econometric tests

Test A: The structural break analysis of supply side growth variables.

Test B: The equality of distributions of supply side growth variables

Test C: The trend analysis for the shares of supply side variables in output.

Test D: The analysis of investment growth variable in relation to supply side growth variables.

Test E: The relationship between the supply side determinants, savings and inflows.

3.4.1.1 Test A: The structural break analysis of supply side growth variables

We begin with Test A, the structural break analysis to test our first set of hypotheses:

Hypothesis 1a: The structural break in investment growth significantly coincides with the structural break in supply side growth variables.

Hypothesis 1b: The supply side growth variables significantly drop post break date, matching the direction of change of the investment growth variable.

Testing the above mentioned hypothesis requires us to conduct the Test A, a structural break analysis on the supply side determinants of investment. Which are savings growth and inflows growth. Restating, we need to test whether the structural break in savings growth and inflows growth coincides with our main variable, investment growth. And also whether the direction of change post break date matches the direction of change in the investment growth variable.

The break in our main variable, the investment growth has already been established in essay one. We were able to detect the structural break in year 92 in the investment growth. We also estimated that the investment growth on average dropped by approximately 3 percentage points. And the drop in the investment growth variable significantly explained the drop in GDP growth post 1992.

Recalling from essay one, the two distinct techniques in the literature were applied to detect the structural break in the investment growth series. The first technique was based on a

classical Chow test to check the shift in the series at a known break date. A second econometric test was based on a dummy regression analysis to test for the significance of the year 1992, as a break dummy in the investment growth series. Using the classical Chow test, we were able to detect a structural change in year 1992 for the investment growth. And the dummy regression showed that the investment growth on average significantly dropped by 3.4 percentage points post 1992. We will be applying a similar set of techniques in this section to our supply side variables. Where, a Classical Chow test will be used to test the structural break, at a known break date of 92, in the growth series of savings and inflows. Hence, testing Hypothesis 1a. And the dummy regression will be further used to test the direction the break in the growth series of savings and inflows. Therefore, testing Hypothesis 1b.

Test A for a structural break in the growth of savings and inflows

We need to examine whether the structural break in our key explanatory supply side variables, savings growth and inflows growth, coincides with the break in investment growth. Recalling the year 1992 has been identified as the significant break date for the drop in investment growth. Therefore, based on Hypothesis 1a, we will test our explanatory supply side variables for the single most significant mean shift at a known break date, for the year 1992, or fairly approximate to it.

Accordingly, one statistical test we will use, will be based on a classical Chow (1960) test to check the shift in the series at a known break date. A second econometric test will be based on a dummy regression analysis, to test for the significance of the year 1992, as a break dummy in the growth series.

A structural break test at a known break date for all explanatory supply side variables

In order to test our explanatory variables series for the single mean shift at a known break date, we use the structural break model specified to test for the break at a known break date. This gives us a specific test for Hypothesis 1a, which is Test A.

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \qquad \text{(Hypothesis 1a Test A)} \qquad \text{(H1a A)}$$

Where y_{it} represents growth in the variable i in time period t. β_{ij} is mean shift parameter for the growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \qquad \text{(H1a A)}$$

For this model we test the null hypothesis that the mean shift parameter does not vary over the subsamples defined by the specified known break date. The known break date *TB*, is taken as the year 1992 identified as the break date in the investment growth series. Therefore, our next step will be to test the mean shift in our explanatory supply side growth series, savings, and inflows, at a known break date year 1992.

Chow's test for a known break date for supply side explanatory variables

The Wald test for the known break date using Chow (1960)'s procedure will be performed, to determine a break in the growth of the explanatory variables. The explanatory variables are savings growth and inflows growth.

Dummy regression for testing a known break date in investment growth

The dummy regression to test for the intercept break is specified for the growth of supply side explanatory variables. We will run the regression for savings growth and inflows growth variables. The dummy regression is given as;

$$g_t = \beta + \theta DU_t + u_t, \qquad \text{(H1b A)}$$

Where, g_t represents growth of supply side variables and DU_t is the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. The dummy regression (H1bA) allows us to check whether savings growth and inflows growth on average exhibits a downwards or upwards trend.

Therefore, the Test A, structural break analysis allows us to test for Hypothesis 1a and Hypothesis 1b, whether there exists a break in our supply side variables in year 1992. Also, if the growth in any of these supply side variables drops after year 1992. We now move to Test B, which is based on testing the equality of distribution across two regimes.

3.4.1.2 Test B: The equality of distributions of supply side growth variables

To further add support to our Hypotheses 1, there is a significant change in the supply side growth variables post 1992. And the direction of change post 1992 matches the direction of change in the investment growth variable, we seek to test the following hypothesis.

Hypothesis 2: The empirical distribution of supply side growth pre 1992 stochastically dominates the supply side growth post 1992.

The above hypothesis requires us to test for the equality of distribution of supply side growth variables, across two phases, pre 1992 and post 1992. The distribution will be analyzed

using the stochastic dominance approach (Hadar and Russell, 1969). A non-parametric test widely used by statisticians and econometricians for comparison of outcomes from various groups/samples. We, to our knowledge, are contributing to the literature by applying the non-parametric test to our growth series of supply side variables. The main advantage of Test B, is that it tests not only for differences in the mean growth but for differences in all moments of the growth distribution.

So far, in our previous section we established the methodology to test for the structural break in our supply side variables. Under the stochastic dominance approach (SD), we will now be observing the empirical distribution of supply side growth series pre and post break date. And would test if the distribution significantly differs across the two groups, pre 1992 and post 1992. Further, supporting the results of our Hypotheses 1.

Recalling, the year 1992 has been identified as the break date in the investment growth variable. We begin with splitting the supply side growth series of savings and inflows into two groups, pre 1992 and post 1992. For each of the series, empirical frequency distribution is formulated and a non-parametric test for the first order stochastic dominance of one growth distribution over another is applied. The procedure works in the following manner.

Let F and G denote the cumulative distribution functions of the supply side growth series, say savings growths, for two groups (say, pre 1992 and post 1992). First order stochastic dominance of F relative to G is given if,

F (z) – G (z) is less or equal zero for all z with strict inequality for some z. (H2 B)

where, F (z) represents the empirical growth distribution function, pre 1992, and G (z) represents the empirical growth distribution function, post 1992.

Given two samples of growth values from each group, pre 1992 and post 1992, the hypothesis that F is to the right of G can be tested by the Kolmogorov-Smirnov test (KS) based on the empirical distribution functions for F and G in the samples (for details, see Conover 1999, p. 456ff.). Note that this tests not only for differences in the mean growth of both groups (like in almost all other papers in the literature on mean shift in growth rates) but for differences in all moments of the distribution. Accordingly, if the structural break hypothesis in the previous section holds. We would expect the empirical growth distribution of savings growth and inflows growth, pre 1992, to dominate the empirical growth distribution of savings growth and inflows growth, post 1992.

3.4.1.3 Test C: The trend analysis for the shares of supply side variables in output

For our third type of test, Test C, we move from examining growth in the macro aggregates to shares in output of macro aggregates. Given confirmation of Hypotheses 1 and Hypothesis 2, we should now expect symmetry with the shares of savings and investment. We have already seen a declining trend in investment share over time in our first essay. We now expect to see similar trends in shares of our supply side variables in output, savings share, and inflows share.

Hypothesis 3: The shares of supply side variables in output has a significant declining trend post 1992.

To test Hypothesis 3, we perform, Test C, the trend analysis for our supply side variables, savings share, and inflows share. Test C, the trend analysis is based on, first examining the trends of investment share and the shares of supply side variables as a time series plot. Second, estimating the functional form of the investment share and shares of supply side variables in output using trend regressions.

Using trend regressions to examine the shares of supply side variables in the output

The regression equation of the following form will be run on the investment variable and supply side variables. The coefficients of the following equation will give us the functional forms for the investment share variable and the shares of supply side variables in output. Further, the coefficients with some statistical significance will analyze whether the share variables have a declining or increasing trend. The regression equation is represented below:

$$share_{kt} = \alpha_0 + \alpha_1 trend_{kt} + \alpha_2 trend_{kt}^2 + e_{kt} \qquad \text{(H3 C)}$$

Where $share_{kt}$ represents the share of the k variable in time period t. α_1 is the coefficient representing the linear trend and α_2 represents the quadratic trend.

Our analysis of shares is limited to either studying them as time plots. Or we can analyze them in trend regressions to see if a particular share variable has an increasing or declining trend. However, our main purpose is to identify the determinant that explains the declining trend in the investment share in output post 1992. Therefore, running investment share as a function of savings share and inflows share in the regression will not be econometrically correct. As the three variables are governed in a macroeconomic accounting relationship, that is additive. Recalling our theoretical equation (32), it follows;

Investment share = savings share + inflows share (31)

However, it would be correct econometrically if we run the above equation in the form of growth rates. In the succeeding section, investment growth is run as a function of savings growth and inflows growth.

3.4.1.4 Test D: The analysis of investment growth variable in relation to supply side growth variables

Recalling, the objective of the essay is to explain the drop in investment growth post 1992. So far, we have presented Test A, Test B, and Test C, to test for a structural break at a known break date of year 92, and the distributional change in supply side growth variables. And have presented the framework to study the supply side variables as shares in output. We now go on further to examine our supply side variables as growth variables in a regression framework, Test D, as stated in Hypothesis 4.

Hypothesis 4: The drop in investment growth post 1992 is significantly associated with the drop in the growth of supply side variables.

Test D, based on the regression framework to test the above hypothesis requires us to specify the investment growth variable as a function of savings growth and inflows growth. Test D will be explained below under an empirical model of investment growth.

An empirical model of investment growth

An empirical model of investment growth based on linear regression model is specified to explain the drop in investment growth. The model of investment growth variable g_t^I, as a function of savings growth g_t^S, and inflows growth g_t^i can be written as:

$$g_t^I = f(g_t^S, g_t^i) \qquad \text{(H4 D)}$$

Specifically, we intend to run three set of specifications for investment growth. First, investment growth as a function of savings growth. Second, investment growth as a function of inflows growth. And third, investment growth as a combined function of savings growth and inflows growth in a multiple linear regression framework. All three specifications will be run independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

$$g_t^I = \alpha_0 + \alpha_1 g_t^S + \epsilon_t \qquad \text{(H4 D1)}$$

$$g_t^I = \beta_0 + \beta_1 g_t^i + \epsilon_t \qquad \text{(H4 D2)}$$

$$g_t^I = \delta_0 + \delta_1 g_t^S + \delta_2 g_t^i + \epsilon_t \qquad \text{(H4 D3)}$$

Where, g_t^I represents investment growth, g_t^S represents savings growth, and g_t^i represents inflows growth.

Since our aim in this essay is to explain the drop in investment growth. And, since we have established Test A, to test the break in investment growth coinciding with the break in the supply side growth variables. We would want our supply side growth variables to significantly explain the drop in investment growth variable. Therefore, while testing Hypothesis 4, using the above three specifications, we would expect the following proposition to hold for Test D:

d. The savings growth and/or inflows growth coefficient should be positive and significant for both the phases, pre 1992 and post 1992. But with a higher coefficient pre 1992 than post 1992.

3.4.1.5 Test E: The relationship between the supply side determinants, savings and inflows

Now recalling, our theoretical model takes the economic argument for explaining the relationship between the supply side determinants of investment. There are two broad views on how inflows may affect savings. The basic macroeconomic accounting relationship that equates saving to investment assumes foreign inflows and domestic savings as additive. In other words, the external sources add to the overall availability of savings without in any way substituting domestic savings (Khan, Hasan, and Malik, 1994). There are also persuasive theoretical arguments to support a negative relationship between domestic and foreign savings. Accordingly, foreign inflows provide an additional supply of resources and thereby increase the possible magnitude of domestic expenditures. The earlier papers by Griffin (1978) and Griffin and Enos (1970) to name a few, argued that capital inflows (loans) rather than accelerating growth may in some cases retard economic growth. Specifically, they argued that foreign capital inflows in the form of foreign aid reduced domestic savings rates. Inflows of foreign capital would be spent on consumption and nonproductive expenditures rather than on investment. The negative correlation between foreign savings and domestic savings was later confirmed by Reinhart and Talvi (1998), Edwards (1995), and Fry (1994). Hence, the literature points out two testable hypotheses for the case of Pakistan;

Hypothesis 5a: Savings and inflows, are significantly positively correlated, and are complements.

The Griffin and Enos hypothesis raises the alternative possibility that inflows may actually reduce savings.

Hypothesis 5b: Savings and inflows, are significantly negatively correlated, and are substitutes.

Test E to test the relationship between savings and inflows

To test the two possibilities, Hypothesis 5a and Hypothesis 5b, posited by the literature, we model the relationship between savings and inflows as follows;

$$g_t^s = \alpha_0 + \alpha_1 g_t^i + \epsilon_t \qquad \text{(H5 E)}$$

where, g_t^s represents the growth in savings, and g_t^i represents the growth in inflows. The model will be run independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992. The nature of relationship between savings and inflows depends on the sign of the coefficient, α_1. If α_1 is significant and positive, the relationship favors the first argument. That the savings and inflows are complements. To the contrary, a significant and negative α_1, favors the alternative possibility. That savings and inflows are indeed substitutes.

Hence, this section establishes the five distinct set of tests to test economic arguments and hypothesis related to supply side determinants of investment growth. The subsequent section will provide us with the empirical results for the supply side determinants of investment.

3.4.2 Empirical Results for Supply Side Determinants of Investment

Explaining the determinants of Pakistan's long run investment growth using supply side variables, and the theoretical framework adopted, has given us the following testable hypotheses.

Hypothesis 1a: The structural break in the investment growth significantly coincides with the structural break in supply side growth variables.

Hypothesis 1b: The supply side growth variables significantly drop post break date, matching the direction of change of the investment growth variable.

Hypothesis 2: The empirical distribution of supply side growth pre 1992 stochastically dominates the supply side growth post 1992.

Hypothesis 3: The shares of supply side variables in output has a statistically significant downward trend post 1992 as compare to pre 1992.

Hypothesis 4: The drop in investment growth post 1992 is significantly associated with the drop in the growth of supply side variables

Hypothesis 5a: Savings and inflows, are significantly positively correlated, and are complements.

Hypothesis 5b: Savings and inflows, are significantly negatively correlated, and are substitutes.

The hypotheses proceed with sequential and intuitive logic.

Having established that there has indeed been a statistically significant drop in Pakistan's investment growth. The aim is to identify the explanatory variable that is statistically well correlated with investment growth. Hypotheses 1 and 2 test for the supply side variables that coincides with the break date in investment growth.

Further, Hypothesis 3 extends the analysis to examine the supply side determinants as shares in output. We have not only seen investment growth dropping, but have also statistically shown a declining trend in the share of investment in output. Having established a structural break in the growth of supply side variables, then Hypothesis 3 tests for the declining trend in the shares of inflows and shares of savings. The hypothesis tests the trend coefficient in each share, savings share and inflows share, to be statistically different in two time periods, pre92 and post 1992. And that the post 1992 trend coefficient is statistically more negative than the pre 1992 coefficient value.

We then proceed to the next level of Hypothesis 4, of using a functional form that specifies that investment growth on the left side of the equation, is well explained by growth in savings and inflows on the right side of the equation.

Finally, Hypothesis 5 examines the relationship between the supply side variables themselves. It tests to check the complementarity and substitutability between the two variables.

The results from our empirical exercise from the supply side will thus provide us with two possible explanations. One for the drop in investment growth. And two the relationship between savings and inflows.

3.4.2.1 Results of Test A, the structural break analysis

Having established in essay one that there has indeed been a statistically significant drop in Pakistan's investment growth from 1992. We now seek to explain the drop in investment growth using the supply side aggregates of investment from our theoretical framework, of

savings and inflows. The series for the supply side aggregates will therefore also be observed over the time period 1973-2019, as in Essay One.

Recalling our Hypothesis 1a expects, of supply side determinants of investments, either savings or inflows or both, will follow the pattern of the drop in investment growth.

Hypothesis 1a: The structural break in the investment growth significantly coincides with the structural break in supply side growth variables.

Our Hypothesis 1b goes on further to specify that if Hypothesis 1a holds true, the growth in supply side variables significantly drops post 1992. Matching the direction of change of investment growth variable.

Hypothesis 1b: The supply side growth variables significantly drop post break date, matching the direction of change of the investment growth variable.

Test A: A test for a structural break in supply side growth variables

In this section we test our supply side growth variables, savings growth and inflows growth, for the structural break, Test A, coinciding with the break date of the investment growth variable. We check for the single most significant mean shift at a known break date, for the year 1992, or fairly approximate to it, ie. 1992$\pm$1.

Recalling from our methodology section 3.4.2.1 above, the statistical test we will use will be based on a classical Chow test to check the shift in the series at a known break date. A second econometric test will be based on a dummy regression analysis, to test for the significance of the year 1992, as a break dummy in the growth series.

A structural break test at a known break date for all explanatory supply side variables

Recalling, to test our explanatory variables series for the single mean shift at a known break date, we use the structural break model specified to test for the break at a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \qquad \text{(H1a A)}$$

Where y_{it} represents growth in variable i in time period t. β_{ij} is mean shift parameter for the growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \qquad \text{(H1a A)}$$

Result of Chow's test for a known break date of supply side growth variables

The Wald test for the known break date using Chow's procedure is performed to determine a break in growth of the explanatory supply side variables. Table 2.1a reports the findings for the Wald test at a known break date. Of all the explanatory supply side variables, only the savings growth variable rejects the null posit of having no structural break. The Wald statistics takes the value 2.93 and is significant at a 10 percent level. Which shows that savings growth has a significant break in the year 1992. We can conclude that under Chow's procedure, the savings growth series shows a significant structural break in the year 1992.

Table 2.1 a: Structural Break Results in STATA

Variable Description	Known Break Date	Tests and Probability		
		Test	Statistics	P-Value
Real Investment Growth	**1993**	Chi2(1)	**2.84***	**0.0906**
Real Investment growth^2(excl.stocks)	**1993**	Chi2(1)	**3.48***	**0.0601**
Real Savings Growth	**1992**	Chi2(1)	**2.93***	**0.0865**

Real Investment Growth^2=Real Investment Growth-stocks of capital

The above exercise provides a valid statistical analysis in support of our Hypothesis 1a, that there has been a significant break in the saving growth series. And that the break in the savings growth series coincides with the break in investment growth.

Dummy regression for testing a known break date in savings growth

The dummy regression to test for the intercept break is specified for the savings growth variable, savings growth and inflows growth. The regression can be specified as;

$$g_t^s = \beta + \theta DU_t + u_t, \qquad \text{(H1b A)}$$

Where, g_t^s represents real savings growth and DU_t is the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. The dummy regression (H1b A) allows us to check whether savings growth exhibits a downwards or upwards trend.

Table 2.1b reports the results for dummy regression (H1b A). The explanatory variable, in the table, is the break dummy for the year 1992. We are looking at column (4), the savings growth variable, for the test of Hypothesis 1b. For savings growth regression, the coefficient of the break dummy variable, θ takes the value -10.07 percent and is significant. The coefficient

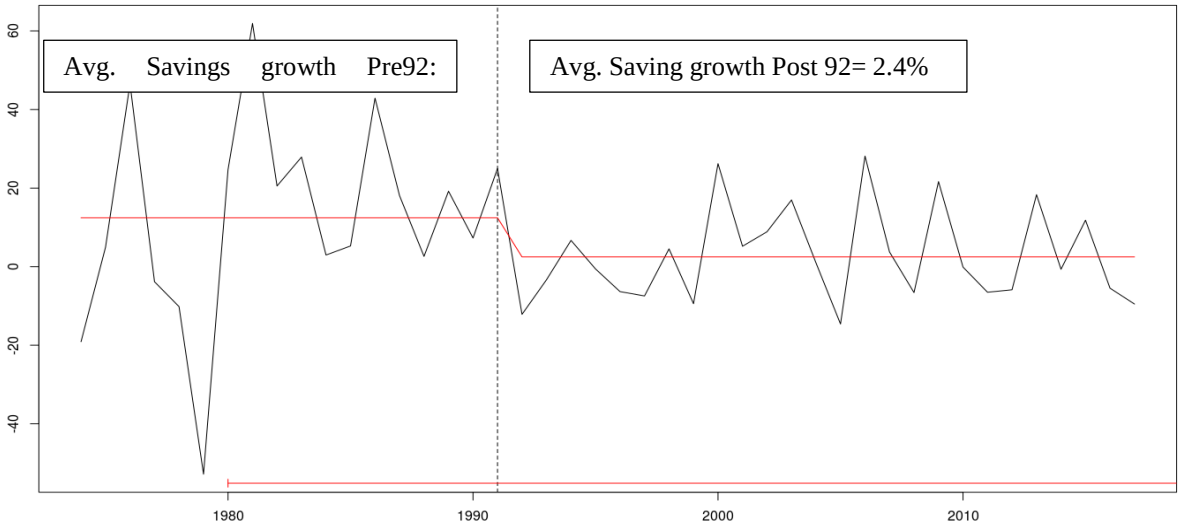
shows that after 1992, on average the savings growth drops by 10 percent. Figure 2.1 illustrates the discrete drop in savings growth.

Table 2.1 b: Structural break Dummy Regression for GDP growth, Investment, and Saving Growth

VARIABLES	(1) Dependent Variable: Real GDP growth	(2) Dependent Variable: Real investment growth	(3) Dependent Variable: Real investment growth^2	(4) Dependent Variable: Real Savings Growth
post92	-1.849***	-2.99*	-3.27*	-10.076*
	(0.516)	(1.66)	(1.86)	(5.60)
Constant	5.893***	6.11***	6.26***	12.44***
	(0.389)	(1.44)	(1.46)	(4.37)
Observations	44	47	47	47
R-squared	0.234	0.059	0.071	0.0685

a. Robust Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable post92=1 for years 1993-2019, post92=0 for years 1973-1992
c. Real Investment Growth^2=Real Investment Growth-stocks of capital

Figure 2.1: Time series plot of Savings growth 1973-2019



Note: The above graph shows the time line for the variable 'savings growth' for Pakistan, for the years 1973-2019. On y-axis, we have plotted savings growth and on x-axis are the years. The dotted line indicates the break in the series in year 1992. And the red line indicates that on average savings growth was higher Pre 1992. And on average the savings growth has dropped Post 1992.

Summarizing, Test A, the structural break analysis shows that the break in savings growth coincided with the break in investment growth. Recalling, on average we observed investment growth to drop by 3.11 percent after Year 1992. Importantly, we observed a similar trend for savings growth. As the savings growth dropped on average 10 percent after the year 1992. Hence, we can say that that the better explanatory variable, coinciding with the downward trend in investment growth post 1992 is the savings growth. Further, in the next section we test the distribution of supply side growth variables, reporting the results of Hypothesis 2.

3.4.2.2 Results of Test B, the test for the equality of distribution of supply side growth variables

Having provided the statistical evidence in favor of Hypothesis 1, that of the supply side determinants of investment, savings growth on average has dropped post 1992. We proceed to test Hypothesis 2, which further tests and compares the distribution of supply side growth series pre 1992 and post 1992.

Hypothesis 2: The empirical distribution of supply side growth pre 1992 stochastically dominates the supply side growth post 1992.

The above hypothesis requires us to run Test B, to test for the equality of distribution of supply side growth variables, across two phases, pre 1992 and post 1992. The distribution will be analyzed using the stochastic dominance approach (SD). Under the stochastic dominance approach a non-parametric test, based on Kolmogorov Smirnov (KS) framework, tests if the growth distributions significantly differ across the two groups, pre 1992 and post 1992. As mentioned in the methodology section 3.4.1.2, the KS test formulates an empirical distribution function for each variable for two groups, group 0 and group 1. The group 0 contains the pre 1992 values and group 1 contains the post 1992 values. It then tests the two hypotheses. One whether group 0 contains smaller values than for group 1. Two, whether group 0 contains larger values than group 1. The results from the KS test are given below;

Result of the Kolmogorov Smirnov test

Table 2 reports the results of KS test for the savings growth. The first line tests the hypothesis that saving growth for group 0 (pre 1992) contains smaller values than for group 1(post 1992). The largest difference between the distribution functions is 0.1. The approximate p-value for this is 0.763, which is not significant.

The second line tests the hypothesis that savings growth for group 0 (pre 1992) contains larger values than for group 1 (post 1992). The largest difference between the distribution functions in this direction is 0.3571. The approximate p-value for this difference is 0.061, which is significant. The p-value for the combined test to determine if there are any differences in the

distribution of savings growth for these two groups is 0.092, which is significant. Hence, Group 0 (pre92) stochastically dominates Group 1 (post92). And the result shows pre92 savings growth frequency distribution is greater than the post 1992 savings growth distribution and is significantly different.

Table 2.2: Test for Stochastic Dominance- Savings Growth

Table 2: Test for Stochastic Dominance- Savings Growth
Two-sample Kolmogorov-Smirnov test for equality of distribution functions

Smaller group	D	P-value	exact
0:	0.1111	0.763	
1:	-0.3571	0.061	
Combined K-S:	0.3571	0.122	0.092

Group 0: Pre 1992
Group 1: Post 1992

The KS test for the inflows growth came out to be insignificant. Therefore, of the supply side growth variables, the result of Test B for Hypothesis 2 (H2 B) holds in favor of the savings growth variable.

3.4.2.3 Results of Test C, the trend analysis for the shares of supply side variables in output

For our third set of empirical results, we move from examining growth in the macro aggregates to shares in output of macro aggregates. Given confirmation of Hypotheses 1 and Hypothesis 2 in favor of the savings growth variable, we now expect symmetry with the shares of savings and investment. We have already seen a declining trend in investment share over time in our first essay. We now report the results for Test C, the trend in shares of our supply side variables in output, savings share and inflows share.

Hypothesis 3: The shares of supply side variables in output has a significant declining trend post 1992.

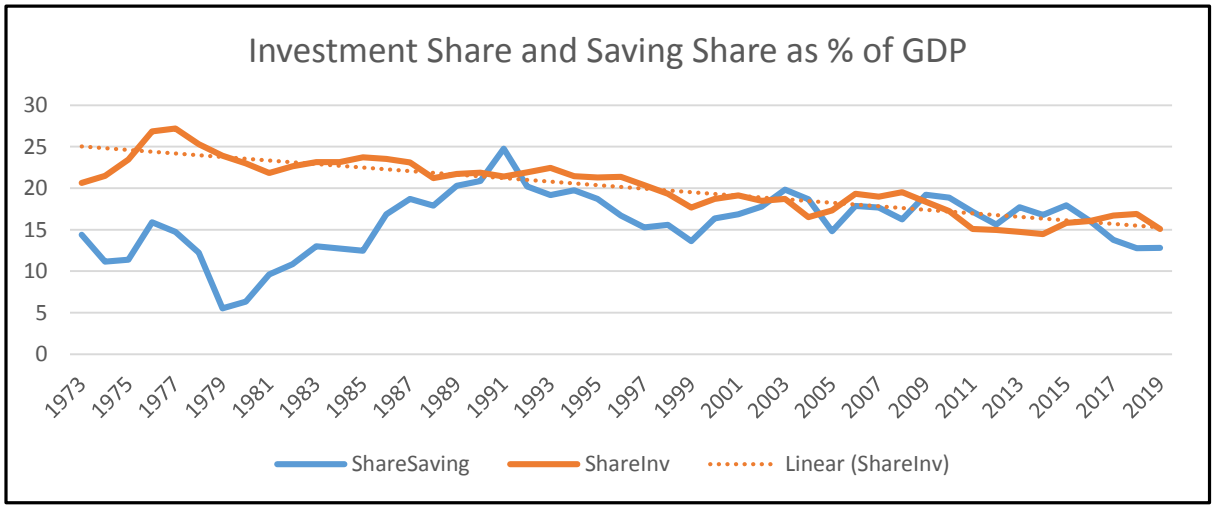
To test Hypothesis 3, we perform the trend analysis, Test C, for our supply side variables, savings share and inflows share. The trend analysis, Test C, is based on, first examining the trends of investment share and the shares of supply side variables as time series plots. Second, estimating the functional form of the investment share and shares of supply side variables in output using trend regressions.

Results using time series plots to examine the behavior of investment share in relation to shares of supply side variable in output

Figure 2.2 plots investment share and savings as shares in GDP for the years 1973-2019. There is a complex relationship between the share of investment in GDP and the share of saving in GDP. The share of investment clearly declines over time. The share of savings in GDP rises to peak in 1992 and then declines. Which means that it is defined by a quadratic equation. The complexity emerges in establishing a relationship between investment share and savings share.

Investment share show a linear drop. While savings has a quadratic function, peaking in 1992 and then falling. This implies that when investment share was high in pre 1992, the savings share was low but increasing, giving a large gap between savings and investment. Post 1992 as investment share falls, the savings share also falls but has a lesser gap with investment.

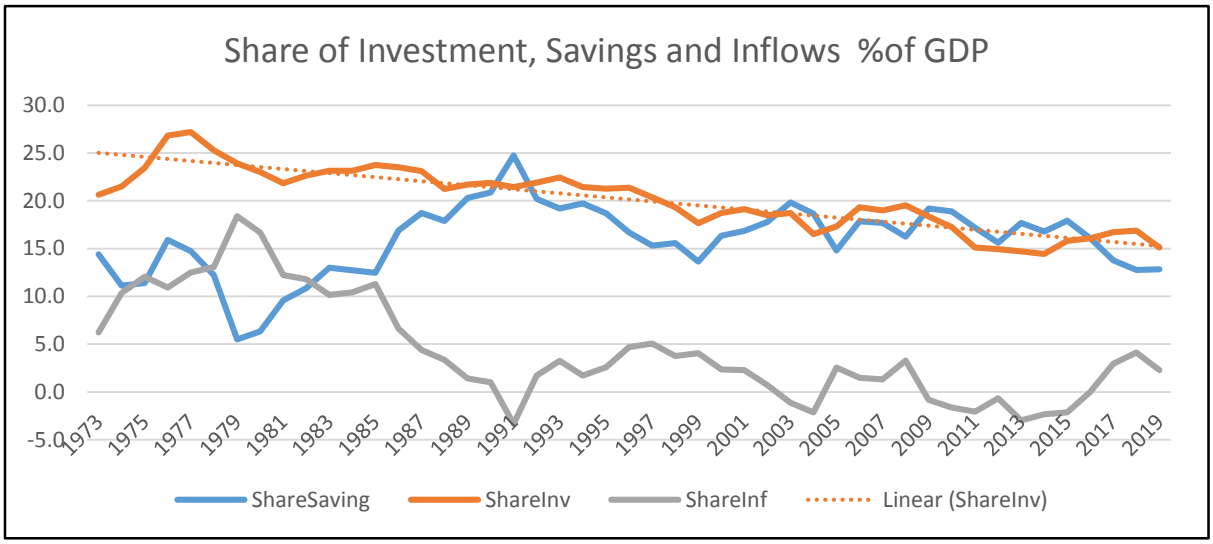
Figure 2.2: Investment Share and Saving Share as % of GDP



To capture this complex relationship between investment share and savings share, between a linear and the quadratic function as observed in Figure 2.2, it would be difficult to correlate the two variables together. Therefore, they are best run separately in the form of trend regressions to confirm their functional forms with some statistical confidence.

So far, we have observed a large gap in Figure 2.2 and the relationship between investment share and saving share seems to be complex. The large gap is the share of inflows. Therefore, we bring in the hypothesis that investment share is a function of inflows share. In Figure 2.3, we add the plot of inflows share to investment share and savings share. In this diagram, inflows share seems to follow a similar declining trend post 1992 as the trend of investment share. We now extend the analysis from studying the shares as time plots to running them as trends in a trend regression.

Figure 2.3: Share of Investment, Saving and Inflows % of GDP



Results using trend regressions to examine the shares of supply side variables in output

Recalling trend regression (H3 C), the specifications of the following form will be run on investment share and share of supply side variables in output.

$$shareI_t = \alpha_0 + \alpha_1 trend_t + \alpha_2 trend_t^2 + e_t \quad \text{(H3 C1)}$$

$$shareS_t = \beta_0 + \beta_1 trend_t + \beta_2 trend_t^2 + e_t \quad \text{(H3 C2)}$$

$$sharei_t = \delta_0 + \delta_1 trend_t + \delta_2 trend_t^2 + e_t \quad \text{(H3 C3)}$$

Where $shareI_t$ represents the share of investment in output in time period *t*, $shareS_t$ represents the share of saving in output in time period *t*, $sharei_t$ represents the share of inflows in output in time period *t*. *trend* variable represents the time trend variable. And $trend^2$ variable represents the quadratic form of the time trend variable. We run the three regressions for the entire time period and for the two time periods, pre 1992 and post92.

The results for the specification (H3 C1) are represented in Table 2.3a. The left hand side variable is the share of investment (shareI). And the right hand side variable is the time trend (t). The significant coefficient of the trend variable, t for the overall sample, -0.212 clearly shows the declining linear trend over time. Also, the coefficient significantly declines post 1992. And the change between the two coefficients, pre and post 1992 significantly differs between the two time periods.

Table 2.3 a: Trend Regression of Share of Investment as % of GDP

VARIABLES	Full Sample Dependent Variable: shareI	Pre 1992 Dependent Variable: shareI	Post92 Dependent Variable: shareI
t	-0.212***	-0.111*	-0.241***
	(0.0157)	(0.0649)	(0.0304)
Constant	25.23***	24.21***	26.19***
	(0.434)	(0.778)	(1.059)
Observations	47	20	27

R-squared	0.801	0.140	0.716

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results for the specification (H3 C2) are represented in Table 2.3b. The left hand side variable is the share of savings (shareS). And the right hand side variable is the time trend (t) and the quadratic form of time trend (tsq). For the overall sample, the significant coefficient, 0.639, for the time trend variable shows the increasing trend over time. The result also shows the significant and negative quadratic terms. Confirming that the share of savings function is quadratic in nature. In fact, the quadratic term indicates that for higher values of trend the savings share will eventually decline. For Pre 1992, the share of savings function shows a significant declining trend. However, for Post 1992, the trend coefficient is insignificant.

Table 2.3 b: Trend Regression of Share of Saving as % of GDP

VARIABLES	Pre 1992 Dependent Variable: ShareS	Post 1992 Dependent Variable: ShareS	Full Sample Dependent Variable: ShareS
t	-1.597***	0.297	0.639***
	(0.435)	(0.415)	(0.132)
tsq	0.108***	-0.00616	-0.0113***
	(0.0211)	(0.00616)	(0.00267)
Constant	16.10***	14.30**	9.067***
	(1.890)	(6.688)	(1.373)
Observations	19	28	47
R-squared	0.779	0.239	0.380

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.3c represents the result of the specification (H3 C3). The left hand side variable in this case, is the share of inflows (sharei). And the right hand side variable is the time trend (t) and the quadratic form of the time trend (tsq). We see a similar trend in share of inflows function as observed earlier in the case of share of investment function. The coefficient of trend variable t,

-0.075 clearly shows a significant decline over time. The coefficient of trend t, is significant and positive pre 1992, with a coefficient value of 2.003. And the trend significantly declines post 1992, taking a value -0.967. The change between the two coefficients significantly differs across two time periods.

Table 2.3 c: Trend Regression of Share of Inflows as % of GDP

VARIABLES	Pre 1992 Dependent Variable: Sharei	Post 1992 Dependent Variable: Sharei	Full Sample Dependent Variable: Sharei
t	2.003***	-0.967**	-0.754***
	(0.336)	(0.458)	(0.141)
tsq	-0.134***	0.0125*	0.00929***
	(0.0163)	(0.00680)	(0.00285)
Constant	6.291***	18.75**	15.38***
	(1.460)	(7.380)	(1.466)
Observations	19	28	47
R-squared	0.896	0.291	0.673

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Comparing the results of the share of savings and the share of inflows, the results of the specification (H3 C3) support Hypothesis 3. That of the shares of the supply side variables in

output, the share of inflows has a significant declining trend post 1992. And the trend in the share of inflows matches the declining trend in the share of investment in output post 1992.

To this point in the empirical analysis section, we have performed individual analyses for each of the supply side variables. We tested savings growth and inflows growth independently for the structural break, stochastic dominance, and trends. Based on the empirical results of Hypotheses 1 and Hypothesis 2, the results of the savings growth variable came out to be coincident with the results of investment growth. And based on the empirical results of Hypothesis 3, the share of inflows function behaved in a similar manner as the share of the investment function. However, we need to investigate the supply side variables further in a joint framework to give a comprehensive conclusion. Therefore, in succeeding sections we present the results for the supply side variables, savings and inflows, jointly under a more comprehensive and integrated framework.

3.4.2.4 Results for Test D, analysing investment growth variable in relation to supply side growth variables

Recalling, the objective of the essay is to explain the drop in investment growth post 1992. So far, we have presented the results for, Test A, the structural break at a known break date of year 92, and the Test B, the distributional change in supply side growth variables. And have presented the results for Test C, examining supply side variables as shares in output. We now go on further to study our supply side variables jointly as growth variables in a regression framework, Test D, to test Hypothesis 4.

Hypothesis 4: The drop in investment growth post 1992 is significantly associated with the drop in the growth of supply side variables.

Results for the empirical growth model of investment

Recalling Test D, based on the investment growth model (H4 D), specifies the investment growth variable as a function of savings growth and inflows growth. We intend to run three specifications. First, investment growth as a function of savings growth. Second, investment growth as a function of inflows growth. And third, investment growth as a combined function of savings growth and inflows growth in a multiple linear regression framework. All three specifications will be run independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

$$g_t^I = \alpha_0 + \alpha_1 g_t^S + \epsilon_t \qquad \text{(H4 D1)}$$

$$g_t^I = \beta_0 + \beta_1 g_t^i + \epsilon_t \qquad \text{(H4 D2)}$$

$$g_t^I = \delta_0 + \delta_1 g_t^S + \delta_2 g_t^i + \epsilon_t \qquad \text{(H4 D3)}$$

Where, g_t^I represents investment growth, g_t^S represents savings growth, and g_t^i represents inflows growth.

Table 2.4a represents the results for specification (H4 D1). The left hand side variable is the investment growth (growthinv). And the right hand side variable is the savings growth (savinggrowth). The coefficient of the savings growth variable, 0.0932, is significantly correlated to investment growth for the overall sample. However, the coefficients came out to be insignificant for the sub time periods, pre 1992 and post 1992. To be able to explain the drop in investment growth, we expected savings growth to be highly correlated with the investment growth variable. But, the results for the savings growth variable came out insignificant, contrary to our expectations.

Table 2.4 a: Regression result of growth of investment and growth of saving

VARIABLES	Full Sample Dependent Variable growthinv	Pre 92 Dependent Variable growthinv	Post 92 Dependent Variable growthinv
savinggrowth	0.0932*	0.0647	0.122
	(0.0493)	(0.0472)	(0.117)
Constant	3.714***	5.317***	2.842**
	(0.977)	(1.332)	(1.348)
Observations	46	18	28
R-squared	0.075	0.105	0.040

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results for the specification (H4 D2) are shown in the Table 2.4b. The left hand side variable is the investment growth (growthinv). And the right hand side variable is the inflows growth (growthinf). The inflows growth is well correlated to investment growth in the overall sample. The inflows growth coefficient remains significantly correlated in both the time periods, pre 1992 and post 1992. Especially pre92, the coefficient is higher. And post 1992 the correlation coefficient of inflows growth drops. The coefficients significantly differ across two time periods.

Table 2.4 b: Regression result of growth of Investment and growth of Inflows

VARIABLES	Full Sample Dependent Variable growthinv	Pre 1992 Dependent Variable growthinv	Post 1992 Dependent Variable growthinv
growthinf	**.0000675*** **	**0.00717***	**.0000829*** **
	(.0000116)	(0.00395)	(.0000163)
Constant	4.179***	6.304***	2.883**
	(0.976)	(1.330)	(1.371)
Observations	46	18	28

R-squared	0.017	0.023	0.036

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Therefore, the significant correlation between investment growth and inflows growth, and the insignificant relationship between investment growth and savings growth, enables us to partially conclude that our growth in investment function is well associated with inflows growth, pre92 and post 1992, and not with the savings growth.

For concreteness, Table 2.4c provides the multiple linear regression results for the specification (H4 D3). The left hand side variable is the investment growth (growthInv). And the right hand side variable is the savings growth (savinggrowth) and the inflows growth (growthinf) . For the full sample, the investment growth came out to be significntly correlated to both savings growth and inflows growth. For pre 1992, we find that investment growth continues to be well correlated to inflows growth. But, investment growth continues to be not significantly correlated to savings growth. For post 1992, we find that investment growth is significantly correlated to inflows growth but the magnitude of the coefficient significantly drops. However, post 1992 investment growth continues not to be well correlated to savings growth. Therefore, our growth in the investment function is well correlated to growth in the inflows function.

Table 2.4 c: Regression result of growth of Investment, growth of Savings and growth of Inflows

VARIABLES	Pre 1992 Dependent Variable growthinv	Post 1992 Dependent Variable growthinv
savinggrowth	0.0812	0.153
	(0.0664)	(0.152)
growthinf	0.0129*	0.000106***
	(0.00687)	(2.74e-05)

Constant	5.439***	2.452*
	(1.058)	(1.418)
Observations	18	28
R-squared	0.174	0.096

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Overall on the basis of our shares result, in the previous section, 3.4.2.3, that share of inflows followed a similar declining trend as the share of investment post 1992. And on the basis of our multiple regression results, our growth in the investment function is well correlated with the growth in the inflows function, pre 1992 and post 1992. We can infer the following set of conclusions,

a. Pre 1992, the growth in investment and the share of investment in output were increasing. Also, the share of inflows had an increasing trend.
b. Post 1992, when the growth in investment and the share of investment declined, the share of inflows also exhibited a declining trend.
c. Pre 1992 and Post 1992, in both the time periods, of the supply side growth variables, the inflows growth remained significantly correlated with the investment growth.

This set of conclusions, hence, provides us with substantial evidence to answer one of our central questions. That, of the supply side determinants of investment, which factor well explains the drop in investment growth. Therefore, we can say that

The drop in investment growth post 1992 is significantly associated with the drop in the growth of inflows post 1992.

3.4.2.5 Results for Test E, analyzing the relationship between the supply side determinants, savings and inflows

Our last set of empirical results are based on the two testable hypothesis, pointed out in the literature. The two hypothesis tests the relationship between the supply side determinants, savings, and inflows.

Hypothesis 5a: Savings and inflows, are significantly positively correlated, and are complements.

The Griffin and Enos hypothesis raises the alternative possibility that inflows may actually reduce savings.

Hypothesis 5b: Savings and inflows, are significantly negatively correlated, and are substitutes.

To test the two possibilities, Hypothesis 5a and Hypothesis 5b, posited by the literature, we model the relationship between savings and inflows as follows;

$$g_t^s = \alpha_0 + \alpha_1 g_t^i + \epsilon_t \qquad \text{(H5 E)}$$

where, g_t^s represents the growth in savings, and g_t^i represents the growth in inflows. The model is run independently for pre 1992 and post 1992. The coefficients of the model are tested for equality across the two time periods, pre 1992 and post 1992. The nature of relationship between savings and inflows depends on the sign of the coefficient, α_1. If α_1 is significant and positive, the relationship favors the first argument. That savings and inflows are complements. Contrary, a significant and negative α_1, favors the alternative possibility. That savings and inflows are indeed substitutes.

Results

The results of the specification (H5 E) are represented in Table 2.5. The left hand side variable is the savings growth (GrowthS). And the right hand side variable is the inflows growth (growthinf). For Pre 1992, the significant and negative α_1, -0.079, goes in the favour of Griffin and Enos hypothesis. That savings and inflows are indeed substitutes. For Post 1992, though the correlation coefficient becomes negligible, it remains negative and significant. Also, the coefficients are significantly different across two time periods.

Table 2.5: Regression showing the relationship between the growth of savings and growth of Inflows

	Pre 1992 Dependent Variable	Post 1992 Dependent Variable
VARIABLES	GrowthS	GrowthS
growthinf	-0.0794*	-0.000156***
	(0.0451)	(2.70e-05)

Constant	9.895	3.389
	(5.852)	(2.251)
Observations	19	27
R-squared	0.124	0.050

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Overall, the findings of this section suggest that the inflows function behaves as a substitute for the savings function. And in fact, the substitutability is stronger pre 1992 as compared to post 1992.

3.4.3 Empirical Methodology to test the demand side determinants

We now proceed to explain the behavior and decline in investment growth, post 1992, using the demand side determinants. The demand side determinants of investment are a public investment and private investment. Recalling our theoretical model equation (24), the macroeconomic relationship between investment and the demand side determinants can be represented as;

Aggregate Investment = Public investment + Private Investment (24)

Recalling from our theoretical model, the **demand side determinants** of investment are posited by two alternative economic models.

III. A Ricardian Model posits that public investment will crowd out private investment and therefore, weaken aggregate investment.

IV. Alternatively, a Keynesian model posits that public investment can actually crowd in private investment and therefore raise aggregate investment.

As we did in the supply side, we will the examine behavior and relationship of these demand side macro aggregates. And we will be using a similar set of econometric tests to study our demand side determinants. Referring to our hypothesis in the subsequent section for the demand side determinants, which are public investment and private investment, we repeat the following econometric tests

Test A: The structural break analysis of demand side growth variables.

Test C: The trend analysis for the shares of demand side variables in output.

Test D: The analysis of investment growth variable in relation to demand side growth variables.

Test E: The relationship between public investment growth and private investment growth.

3.4.3.1 Test A, the structural break analysis of demand side growth variables

We begin with our first set of hypotheses on the demand side:

Hypothesis 6a: The structural break in the investment growth significantly coincides with the structural break in demand side growth variables.

Assuming 6a holds,

Hypothesis 6b: The demand side growth variables have significantly lower growth post break date, matching the direction of change of investment growth variable.

Testing the above mentioned hypothesis, requires us to conduct Test A, a structural break analysis on the demand side determinants of investment. Which are public investment growth and private investment growth. Restating, we need to test whether the structural break in public investment growth and private investment growth coincides with our main variable, investment

growth. And also whether the direction of change post break date matches the direction of change in the investment growth variable.

Recalling, the break in our main variable, the investment growth has already been established in essay one. We were able to detect the structural break in year 92 in the investment growth. We also estimated that the investment growth on average dropped by approximately 3 percentage points. And the investment growth variable significantly explained the drop in GDP growth post 1992. Now, we need to establish whether there exists a break in the demand side determinants of investment in the year 1992. And that the average growth of the demand side variables is significantly lower post 1992 as compared to pre 1992. For which we repeat the similar, Test A, structural break analysis for our demand side determinants of investment as we did for the supply side variables in section 3.4.1.1. A Classical Chow test will be used to test the structural break, at a known break date of 92, in the growth series of public investment and private investment. Hence, testing Hypothesis 6a. And the t test will be further used to test the difference between the average growth rates of public investment and private investment in two time periods, pre 1992 and post 1992. Therefore, testing Hypothesis 6b.

A test for a structural break in the growth of public investment and private investment

We need to examine whether the structural break in our key explanatory demand side variables, public investment growth, and private investment growth coincides with the break in investment growth. Recalling, year 92 has been identified as the significant break date for the drop in investment growth. Therefore, based on Hypothesis 6a, we will test our explanatory demand side variables for the single most significant mean shift at a known break date, for the year 92, or fairly approximate to it.

Accordingly, one statistical test we will use will be based on a classical Chow (1960) test to check the shift in the series at a known break date. A second econometric test will be based on a two sample t test analysis, to test if the average growth rates pre 1992 are significantly greater than post 1992.

A structural break test at a known break date for all explanatory demand side variables

To test our explanatory demand side series for the single mean shift at a known break date, we repeat the structural break model specified to test for the break at a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \qquad \text{(H6a A)}$$

Where y_{it} represents growth in variable i in time period t. β_{ij} is the mean shift parameter for the growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \qquad \text{(H6a A)}$$

For this model, we test the null hypothesis which means shift parameters do not vary over the subsamples defined by the specified known break date. The known break date TB, is taken as the year 92 identified as break date in investment growth series. Therefore, our next step will be to test the mean shift in our explanatory demand side growth series, public investment and private investment, at a known break date year 92.

Chow's test for a known break date for demand side explanatory variables

The Wald test for the known break date using Chow (1960)'s procedure will be performed, to determine a break in growth of the explanatory variables. The explanatory variables are public investment growth and private investment growth.

Two sample t-tests for the equality of means

This t-test is designed to compare means/averages of the same variable between two groups. In our example, the two groups are pre 1992 and post 1992. For each of our demand side growth variables, public investment growth and private investment growth, we calculate the average growth rates for the years pre 1992 and post 1992. Our sample ranges from 1973-2019. After calculating the average growth rates, we test the difference in the average growth rates using the t-test. The test allows us to test the following set of hypotheses:

H_a: $\mu_{i1} != \mu_{i2}$ (H6b Ai)

H_a: $\mu_{i1} < \mu_{i2}$, (H6b Aii)

H_a: $\mu_{i1} > \mu_{i2}$ (H6b Aiii)

Where μ_{i1} is the average growth rate of i variable pre 1992. And μ_{i2} is the average growth rate of the i variable post 1992. To support our Hypothesis 6b, that the average growth rate of the demand side variables dropped post 1992, we are particularly interested in the result of hypothesis (H6b Aiii) above. Which tests for the alternative hypothesis that the average growth rate pre 1992 is significantly greater than the average growth rate post 1992.

Hence, in Test A, the structural break analysis in this section allows us to test for Hypothesis 6a and Hypothesis 6b, whether there exists a break in our demand side variables in

year 92. Also, if the average growth in any of these demand side variables was significantly higher pre 1992 and lower after year 92.

3.4.3.2 Test C: The trend analysis for the shares of demand side variables in output

Now we move from examining breaks in the macro aggregates to trends in the shares of macro aggregates. Given confirmation of Hypotheses 6, we should now expect symmetry with the shares of demand side determinants and investment. We have already seen a declining trend in investment share over time in our first essay. We now expect to see a similar trend in shares of our demand side variables in output, public investment share, and private investment share.

Hypothesis 7: The shares of demand side variables in output has a significant declining trend post 1992.

To test Hypothesis 7, we perform Test C, the trend analysis, and the two sample t-test for the demand side variables, public investment share, and private investment share. The trend analysis, Test C, is based on, first examining the trends of investment share and the shares of demand side variables as a time series plot. Second, examining the statistical significance of trend coefficients using simple linear regression. The two sample t-test will be used to statistically test the difference between the average values of demand side shares pre92 and post 1992. The methodology for the two sample t-tests has been discussed earlier in section 3.4.3.1 for the demand side growth variables. A similar test will be applied to the shares of demand side variables.

Using trend regressions to examine the shares of demand side variables in the output

The regression equation of the following form will be run on the investment variable and demand side variables. The coefficients of the following equation with some statistical

significance will analyze whether the share variables have a declining or increasing trend. The regression equation is presented below:

$$share_{kt} = \alpha_0 + \alpha_1 trend_{kt} + e_{kt} \quad \text{(H7 C)}$$

Where $share_{kt}$ represents the share of the *k* variable in time period *t*. α_1 is the coefficient representing the linear trend.

Two sample t-tests for the equality of means

As we did in section 3.4.3.1 for demand side growth variables, we will repeat the methodology for each of our demand side share variables, share of public investment and share of private investment in output. We calculate the average share value for each variable, for the yearly observations pre 1992 and post 1992. Our sample ranges from 1973-2019. After calculating the average share values for Pre 1992 and Post 1992, we test the difference in the average values using the t-test. The test allows us to test the following set of hypotheses:

H_a: $\mu_{i1} != \mu_{i2}$ (H7 Ci)

H_a: $\mu_{i1} < \mu_{i2}$, and (H7 Cii)

H_a: $\mu_{i1} > \mu_{i2}$ (H7 Ciii)

Where μ_{i1} is the average share value of i variable pre 1992. And μ_{i2} is the average share value of the i variable post 1992. To support our Hypothesis 7, that there has been a declining trend in the shares of the demand side variables post 1992, we would expect hypothesis (H7 Ciii) to hold. Which tests for the alternative hypothesis that the average value of the demand side share in output pre 1992 is significantly greater than the average value of the demand side share in output post 1992.

Our analysis of shares is limited to either studying them as time plots. Or we can analyze them in trend regressions to see if a particular share variable has an increasing or declining trend. However, our main purpose is to identify the determinant that explains the declining trend in the investment share in output post 1992. Therefore, running investment share as a function of public investment share and private investment share in the regression will not be econometrically correct. Recalling equation (24) from our theoretical model, the three variables are governed by a macroeconomic accounting relationship, that is additive.

Investment share = public investment share + private investment share (24)

However, it would be correct econometrically if we run the above equation in the form of growth rates. In the succeeding section, investment growth is run as a function of public investment growth and private investment growth.

3.4.3.3 Test D: The analysis of investment growth variable in relation to demand side growth variables

Recalling, the objective of the essay is to explain the drop in investment growth post 1992. So far, we have presented the methodology for the structural break. And have presented the framework to study the demand side variables as shares in output. We now go on further to study our demand side variables as growth in a regression framework as stated in Hypothesis 8.

Hypothesis 8: The drop in investment growth post 1992 is significantly associated with the drop in the growth of demand side variables.

The regression framework to test the above hypothesis requires us to specify the investment growth variable as a function of public investment growth and private investment growth. The framework will be explained below under an empirical model of investment growth.

An empirical model of investment growth

An empirical model of investment growth based on a linear regression model is specified to explain the drop in investment growth. The model of investment growth variable g_t^I, as a function of public investment growth g_t^{IG}, and private investment growth g_t^{IP} can be written as:

$$g_t^I = f(g_t^{IG}, g_t^{IP}) \qquad \text{(H8 D)}$$

Specifically, we intend to run three specifications for investment growth. First, investment growth as a function of public investment growth. Second, investment growth as a function of private investment growth. And third, investment growth as a combined function of public investment growth and private investment growth in a multiple linear regression framework. All three specifications will be run independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

$$g_t^I = \alpha_0 + \alpha_1 g_t^{IG} + \epsilon_t \qquad \text{(H8 D1)}$$

$$g_t^I = \beta_0 + \beta_1 g_t^{IP} + \epsilon_t \qquad \text{(H8 D2)}$$

$$g_t^I = \delta_0 + \delta_1 g_t^{IG} + \delta_2 g_t^{IP} + \epsilon_t \qquad \text{(H8 D3)}$$

Where, g_t^I represents investment growth, g_t^{IG} represents public investment growth, and g_t^{IP} represents private investment growth.

Our aim in this essay is to explain the drop in investment growth. And, since we have established the methodology to test the break in investment growth coinciding with the break in the demand side growth variables. We would want our demand side growth variables to significantly explain the drop in investment growth variables. Therefore, while testing

Hypothesis 8, using the above three specifications of investment growth, we would expect the following proposition to hold:

- The public investment growth and/or private investment growth coefficient should be positive and significant for both the phases, pre 1992 and post 1992.

3.4.3.4 Test E: The relationship between the demand side determinants, public investment, and private investment

Now recalling, our theoretical model takes the economic argument for explaining the relationship between the demand side determinants of investment themselves. There are two broad arguments on how public investment and private investment can be related. The Ricardian argument is that public expenditures/investments, unfinanced by revenues, giving budgetary deficits, will lower investment and consumption. Because investors and consumers will anticipate a future rise in taxation to cover the current deficit.

The alternative Keynesian argument is that given excess capacity, a budget deficit can be used to raise investment and consumption through the accelerator. That elevated public expenditure/investment will enhance employment, incomes, consumption, aggregate demand, and therefore private investment.

Hence, the literature implies two testable hypotheses for the case of Pakistan;

Hypothesis 9a: Public investment and private investment, are significantly positively correlated, which results in crowding in.

Hypothesis 9b: Public investment and private investment, are significantly negatively correlated, which results in crowding out.

Empirical Model to test the relationship between public investment and private investment

To test the two possibilities, Hypothesis 9a and Hypothesis 9b, posited by the literature, we model the relationship between public investment and private investment as follows;

$$g_t^{IP} = \alpha_0 + \alpha_1 g_t^{IG} + \epsilon_t \qquad \text{(H9 E)}$$

where, g_t^{IP} represents the growth in private investment, and g_t^{IG} represents the growth in public investment. The model will be run independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992. The nature of relationship between public investment and private investment depends on the sign of the coefficient, α_1. If α_1 is significant and positive, the relationship favors the first argument. That there is crowding in. Contrary, the significant and negative α_1, favors the alternative possibility. That there is indeed a crowding out.

Hence, this section establishes the four distinct sets of econometric tests to test economic arguments and hypotheses related to demand side determinants of investment growth. The subsequent section will provide us with the empirical results for the demand side determinants of investment.

3.4.4 Empirical Results for Demand Side Determinants of Investment

Explaining the determinants of Pakistan's long run investment growth using demand side variables, and the theoretical framework adopted, has given us the following testable hypotheses.

Hypothesis 6a: The structural break in the investment growth significantly coincides with the structural break in demand side growth variables.

Assuming 6a holds,

Hypothesis 6b: The demand side growth variables have significantly lower growth post break date, matching the direction of change of the investment growth variable.

Hypothesis 7: The shares of demand side variables in output has a significant declining trend post 1992.

Hypothesis 8: The drop in investment growth post 1992 is significantly associated with the drop in the growth of demand side variables.

Hypothesis 9a: Public investment and private investment, are significantly positively correlated, which results in crowding in.

Hypothesis 9b: Public investment and private investment, are significantly negatively correlated, which results in crowding out.

The hypotheses proceed in a sequential and intuitively logical way.

Having established that there has indeed been a statistically significant drop in Pakistan's investment growth. The aim is to identify the explanatory variable that is statistically well correlated with investment growth. Hypothesis 6 tests for the better demand side variable that coincides with the break date in investment growth.

Further, Hypothesis 7 extends the analysis to examine the demand side determinants as shares in output. We have not only seen investment growth dropping but have also statistically proved a declining trend in the share of investment in output. Having studied the structural break

in the growth of demand side variables, Hypothesis 7 tests for the declining trend in the shares of public investment and shares of private investment. The hypothesis tests the trend coefficient in each share, public investment share, and private investment share, to be statistically different in two time periods, pre92 and post 1992. And that the post 1992 trend coefficient is statistically more negative than the pre 1992 coefficient value.

We then proceed to Hypothesis 8, which specifies that the investment growth is well explained by growth in public investment and growth in private investment.

Finally, Hypothesis 9 establishes the relationship between the demand side variables themselves. Tests to check whether the relationship between two variables results in crowding in or crowding out.

The results from our empirical exercise from the demand side will thus provide us with two possible explanations. One for the drop in investment growth. And two the relationship between public and private investment.

3.4.4.1 Results of Test A, the structural break analysis of demand side variables

Having established in essay one that there has indeed been a statistically significant drop in Pakistan's investment growth from 1992. We now seek to explain the drop in investment growth using the demand side aggregates of investment from our theoretical framework, of public investment and private investment. The series for the demand side aggregates will be observed over the time period 1973-2019.

Recalling our Hypothesis 6a expects, of demand side determinants of investments, either public investment or private investment, or both, will follow the pattern of the drop in investment growth.

Hypothesis 6a: The structural break in the investment growth significantly coincides with the structural break in demand side growth variables.

Our Hypothesis 6b goes on further to specify that if Hypothesis 6a holds true, the growth in demand side variables will be significantly lower post 1992. Matching the direction of change of the investment growth variable.

Hypothesis 6b: The demand side growth variables have significantly lower growth post break date, matching the direction of change of the investment growth variable.

A test for a structural break in demand side growth variables

In this section, we test our demand side growth variables, public investment growth, and private investment growth, for the structural break coinciding with the break date of the investment growth variable. We check for the single most significant mean shift at a known break date, for the year 1992, or fairly approximate to it.

Recalling from our methodology section 3.4.1.1 above, the statistical test we will use will be based on a classical Chow test to check the shift in the series at a known break date. A second econometric test will be based on a two sample t test analysis, to test if the average growth rates pre 1992 are significantly greater than post 1992.

A structural break test at a known break date for all explanatory demand side variables

To test our explanatory demand side series for the single mean shift at a known break date, we repeat the structural break model specified to test for the break at a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \qquad \text{(H6a A)}$$

Where y_{it} represents growth in the variable i in time period t. β_{ij} is the mean shift parameter for the growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \qquad \text{(H6a A)}$$

Result of Chow's test for a known break date of demand side growth variables

The Wald test for the known break date using Chow's procedure is performed to determine a break in the growth of the explanatory demand side variables. Table 2.6a reports the findings for the Wald test at a known break date. Of all the explanatory demand side variables, only the public investment growth variable rejects the null posit of having no structural break. The Wald statistics takes the value 4.72 and is significant at a 10 percent level. This shows that public investment growth has a significant break in the year 1993. We can conclude that under Chow's procedure, the public investment growth series shows a significant structural break in the year 1993.

Table 2.6 a: Structural Break Test for Real Public Investment Growth

Results: Test for the known structural break				
Variable Description	Known Break Date	Tests and Probability		
		Test	Statistics	P-Value
Real Public investment growth	**1993**	$\chi^2(1)$	**4.72***	**0.091**

The above exercise (H6 A) provides a valid statistical analysis in support of our Hypothesis 6a, that there has been a significant break in the public investment growth series.

And that the break in the public investment growth series coincides with the break in investment growth.

Result from two sample t-test for testing a known break date in public investment growth

The two sample t- test will be used to compare the average growth rates of public investment and private investment across two time periods, pre 1992 and post 1992. The test allows us to test the following set of hypothesis:

H_a: $\mu_{i1} != \mu_{i2}$ (H6b Ai)

H_a: $\mu_{i1} < \mu_{i2}$, (H6b Aii)

H_a: $\mu_{i1} > \mu_{i2}$ (H6b Aiii)

Where, μ_{i1} is the average growth rate of i^{th} variable pre 1992. And μ_{i2} is the average growth rate of the i^{th} variable post 1992. To support our Hypothesis 6b, that the average growth rate of the demand side variables dropped post 1992, we are particularly interested in the result of (H6b Aiii) above. Which tests for the alternative hypothesis that the average growth rate pre 1992 is significantly greater than the average growth rate post 1992.

Table 2.6b reports the results for the two sample t-test. The test is separately run to compare average growth rates of public investment pre 1992 and post 1992. And to compare average growth rates of private investment pre 1992 and post 1992. Of the two demand side determinants, the results for the public investment came out to be significant. The results for the public investment in Table 2.6b reports that on average public investment growth rate has been 5.4 percentage points higher pre 1992 as compare to post 1992. The difference is significant at a p-value of 0.0702. The result favours the (H6b Aiii) above. This result supports our Hypothesis

6b that, of the demand side determinants, on average public investment growth has significantly lower growth post break date, matching the direction of change of investment growth variable.

Table 2.6 b: Two Sample t-test for growth in public investment

Pre 1992 Average Public Investment Growth	Post 1992 Average Public Investment Growth	Public Investment Growth Difference in Mean (Post 1992 - Pre 1992)
7.031	1.618	-5.21**

Summarising, the break in public investment growth coincided with the break in investment growth. Recalling, we observed on average investment growth to drop by 3.11 percent after Year 1992. Most importantly, now we observed a similar trend for public investment growth. Public investment growth dropped on average 5.4 percent after the year 1992. Hence, we can say that that the better explanatory variable, coinciding with the downward trend in investment growth post 1992 is public investment growth. Further, in next section we test the demand side variables as share in output, reporting the results of Hypothesis 7.

3.4.4.2 Results of Test C, the trend analysis for the shares of demand side variables in output

For our second set of empirical results, we move from examining growth in the macro aggregates to shares in output of macro aggregates. Given confirmation of hypotheses 6 in favor of the public investment growth variable, we now expect symmetry between the shares of public investment and investment. We have already seen a declining trend in investment share over time in our first essay. We now report the results for the trend in shares of our demand side variables in output, public investment share, and private investment share.

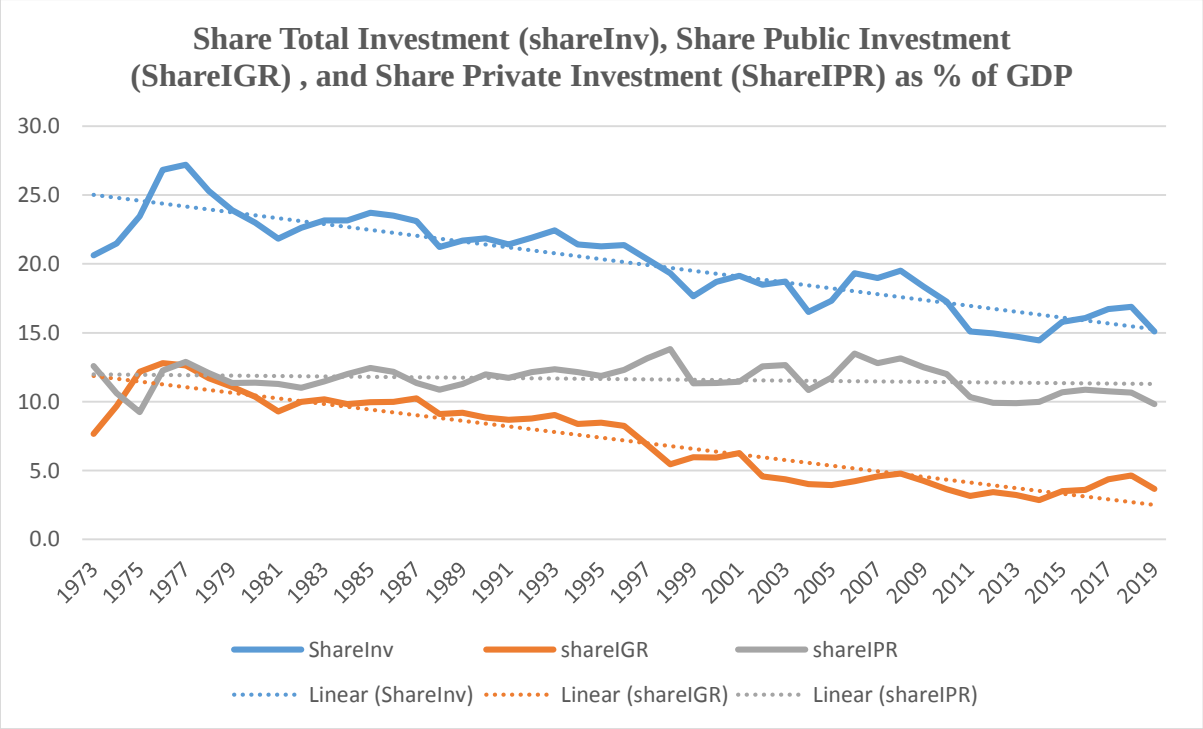
Hypothesis 7: The shares of demand side variables in output has a significant declining trend post 1992, matching the declining trend in the share of investment in output.

To test Hypothesis 7, we perform the trend analysis and the two sample t-test for our demand side variables, public investment share and private investment share. The trend analysis is based on, first examining the trends of investment share and the shares of demand side variables as time series plots. Second, examining the statistical significance of trend coefficients using simple linear regression. The two sample t-test is a statistical method to test for the equality of average share values of the demand side variables across two time periods, pre 1992 and post 1992.

Results using time series plots to examine the behavior of investment share in relation to shares of demand side variable in output

Figure 2.4 plots total investment, public investment, and private investment as shares in total output (GDP) from the year 1973-2019. Recalling, we have observed investment share declining over time in Essay One. We now see public investment share declining over time. While the private investment share remains approximately constant over time. This implies that the declining investment share can be explained by declining public investment shares over time. It also implies that declining investment shares will not be well explained by the constant private investment share over time.

Figure 2.4: Share Total Investment (shareInv), Share Public Investment (ShareIGR), and Share Private Investment (ShareIPR) as % of GDP



As far as the shares are concerned, a nonrigorous test, observing the time plots in figure 2.4 shows that share of public investment has declined over time. However, the share of private investment has remained constant and has not increased. This provides an informal confirmation of the Keynesian hypothesis. That Pre 1992, when public investment was high, total investment was high and private investment was constant. However, Post 1992, when public investment fell it did not increase the private investment share, and hence, the total investment also fell. This

again points out towards the refutation of the Ricardian hypothesis of crowding out of private investment by public investment. And favors the Keynesian hypothesis., of crowding in of total investment by public investment.

We now proceed to test the statistical significance of the trends and relationships observed in Figure 2.3, in the form of trend regressions.

Results using trend regressions to examine the shares of demand side variables in output

The regression equation of the following form will be run on investment share and shares of demand side variables in output.

$$shareI_t = \alpha_0 + \alpha_1 trend_t + e_t \qquad \text{(H7 C1)}$$

$$shareIG_t = \beta_0 + \beta_1 trend_t + e_t \qquad \text{(H7 C2)}$$

$$shareIP_t = \delta_0 + \delta_1 trend_t + e_t \qquad \text{(H7 C3)}$$

Where $shareI_t$ represents the share of investment in output in time period *t*, $shareIG_t$ represents the share of public investment in output in time period *t*, $shareIP_t$ represents the share of private investment in output in time period *t*. *trend* variable represents the time trend variable. We run the three models for the entire time period and for the two time periods, pre 1992 and post92.

The results for the specification (H7 C1) are represented in Table 2.7a.

The left hand side variable is the share of investment (shareI). And the right hand side variable is the time trend (t). The significant coefficient of the trend variable, t for the overall sample, -0.212 clearly shows the declining linear trend over time. Also, the coefficient

significantly declines post 1992. And the change between the two coefficients, pre and post 1992 significantly differs between the two time periods.

Table 2.7 a: Trend Regression of Share of Investment as % of GDP

VARIABLES	Full Sample shareI	Pre 1992 shareI	Post92 shareI
t	-0.212***	-0.111*	-0.241***
	(0.0157)	(0.0649)	(0.0304)
Constant	25.23***	24.21***	26.19***
	(0.434)	(0.778)	(1.059)
Observations	47	20	27
R-squared	0.801	0.140	0.716

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results for the specification (H7 C2) are represented in Table 2.7b. The left hand side variable is the share of public investment (shareIG). And the right hand side variable is the time trend (trend). For the overall sample, the significant coefficient, -0.204, for the time trend variable shows the declining trend over time. For the subsamples, Pre 1992 and Post92, the share of public investment consistently shows a significant declining trend in both the time periods. In fact, the trend for the share of public investment has become more negative post 1992. Taking the coefficient value of -0.189 Post 1992 as compared to -0.116 Pre 1992. The two coefficients are individually significant for each time period, but are not statistically different from each other.

Table 2.7 b: Trend Regression of Share of Public Investment

VARIABLES	Dependent Variable ShareIG full sample	Dependent Variable ShareIG Pre 1992	Dependent Variable ShareIG post 1992
trend	-0.204***	-0.116*	-0.189***
	(0.0162)	(0.0648)	(0.0295)
Constant	12.08***	11.33***	11.44***
	(0.474)	(0.932)	(1.034)
Observations	47	20	27
R-squared	0.861	0.251	0.700

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.7c represents the result of the specification (H7 C3). The left hand side variable in this case, is the share of private investment (shareIP). And the right hand side variable is the time trend (t). The results for the overall sample are consistent with the visual observation of time series plots. The insignificant trend coefficient for the overall sample shows that the share of private investment has remained constant. However, for the sub sample results, there is a negative and significant trend coefficient Post 1992, showing that the trend of the private investment share has significantly declined Post 1992 as compared to Pre 1992.

Table 2.7 c: Trend Regression of Share of Private Investment

VARIABLES	Dependent Variable ShareIP Full sample	Dependent Variable ShareIP Pre 1992	Dependent Variable ShareIP Post 1992
t	-0.0149	0.0174	-0.0935***
	(0.0122)	(0.0391)	(0.0172)
Constant	12.00***	11.43***	14.84***
	(0.314)	(0.565)	(0.619)
Observations	47	20	27
R-squared	0.039	0.016	0.398

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Comparing the results of the share of public investment in Table 2.7b and the share of private investment in Table 2.7c, it shows that the share of public investment follows the similar declining trend as the share of investment in output. Although the share of private investment declined significantly, Post 1992, it remained constant for the entire series. To further add validity to our analysis we proceed to run a two sample t-test on average values of the share across two time periods.

Results from the two sample t-test for the equality of average values

The two sample t- test will be used to compare the average values of the share of public investment and the share of private investment across two time periods, pre 1992 and post 1992. The test allows us to test the following set of hypotheses:

H_a: $\mu_{i1} != \mu_{i2}$ (H7 Ci)

H_a: $\mu_{i1} < \mu_{i2}$, and (H7 Cii)

H_a: $\mu_{i1} > \mu_{i2}$ (H7 Ciii)

To support our Hypothesis 7, that the average value of the share of demand side variables dropped post 1992, we are particularly interested in the result of (H7 Ciii) above. Which tests for the alternative hypothesis that the average value of the shares pre 1992 is significantly greater than the average value of the shares post 1992.

Table 2.7d reports the results of two sample t-tests for the share of public investment. The test is separately run to compare the average values of the share of public investment and the share of private investment in output Pre 1992 and Post 1992. Of the two demand side determinants, the results for the public investment share came out to be significant. The results for the public investment share in Table 2.7d reports that on average public investment share has been 5.03 percentage points higher Pre 1992 as compared to Post 1992. The difference in the average values between Pre 1992 and Post 1992 is statistically significant. The result favors the (H7 Ciii) above.

Table 2.7 d: Two sample t-test for Share of Public Investment

Pre 1992 Average Share of Public Investment	Post 1992 Average Share of Public Investment	Share of Public Investment Difference in Mean (Post 1992 - Pre 1992)

10.18	5.15	-5.03**

Combining the results from the trend analysis and two sample t-test in this section, we may conclude that overall, the share of private investment has remained constant. Whereas, Post 1992, the share of private investment has a significant declining trend. Alternatively, we have observed the declining trend overall as well as the lower average share of public investment Post 1992. This observation further adds support to our Hypothesis 6b, that of the demand side determinants, on average public investment growth has significantly lower growth post break date, matching the direction of change in the investment growth variable.

To this point in the empirical analysis section, we have performed individual analyses for each of the demand side variables. We tested public investment growth and private investment growth independently for Test A of structural break, and Test C of trends and equality of mean values. Based on the empirical results of Hypotheses 6 and Hypothesis 7, the results support that public investment is the significant determinant of investment growth. However, we need to further investigate the demand side variables in a joint framework to give a concrete conclusion. Therefore, in succeeding sections we present the results for the demand side variables, public investment, and private investment, jointly under a more comprehensive and integrated framework.

3.4.4.3 Results of Test D, for analysing investment growth variable in relation to demand side growth variables

Recalling, the objective of the essay is to explain the drop in investment growth post 1992. So far, we have presented the results for a structural break at a known break date of year 92. And have represented the results of the demand side variables as shares in output. We now

go on further to study our demand side variables jointly in a growth regression to test Hypothesis 8.

Hypothesis 8: The drop in investment growth post 1992 is significantly associated with the drop in the growth of demand side variables.

Results for the empirical growth model of investment

The Test D, based on regression framework to test the Hypothesis 8 specifies investment growth variable as a function of public investment growth and private investment growth. We intend to run three specifications. First, investment growth as a function of public investment growth. Second, investment growth as a function of private investment growth. And third, investment growth as a combined function of public investment growth and private investment growth in a multiple linear regression framework. All three specifications will be run independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

$$g_t^I = \alpha_0 + \alpha_1 g_t^{IG} + \epsilon_t \qquad \text{(H8 D1)}$$

$$g_t^I = \beta_0 + \beta_1 g_t^{IP} + \epsilon_t \qquad \text{(H8 D2)}$$

$$g_t^I = \delta_0 + \delta_1 g_t^{IG} + \delta_2 g_t^{IP} + \epsilon_t \qquad \text{(H8 D3)}$$

Where, g_t^I represents investment growth, g_t^{IG} represents public investment growth, and g_t^{IP} represents private investment growth.

Table 2.8a represents the results for specification (H8 D1). The left hand side variable is the investment growth (growthI). And the right hand side variable is the public investment growth (growthIG). The coefficient of the public investment growth variable, 0.38, is

significantly correlated to investment growth for the overall sample. Similarly, the coefficient remained significantly correlated to investment growth variable in subsamples, pre 1992 and post 1992. Therefore, the public investment growth is well correlated to the investment growth variable.

Table 2.8 a: Regression of growth of investment and growth in public investment

VARIABLES	Dependent Variable GrowthI Full sample	Dependent Variable GrowthI Pre92	Dependent Variable GrowthI Post92
GrowthIG	0.388***	0.337***	0.385***
	(0.0604)	(0.107)	(0.0764)
Constant	2.572***	3.894***	1.895*
	(0.703)	(0.994)	(0.998)
Observations	46	19	27
R-squared	0.495	0.393	0.499

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results for the (H8 D2) are shown in the Table 2.8b. The left hand side variable is the investment growth (growthI). And the right hand side variable is the private investment growth (growthIP). The private investment growth is well correlated to investment growth in the overall sample. The private investment growth coefficient remains significantly correlated in both the

time periods, pre 1992 and post 1992. Especially Post92, the coefficient is significant, and higher in magnitude than Pre92. This means, that the investment growth is significantly better correlated to private investment growth Post 1992, as compared to Pre 1992.

Table 2.8 b: Regression of growth of investment and growth in private investment

VARIABLES	Dependent Variable GrowthI full sample	Dependent Variable GrowthI Pre92	Dependent Variable GrowthI Post92
GrowthIP	0.474***	0.245**	0.709***
	(0.109)	(0.104)	(0.127)
Constant	1.873*	4.762***	-0.00666
	(1.077)	(1.636)	(0.897)
Observations	46	19	27
R-squared	0.413	0.244	0.600

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

So far the results for the specification (H8 D1) and (H8 D2) shows that the magnitude of correlation between the growth in investment and public investment has remained almost constant in the two sub periods. Whereas, the magnitude of correlation increased considerably between growth in investment and private investment Post 1992 as compare to Pre92. This

shows that, Post 1992 investment growth is better correlated to private investment. And, Pre 1992, the investment growth was better correlated to public investment.

For concreteness, Table 2.8c provides the multiple linear regression results for the specification (H8 D3). The left hand side variable is the investment growth (growthI). And the right hand side variable is the public investment growth (growthIG) and the private investment growth (growthIP) . For the full sample, the investment growth came out to be significantly correlated to both public investment growth and private investment growth. Consistent with the partial results discussed in the preceding paragraph, Pre 1992, the investment growth is better correlated with public investment growth. And Post 1992, the coefficient for the public investment growth significantly drops, but the coefficient of private investment growth significantly increases. This means, Post 1992 investment growth is better correlated to private investment growth.

Table 2.8 c: Regression of growth of investment, growth in public investment, and growth in private investment

	Dependent Variable GrowthI	Dependent Variable GrowthI	Dependent Variable GrowthI
VARIABLES	Full sample	Pre92	Post92
GrowthIG	0.398***	0.491***	0.336***
	(0.0313)	(0.0424)	(0.0229)
GrowthIP	0.489***	0.403***	0.636***
	(0.0486)	(0.0272)	(0.0289)
Constant	0.273	0.339	-0.292
	(0.304)	(0.211)	(0.213)
Observations	46	19	27
R-squared	0.933	0.973	0.974

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Overall on the basis of our analysis for the demand side, we can infer the following set of conclusions,

a. Pre 1992, on average, the growth in investment of 6.3% and the share of investment in output of 23%, were higher. Also, the growth in public investment of 7.03% and the share of public investment of 10.1% were significantly higher.

b. Post 1992, on average, when the growth in investment of 2.8% and the share of investment in output of 17.9% significantly declined, the share of public investment of 5% dropped as well. While, on average the share of private investment in output remained constant.

c. The growth in investment is significantly correlated to the growth in public investment and to the growth in private investment for the entire period and sub periods.

d. Pre 1992, of the demand side growth variables, the growth in public investment remained better correlated with the growth in investment.

e. Post 1992, of the demand side growth variables, the private investment growth showed higher correlation with the growth in investment.

This set of conclusions, hence, provides us with substantial evidence to answer one of our central questions. That, of the demand side determinants of investment, which factor is well correlated with the drop in investment growth. Therefore, we can state Hypothesis 8 as;

The drop in investment growth post 1992 is significantly associated with the drop in the growth of public investment post 1992.

3.4.4.4 Results of Test E, analyzing the relationship between the demand side determinants, public investment and private investment

Our last set of empirical results are based on the two testable hypothesis, implied by the literature. One is the Keynesian crowding in hypothesis. And other is the Ricardian crowding out hypothesis. The two hypotheses test the relationship between the demand side determinants themselves, public investment and private investment.

Hypothesis 9a: Private investment is a positive function of public investment.

According to the Keynesian Hypothesis of crowding in.

Hypothesis 9b: Private investment is a negative function of public investment.

According to the Ricardian Hypothesis of crowding out.

To test the two possibilities, hypothesis 9a and hypothesis 9b. We will present the results comprehensively using the results discussed so far in the demand side. And, the results from the model of this section.

The relationship between public investment and private investment can be estimated as follows;

$$g_t^{IP} = \alpha_0 + \alpha_1 g_t^{IG} + \epsilon_t \qquad \text{(H9 E)}$$

where, g_t^{IP} represents the growth in private investment, and g_t^{IG} represents the growth in public investment. The model is run independently for pre 1992 and post 1992. The coefficients of the model are tested for equality across the two time periods, pre 1992 and post 1992.

The nature of the relationship between public investment and private investment depends on the sign of the coefficient, α_1. If α_1 is significant and positive, the relationship favors the first argument. That the public investment crowds in private investment. Contrary, the significant and negative α_1, favors the alternative possibility. That public investment crowds out private investment.

In addition to the results of this section, the entire set of results from the demand side will be used to determine whether the crowding in or crowding out hypothesis holds in the case of Pakistan.

3.5. Results

The results for the specification (H9 E) are presented in Table 2.9. The left hand side variable is the private investment growth (growthIG). And the right hand side variable is the public investment growth (growthIP). For the full series, the relationship between the public investment and private investment did not appear to be significant. Pre 1992, the coefficient, α_1, came out to be negative and marginally significant. Showing, on average that a 1% increase in public investment growth is associated with 0.44% decline in the private investment growth. Indicating, the crowding out of growth in private investment, Pre 1992. Post 1992, the relationship between the growth in public investment and the growth in private investment has weakened. The coefficient appears insignificant Post 1992.

Table 2.9: Regression showing the relationship between the growth of private investment and growth of public investment

	Dependent Variable: GrowthIP	Dependent Variable: GrowthIP	Dependent Variable: GrowthIP

VARIABLES	Full sample	Pre92	Post92
GrowthIG	-0.0357	-0.448*	0.102
	(0.127)	(0.236)	(0.130)
t	-0.0834	-0.242	-0.140
	(0.120)	(0.633)	(0.144)
Constant	6.807*	11.50	8.359
	(3.465)	(9.582)	(5.310)
Observations	46	18	28
R-squared	0.015	0.139	0.041

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Although, the relationship between the growth of private and public investment came out negative in this section. We need to review the entire set of demand side results comprehensively in order to draw out concrete conclusions. Hence, reviewing

- The results show that private investment has no significant correlation with public investment in the full sample.
- This implies the rejection of the Ricardian hypothesis that public investment crowds out private investment.
- The decreasing share of public investment over time also rejects the Ricardian hypothesis.
- Because as the public investment share drops, it should have crowded in, increasing the private investment share.
- But, the Private investment share remains constant at a very low level of approx 12% of GDP.
- And the reduction in public investment over time accounts for the drop in the total investment over time. Which in turn accounts for the drop in GDP over time. This is a

qualified acceptance of the Keynesian hypothesis that public investment crowds in aggregate investment.

3.6 Conclusions for Essay Two

Essay two has focused on explaining the observed drop in Pakistan's investment growth between the two time periods, pre 1992 and post 1992. It has done this by examining the impact on investment, of the macro aggregate determinants of investment growth. These are the supply side determinants of investment, and the demand side determinants of investment.

The **supply side determinants** of investment are savings and capital inflows.

Based on our theoretical model of supply side determinants and the literature examining the relationship between savings, capital inflows, and investment, points to two possibilities;

1. Savings and inflows are complements for developing countries, like Pakistan.
2. The Griffin and Enos model raises the alternative possibility that inflows may actually reduce savings.

Similarly, the **demand side determinants** of investment, public investment, and private investment are posited by two alternative economic models.

3. A Ricardian Model posits that public investment will crowd out private investment and therefore, weaken aggregate investment.
4. Alternatively, a Keynesian model posits that public investment can actually crowd in private investment and therefore raise aggregate investment.

The empirical methodology explained the behavior of investment and its determinants through a series of hypotheses and econometric tests, including structural break analysis, trend analysis, and regression analysis.

Our empirical methodology provided us with two sets of empirical results. One for the supply side determinants and the second for the demand side determinants. The empirical results for the supply side determinants, savings, and inflows, suggest that

a. Pre 1992, the growth in investment and the share of investment in output were increasing. Also, the share of inflows had an increasing trend.
b. Post 1992, when the growth in investment and the share of investment declined, the share of inflows also exhibited a declining trend.
c. Pre 1992 and Post 1992, in both the time periods, of the supply side growth variables, inflows growth remained significantly correlated with the investment growth.
d. The negative relationship between savings and inflows supports Griffin Enos hypothesis, suggesting that they are substitutes.

These sets of results on the supply side, hence, allow us to conclude that the drop in investment growth post 1992 is significantly associated with the drop in the growth of inflows post 1992.

The empirical results for the demand side determinants, public investment, and private investment, suggest that:

a. Observing the growth of the demand side determinants of investment, there is a significant break in public investment growth in the year 1992. And public investment growth dropped on average 5.4 percent after the year 1992. Hence, we can say that the

better explanatory variable, coinciding with the downward trend in investment growth post 1992 is public investment growth.

b. Observing the shares of the demand side determinants, the share of private investment has remained constant. Over the time period 1973-2019, the share of public investment has significantly declined by 5.04 percent, post 1992.
c. The growth in investment is significantly correlated to the growth in public investment for the entire period and sub periods, even controlling for the growth in private investment.

These sets of results, hence, allow us to conclude that public investment explains the drop in aggregate investment. Our last set of empirical results in essay two is based on the two testable hypotheses, implied by the literature. One is Keynesian crowding in hypothesis. And other is the Ricardian crowding out hypothesis. The two hypotheses test the relationship between the demand side determinants themselves, public investment and private investment. Our results suggest that,

- Private investment has no significant correlation with public investment in the full sample.
- This implies the rejection of the Ricardian hypothesis that public investment crowds out private investment.
- The decreasing share of public investment over time also rejects the Ricardian hypothesis.
- Because as the public investment share drops, it should have crowded in increasing the private investment share.

- But, the Private investment share remains constant at a very low level of approx 12% of GDP.

And the reduction in public investment over time accounts for the drop in the total investment over time. Which in turn accounts for the drop in GDP over time. This is a qualified acceptance of the Keynesian hypothesis that public investment crowds in aggregate investment. Therefore, Essay two suggests that of the demand side determinants, the growth and the declining share of public investment explain the drop in the growth of investment post 1992.

4. Essay Three: Explaining the behavior of Public investment in Pakistan from 1973-2019

4.1. Recapping Essay One and Essay Two

This thesis aims to establish the determinants of Pakistan's long run GDP growth. The problem of establishing the determinants of GDP growth is a perennial one for all economies to be able to choose their policy levers and gauge their impact more precisely. The problem becomes more acute and even existential for Pakistan, because of an observable long run decline in GDP growth rates. The 60s, 70s, and 80s, appear to have had higher growth rates on trend, nearer 6% per annum, compared to the 90s onwards, nearer 4% per annum. Not least the three

years prior to Covid, and then Covid appear to have sunk GDP growth even lower than this 4% trend.

Policy debate, and multilateral and donor advice, we find focus more on the shorter run cyclical concerns and policy variables. These are no doubt important, but they do not address longer run structural factors, such as investment. Therefore, this Ph.D. thesis attempts to address long run determinants of trend GDP growth.

Essay One has focused on explaining the long run growth of output through its structural determinants in a General Equilibrium analysis.

Essay One has focused on explaining the observed drop in Pakistan output growth between two time periods, pre 1990, and post 1990. It has done this by examining the impact on output, of the macro aggregate determinants of output growth.

The theoretical framework chosen in essay one has been the Keynesian general equilibrium framework of estimating and analyzing aggregate demand. The alternative framework in the international and Pakistani literature was seen to be the decomposition of output through Swan Solow production functions. We have chosen the Keynesian decomposition of output into the macro aggregate components of aggregate demand, consumption, investment, government expenditures, exports, and imports. This choice of analytical frameworks has been argued on theoretical grounds in essay one, to have more explanatory power. And has been justified by the empirical results obtained in Essays One and Two.

Data considerations, of consistency and comparability, have made us choose the period of analysis from 1973 to 2017.

The analytical strategy we have used is to establish first whether there has been a discrete drop in GDP growth at a particular break date. Establishing this break date allows us to define two periods of GDP growth, a higher growth period, followed by a lower growth period. The determinants of GDP growth can then be established, by looking for such changes in their behavior between the two time periods.

We started our empirical analysis with a structural break analysis, using the procedures proposed by Bai and Perron (1998, 2003), henceforth BP, Andrews (1993), and Chow (1960), and using a dummy regression. We then applied a Markov Switching Regime Model.

We found a significant structural break for the year 1992. Running a dummy regression for this known break date, found that GDP growth dropped by 1.84% after 1992.

A Markov Switching Regime Model further strengthened and supplemented the argument for the distinction between the two time periods, and demonstrated that in the high growth period, both the highs and the lows in GDP growth rates, have been higher than the highs and the lows in the low growth period.

Further, the probability of switching from a low growth regime to a high growth regime has also been higher in the pre 1992 high growth period, compared to the post 1992 low growth period.

Next, our analytical strategy was to establish which of the explanatory macro aggregates follows this pattern of high GDP growth in the pre 1992 period, and low GDP growth in the post 1992 period.

Our results suggested that after 1992, on average investment growth drops by 3.11 percent. And the break in investment growth coincided with the break in GDP growth. Having established that of all the explanatory macro aggregates only investment growth had a significant drop post 1992, following the drop in GDP growth, we proceeded to the next step of testing whether GDP growth was indeed a function of its explanatory macro aggregates.

As expected, only the investment growth variable consistently explains GDP growth across the two time periods, pre 1992 and post 1992. The investment growth variable showed that a 1 percent increase in investment growth was associated with a 0.24 percent increase in GDP growth pre 1992. The coefficient of investment growth dropped post 1992 and was associated with a 0.17 percent increase in GDP growth. Both the coefficients were significant and positive in both time periods. The investment growth coefficient had a higher value in the first phase pre 1992, and a lower value in the second phase post 1992. And the drop in investment growth coefficient was highly significant between the two time periods, pre 1992 and post 1992. All the results showed the investment growth variable to be the major determinant of output growth.

Having established that the drop in Pakistan's GDP growth between the two time periods pre 1992 and post 1992, is well explained by the drop in investment growth, Essay one has attempted to go further. The theoretical framework adopted of the Kahn Keynes investment multiplier being based on Marginal Propensity to Consume (MPC), implied that there could be two channels working to determine long run GDP growth, the investment channel and the consumption channel.

Essentially, this theoretical framework implies that the high GDP growth period pre 1992 would be investment led, with a weaker consumption channel. While the low GDP growth period post 1992 would be consumption led, with a weaker investment channel. The argument had now to be based on estimating the MPC across two phases of GDP growth, pre 1992 with its high GDP growth, and post 1992 with its drop in GDP growth.

The estimated results showed that the MPC in the high growth phase pre 1992, was 68.5 percent and highly significant. And the MPC, in the low growth phase post 1992, was 76.4 percent and again highly significant. We then ran a Chi square test which confirmed that the two coefficients, representing MPC values, were significantly different. Therefore, we can say that high GDP growth in the first phase, pre 1992, is explained by high investment growth. And that the Marginal Propensity to Consume in this phase is low. Making this high GDP growth phase investment led. And that the Low GDP growth in the second phase, post 1992, is again explained by low investment growth. And the Marginal Propensity to Consume, in this phase is higher. Making this phase consumption led.

In summary, Essay 1 establishes investment growth as the main driver of GDP growth. And that on average the investment growth drops by 3.11 percent. And the break in investment growth coincides with the break in GDP growth. Hence, observing a similar declining trend for GDP growth and investment growth. We then needed to provide the theoretical and empirical methodology to explain the discrete drop in investment. Having established investment as a major determinant of high GDP growth in Essay One. We then needed to explain in Essay Two the determinant of investment in turn.

Essay Two

Essay two focused on explaining the observed drop in Pakistan's investment growth between the two time periods, pre 1992 and post 1992. It has done this by examining the impact on investment, of the macro aggregate determinants of investment growth. These are the supply side determinants of investment, and the demand side determinants of investment.

The **supply side determinants** of investment are savings and capital inflows.

Based on our theoretical model of supply side determinants and the literature examining the relationship between savings, capital inflows, and investment, points to two possibilities;

5. Savings and inflows are complements for developing countries, like Pakistan.
6. The Griffin and Enos model raises the alternative possibility that inflows may actually reduce savings.

Similarly, the **demand side determinants** of investment, public investment, and private investment are posited by two alternative economic models.

7. A Ricardian Model posits that public investment will crowd out private investment and therefore, weaken aggregate investment.
8. Alternatively, a Keynesian model posits that public investment can actually crowd in private investment and therefore raise aggregate investment.

The essay established the empirical methodology to test the above possibilities. And explained the behavior of investment and its determinants through a series of hypotheses and econometric tests, including structural break analysis, trend analysis, and regression analysis. Data considerations, of consistency and comparability, made us choose our period of analysis to be 1973 to 2019, as in Essay One.

Our empirical methodology provided us with two sets of empirical results. One for the supply side determinants and the second for the demand side determinants. The empirical results for the supply side determinants, savings, and inflows, suggest that

e. Pre 1992, the growth in investment and the share of investment in output were increasing. Also, the share of inflows had an increasing trend.
f. Post 1992, when the growth in investment and the share of investment declined, the share of inflows also exhibited a declining trend.
g. Pre 1992 and Post 1992, in both the time periods, of the supply side growth variables, inflows growth remained significantly correlated with the investment growth.
h. The negative relationship between savings and inflows supports Griffin Enos hypothesis, suggesting that they are substitutes.

These sets of results on the supply side, hence, allow us to conclude that the drop in investment growth post 1992 is significantly associated with the drop in the growth of inflows post 1992.

The empirical results for the demand side determinants, public investment, and private investment, suggest that:

d. Observing the growth of the demand side determinants of investment, there is a significant break in public investment growth in the year 1992. And public investment growth dropped on average 5.4 percent after the year 1992. Hence, we can say that the better explanatory variable, coinciding with the downward trend in investment growth post 1992 is public investment growth.

e. Observing the shares of the demand side determinants, the share of private investment has remained constant. Over the time period 1973-2019, the share of public investment has significantly declined by 5.04 percent, post 1992.
f. The growth in investment is significantly correlated to the growth in public investment for the entire period and sub periods, even controlling for the growth in private investment.

These sets of results, hence, allow us to conclude that public investment explains the drop in aggregate investment. Our last set of empirical results in essay two is based on the two testable hypotheses, implies by the literature. One is Keynesian crowding in hypothesis. And other is the Ricardian crowding out hypothesis. The two hypotheses test the relationship between the demand side determinants themselves, public investment and private investment. Our results suggest that,

- Private investment has no significant correlation with public investment in the full sample.
- This implies the rejection of the Ricardian hypothesis that public investment crowds out private investment.
- The decreasing share of public investment over time also rejects the Ricardian hypothesis.
- Because as the public investment share drops, it should have crowded in increasing the private investment share.
- But, the Private investment share remains constant at a very low level of approx 12% of GDP.

And the reduction in public investment over time accounts for the drop in the total investment over time. Which in turn accounts for the drop in GDP over time. This is a qualified acceptance of the Keynesian hypothesis that public investment crowds in aggregate investment. Therefore, Essay two suggests that of the demand side determinants, the growth and the declining share of public investment explain the drop in the growth of investment post 1992.

Implications of the argument established in Essay One and Essay Two for Essay Three

Thus Essay one and Essay two suggest that the structural breaks, in the GDP growth, the investment growth, and the public investment growth, coincide at 1992. Using structural break analysis, all three macro aggregates exhibited a structural break in the year 1992. After the year 1992, the average growth in GDP dropped by 1.84 percent, the average growth of investment dropped by 3.11 percent, and the average growth of public investment dropped by 5.4 percent. Regression analysis shows investment growth as a significant determinant of the drop in GDP growth. And, the public investment growth as a significant determinant of the drop in investment growth.

Since public investment has come out to be a key determinant explaining the investment growth in Pakistan. The next step is to examine the factors that explain the evolution of public investment in Pakistan. The cross-country literature has two approaches to analyzing these factors. One is to examine the behavior of public investment in terms of its sub sectors e.g infrastructure, energy, transport, etc. This approach allows us to identify the most constrained sub sector under the public sector investment.The second approach is to examine the role of the regulatory policy environment in determining the behavior of public investment. This raises the issue of whether the public sector is constrained by the internal or external regulatory policy environment. Both of these approaches are widely discussed in the literature. Therefore, in this

Essay three of our thesis, we attempt to explain the behavior of public investment over time in terms of its sub-sectors and in terms of the regulatory policy environment.

4.2. Introduction to Essay three

Our concern in essay three is to empirically analyze the behavior of public investment in Pakistan over the years 1973-2019. Essentially, our research objective in essay three is, to determine the factors that explain the observed declining trend in the share of public investment over time. And, specifically to explain the drop in the growth of public investment variable post 1992. The essay seeks to achieve these objectives in two parts. In the first part, we carry out a disaggregated analysis of the components of the public investment variable. Where the public investment is analyzed as a function of its subsectors. In the second part, we examine the impact of the regulatory policy environment governing the behavior of public investment in Pakistan. Introducing the impact of the regulatory policy environment in our essay is critical to our study. The regulatory impact will be estimated using a key policy variable, the **targeted fiscal deficit agreed under the international monetary fund (IMF) program**. This long run series for the targeted fiscal deficits has been compiled for the first time, to our knowledge. The data for the targeted deficits has been taken from the lending arrangements between Pakistan and IMF since 1973. In the subsequent paragraph, we discuss the importance of including this key policy variable in our study.

There has been and continues to be, a rigorous debate in the literature concerning whether and how public investment is affected by the regulations of governing institutions. In our case, for the economy of Pakistan, where we face limited budgetary resources and competing spending needs, the involvement of the IMF has been increasing since 1973. By increasing involvement

we mean not only the amount of funds that Pakistan has borrowed increased over time but also the conditions on which Pakistan has been given the loan amount, have become tighter over time.

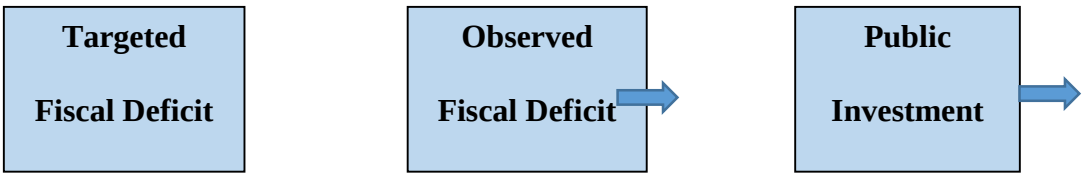
Numerous studies in this regard have presented stylized facts on how IMF programs have affected growth in Pakistan and other economies. Some of these studies focus on IMF programs and imposed conditionalities and targets on the fiscal and current accounts of countries. And how far the conditionalities have proven successful or detrimental for these economies. The most common target that indebted economies have to meet on the fiscal account is to curtail the fiscal deficit. Which, in turn, is expected to be achieved either using a tax increase or an expenditure cut, or a mix of the two. Of which, the expenditure cut has been seen to be the preferred option adopted in most cases. And these expenditure cuts under the IMF programs that governments end up cutting are mainly observed to be public investment and development expenditures[4] rather than cutting current expenditures to curtail fiscal balance.

We, introduce a key policy variable on the fiscal side, **"the agreed target of the fiscal deficit under IMF Programs from 1973-2019"** to estimate the effect of a key policy variable on public investment expenditures. However, the effect of the targeted fiscal deficit on public investment will not be direct. It will work through an indirect effect, of the observed fiscal deficit. The targeted fiscal deficit under the fund program will affect the determination of the observed fiscal deficit. Which will then have an effect on the public investment expenditures. Theoretically, a tighter targeted fiscal deficit will lower the observed fiscal deficit. In turn,

[4]Saeed, Hyder and Ali (2006) explains the public investment and development expenditures as,"Theoretically, development expenditure component of fiscal outlays equals net investment by the public sector in Pakistan. Public investment is constructed primarily by economic activity as well as by capital assets. It comprises expenditures incurred on the acquisition of fixed assets, replacement, additions, and major improvements of fixed capital, viz., land improvement, buildings, civil and engineering works, machinery, transport equipment, and furniture and fixtures. Whereas, expenditures incurred on the developmental activities are termed as development expenditures.'' In national income accounts, we refer to public investment expenditures as 'Public Investment' and under fiscal outlays/budgetary documents, these are referred as 'development expenditures'.

leading to a cut in public investment expenditures. Figure 3.3.1 explains the theoretical phenomenon.

Figure 3.3. 1: Theoretical logic of the impact of the regulatory policy environment on the observed behavior of public investment



Therefore this Essay Three seeks to explain the behavior of public investment in two parts. Part one carries out a disaggregated analysis of the public investment. And part two examines the regulatory policy environment shaping the behavior of public investment.

The essay proceeds in the following manner. Section 4.3 reviews the literature on the determinants of public investment and the role of the regulatory policy environment in shaping the behavior of public investment in developed and developing countries. Section 4.4 presents the data. Section 4.5 presents the empirical results explaining the behavior of public investment over time. Section 4.6 concludes by providing policy implications from the essay and the whole thesis.

4.3. Literature Review

In our thesis so far we established an empirical argument that a drop in investment growth post 1992 explained the drop in the GDP growth post 1992. In turn, investment in the economy was explained by its two components, public investment and private investment. In our case,

although we see the growth in public investment crowds in private investment. But, the growth in the public investment itself dropped post 1992 and explained the drop in aggregate investment. Our empirical arguments are consistent with the existing studies in the literature showing the positive relation of investment and its components with economic growth (Cabebellero 1999, Chrinko 1993, Hashmi, Akram & Hashmi 2012, Bivens 2012). In this essay, we proceed to examine the behavior of public investment. First, in terms of its sectors. And second, as a function of the regulatory policy environment.

We now present the literature for this essay discussing, the role of public goods, the declining trend in public goods, and the determination of public goods by the regulatory policy environment.

4.3.1 The Role of Public Goods

There is a huge consensus in the literature that public investment in developing as well as developed countries have played a major role in raising GDP growth. The earlier literature right up to the more recent literature shows a strong positive correlation between GDP growth and public sector investment. (Aschauer 1989, Cullison 1993, Barro 1989, Ramirez 2000, Papagni et al., 2021)

Particularly, the scaling up of public investments in infrastructure, construction, transport, and energy has shown a significant increase in growth. Further, in low-income economies with deficiencies in public investment in energy and infrastructure, the loss of productivity levels has been observed to be detrimental to GDP growth. (Straub 2008, Foster and Smits 2008).

The studies have empirically estimated the substantial growth impact of infrastructure spending. Calderon and Serven (2003, 2008), using physical indicators of infrastructure, have

shown that if low-income countries halved their infrastructure gap, reaching the level of middle income countries, annual GDP growth rates would increase by 2 %. They also find that quantitative measures of electricity generating capacity, road and rail lines, and telephone lines have a positive and significant impact on output per worker. The study estimated that, if low-income countries in sub Saharan Africa reach the level of the regional leader (Mauritius), GDP growth could increase by 2.3 percent per annum; if they catch up with countries like South Korea, GDP growth would increase by 2.6 % per annum. Therefore, public investment in infrastructure has a well observed and significant impact on output growth. While constraints on such public goods can be detrimental to output growth.

4.3.2 Declining Trend in Public Goods

More generally, low-income countries across all regions suffer from an infrastructure deficit in comparison to middle-income countries, with the gap widening over time (Foster and Smits 2008). The drop in the growth of public investment is not only specific to low income countries, even the growth of public investment in advanced and emerging economies seems to be on a downward trend. (Breunig and Busemeyer 2012). And the reason is the episodes of fiscal consolidation. (Valila and Mehrotra 2005)

The literature discusses the specific and overlapping reasons for the drop in the growth of public sector investment generally for advanced, middle income, and low income countries. One of the reasons that are widely mentioned in the literature is the effect of the regulatory policy environment in shaping the behavior of public investment in these sets of countries. The regulatory policy environment can be based on the country's own internal public sector policies. Or the regulatory policy environment can be based on external policies influencing the country's public sector policies.

4.3.3 The Determination of Public Goods by the Regulatory Policy Environment

The importance of public policy has been recognized by the public-policy endogenous growth models of Barro 1990, Barro and Sala-i-Martin 1992, 1995 and Mendoza et al 1997 which provide mechanisms by which fiscal policy can determine both the level of investment, output, and the steady-state growth rate. Using OLS on a pooled cross section of countries, Kneller, Bleaney, & Gemmell 1999, find strong support for the Barro model 1990. Specifically, the paper finds that productive government expenditure on health, education, and infrastructure, enhances growth. While non-productive expenditure does not. So, productive government expenditures have been seen to be an essential part of a country's fiscal policy.

In recent years, the objective of the country's fiscal policy has started shifting towards achieving better fiscal discipline in government revenues and expenditures. The literature regarding achieving fiscal discipline, however, suggests that the capacity of governments to shift resources towards soft public investment decreases as pressures for fiscal consolidation increase. In most economies, either rich or poor, there is always a tendency for discretionary expenditures by the government to shrink. Most of these discretionary expenditures come under the category of public investment expenditures (Streeck and Merterns 2011, Breunig and Busemeyer 2012). Other evidence suggests that policymakers usually cannot resist the temptation of spending more on current expenditures in good times, but only pick capital expenditures to adjust during bad times. (Ardanaz and Izquierdo 2017).

Martner and Tromben (2005) showed that from 1998-2003 when Latin American countries had to implement the fiscal reforms embedded in the IMF programs, the governments postponed public investment projects rather than cutting the current expenditures. The study

proposes that one way to safeguard investments in public projects is to make the fiscal targets less stringent for the countries under the IMF programs.

For advanced economies Teller et al., (2020) argue that public investment is also at historical lows since the 1980s. And one of the major reasons for the low public investment is the too rigid fiscal rules. The rigid fiscal rules results in the retrenchment of fiscal budgets and that creates downward pressure on the public investment side.

Amongst many, Fedelino and Hemming (2006) studies a fiscal policy framework to safeguard public sector investment. The paper highlights the importance of public sector investment for developing countries and seeks to present a number of perspectives on the public investment debate. More specifically, it discusses proposals to modify the traditional fiscal policy framework by looking at fiscal indicators and targets that may be better suited to safeguarding public investment. It concludes, that public investment needs to be financed from public resources. And even if the government faces fiscal constraints, the additional room should be provided for public investments. One of the reforms that the paper mentions are to delink the borrowing for public investment from the overall borrowing or public debt.

Ardanaz et al., (2020) for the panel of advanced and emerging economies shows that in countries with either no fiscal rule or with a rigid fiscal rule, a fiscal consolidation of at least 2 percent of GDP is associated with an average of 10 percent reduction in public investment. And under flexible fiscal rules, the negative effect of fiscal adjustments on public investment vanishes. Therefore, the fiscal rules have a significant impact on GDP growth.

In summary, the literature shows that the level of public investment has significantly dropped over the past few years in developed as well as developing countries. However, the effect

associated with the drop in public sector investment has been observed to be more detrimental to developing countries as compared to developed countries. One of the major reasons highlighted behind the fall in public sector investments is the role of the regulatory policy environment. Where the role of the regulatory policy environment is shaped specifically by the IMF programs which in turn has a significant negative effect on the country's fiscal variables. Particularly, the development and public investment expenditures.

4.4. Data

The essay uses the same macroeconomic aggregate data series over the time period 1973-2019, used for Essay one and Essay two for internal consistency.

For the first part of this essay, the disaggregated analysis of public investment, we construct a real series for the components and subsectors of public investment at constant prices (2005-2006). This data is taken from Pakistan National Income Accounts and is consistent with the real series constructed for Essay one and Essay two.

For the second part, the role of the regulatory policy environment, the data for the fiscal variables are taken from the budgetary plans of the Ministry of Finance of Pakistan. The data for the fiscal variables are used as current values. And cover the years 1976-2019, as available. The data for the key policy variable, the targeted fiscal deficits under the IMF program, is extracted from the letters of agreement between Pakistan and the IMF since 1973, provided to us bilaterally by the IMF. The list of variables used in each section with their definitions and data sources is given in Appendix Table A1.

4.5. Empirical Methodology and Results

Having established in essay two, a known break date at year 92 in our series for public investment growth will have given us two time periods, pre 1992 with on average high public investment growth, and post 1992 with significantly lowered public investment growth. Also, we established the significant declining trend in the share of public investment in output (GDP) Post 1992. Specifically, on average the public investment growth dropped by 5.4 percent post 1992.

We now need to provide an empirical methodology to explain the discrete drop and declining trend of public investment over the period 1973-2019. This will be explained empirically by observing the behavior of disaggregated components of public investment in Part I. And the regulatory policy environment that has shaped the behavior of public investment in Pakistan, in Part II.

Part I: The first part of the empirical section will focus on the **disaggregated analysis of the public investment.** We will formulate an empirical strategy to observe two major components of public investment and further their subsectors. This will be examined in two forms. As growth in real variables. And as shares in output (GDP). The two major components of public investment are;

i. Productive sector investment
ii. Administrative services sector investment

Then, Public Investment = Productive sector investment + Administrative services sector investment (1)

The objective of this part would be to test which of the above two major components has contributed to the declining trend in public investment over the years. Further, on the basis of

their significant contribution, the components will be studied in terms of their subsectors. The productive sector investments are classified into investments in the following sub sectors on the basis of economic activity on the production side;

1. Agriculture
2. Construction
3. Transport
4. Mining and quarrying
5. Large scale manufacturing industries and Small and household manufacturing industries
6. Electricity generation and distribution, and gas distribution
7. Wholesale and retail trade
8. Financial institutions
9. Housing services, real estate including ownership of dwellings

Administrative services sector investment is classified into the following sub sectors on the basis of economic activity on the administrative and services side;

10. General public services
11. Defense
12. Public order and safety
13. Economic Affairs
14. Environmental protection
15. Housing and community amenities
16. Health
17. Recreation, culture, and religion
18. Education

19. Social protection

Part II: The literature points to a large impact of the external regulatory policy environment on domestic growth and development. Accordingly, the next part of this essay examines the impact of the regulatory policy environment on public investment. Public investment in this essay three is examined as a part of the general equilibrium of Keynesian aggregate demand as a continuation of this conceptual framework applied throughout all Essay one and Essay Two. This is a conceptual framework of macro aggregates of consumption, investment, government expenditures, and net exports determining aggregate output. So our aggregate demand equation is;

$$Y = C+I+G\ (T+D) + NX \qquad (2)$$

So we will now turn to examine public investment as a component of government expenditure (G). Government expenditures, (G) are a function of Tax revenue, (T) and the budget deficits, (D).

So

$$G= T+D \qquad (3)$$

Equation (3) captures the proposition that the government expenditure will be subject to the regulatory policy environment. A liberal regulatory policy environment will allow a high government expenditure (G) uncovered by taxes (T) through a higher budget deficit (D).

A tighter regulatory policy environment will permit only a lower government expenditure (G) covered more by higher taxes (T) and a lower budget deficit (D).

Further, the proposition is that, if the regulatory policy environment becomes austere, reducing government expenditure (G) and the budget deficit (D), then the government has two choices.

Total government expenditures comprise two elements; a recurrent budget and a development budget.

G = Recurrent Budget + Development Budget (4)

Both the recurrent budget and the development budget obviously determine total government expenditure (G).

But the major difference between the two budgetary components is that the recurrent budget just maintains the existing capacity of public goods. While the development budget expands the capacity of public goods.

Therefore, the recurrent budget keeps the provision of public investment constant. The development budget allows for the expansion of public investment.

Ergo, an expansionary development budget will expand public goods capacity and therefore public investment. While a decreasing development budget will reduce the rate of expansion of public goods capacity and therefore public investment. So we will hypothesize that the observed reduction in public investment in Part I of this essay 3, will be explained by the regulatory policy environment working through the two key variables.

Hypothesis 1: An observed reduction in the budget deficit leads to a drop in government expenditure (G).

Hypothesis 2: an observed reduction in the development budget leading to a drop in government expenditure (G).

Hypothesis 3: The observed drop in the budget deficit (D) will be influenced by the regulatory policy environment captured by the variable of the agreed budget deficit between the IMF and GOP.

This will be done in three steps. The first step will examine the relationship between observed fiscal deficits, public expenditures, and public revenues over time. The second step will be to relate the observed fiscal deficits to development expenditures. The third step will examine the relationship between the regulatory policy environment and observed fiscal deficits over time. This will take the form of examining the relationship between targeted fiscal deficits, and observed fiscal deficits. The following set of fiscal variables as shares in output (GDP) will be used

i. Observed fiscal deficit, measured as a percentage share in output (GDP).
ii. Total expenditures, current expenditures, and public investment expenditures, or development expenditures, are measured as a percentage share of output (GDP).
iii. Total Revenues are measured as a percentage share of output (GDP).
iv. Targeted fiscal deficits as agreed under the IMF programs.

4.5.1 Empirical Methodology and Results for disaggregated analysis of Public Investment

The results for the disaggregated analysis of public investment will be based on the following set of empirical tests;

Test A: Trend Analysis using time plots

Test B: Trend Analysis using regressions

Test C: Structural Break Analysis

Test D: Regression Analysis

Test A, the trend analysis

Recalling from above, the macroeconomic relationship between investment and the demand side determinants in equation (1) from essay two;

Total Investment (Realinv) = Public investment (IGR) + Private Investment (IPR) (1)

Figure 3.3. 2: Time series plot of Total Investment, Public Investment, and Private investment as % of GDP

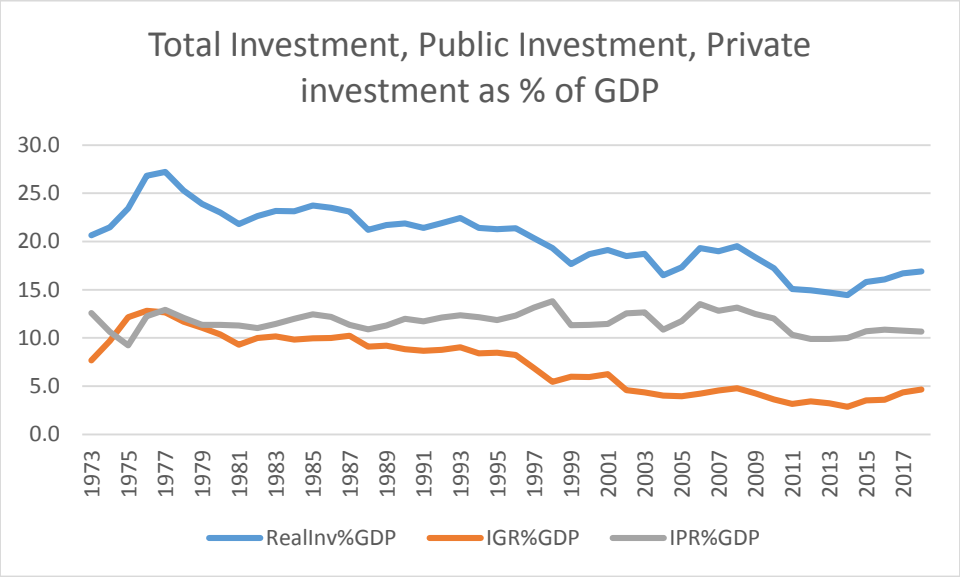


Figure 3.3.2 recalls the plot of total investment (realinv), public investment (IGR), and private investment (IPR) as a share of total output (GDP) from the year 1973-2019.

In essay two, we observed the declining trend of the share of total investment to be highly correlated with the declining trend in the share of public investment pre and post 1992. While the private investment share remained approximately constant over time. Which implied that the declining share of total investment Post 1992 seems to be associated with the declining public investment share Post 1992. Recalling, the objective of this essay is to determine the correlating factor that explains the declining trend and behavior of public investment Post 1992. Therefore, we proceed to observe the trends in the disaggregated components of the share of public investment in output.

Recalling that public investment in terms of its components can be represented as;

Public investment (IGR) = Productive sector investment (IPUBR) + Administrative services sector investment (IGGR)

(1)

Figure 3.1: Time series plot of public investment, productive sector investment, and administrative services sector investment as share in output (GDP)

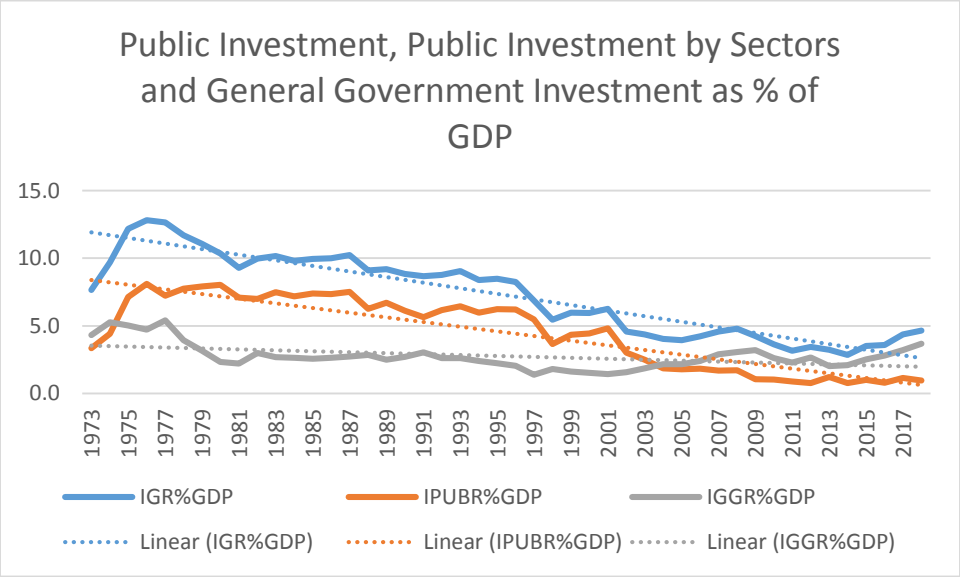
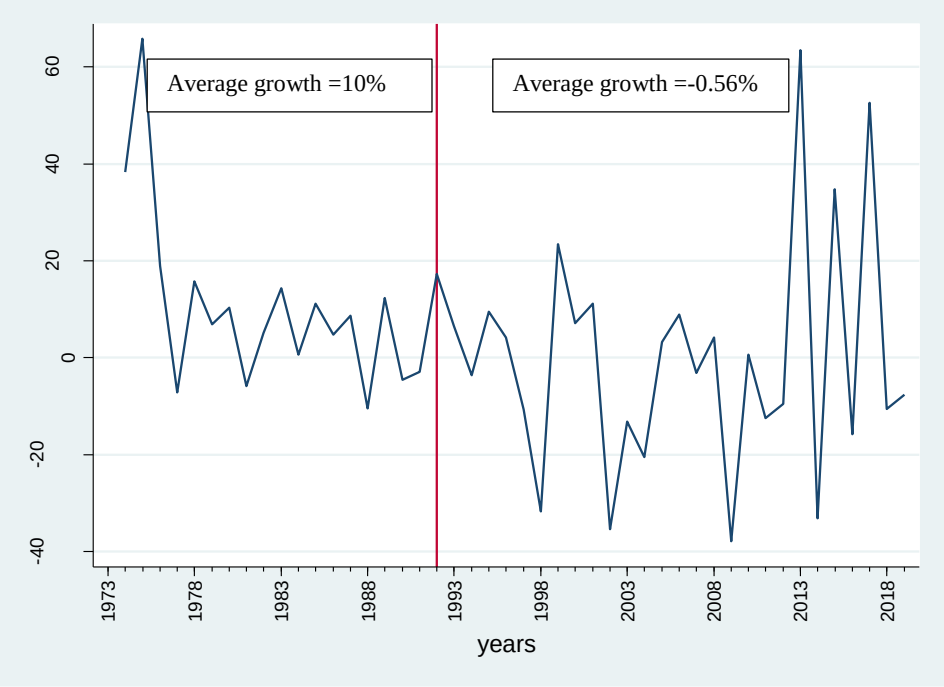


Figure 3.1 presents the time plots for the share of public investment and its two components. The share of productive sector investment (IPUBR) and the share of administrative services sector investment (IGGR). The share of productive sector investment persistently declines, however, the share of administrative services sector investment approximately remains constant. Also, the share of productive sector investment follows a similar declining pattern as the share of public investment in GDP. Additionally, the trend in the share of productive sector investment seems to become more negative Post 1992 as compared to Pre 1992. Of the two components of public investment, the trend in the share of productive sector investment follows a similar pattern as the share in public investment.

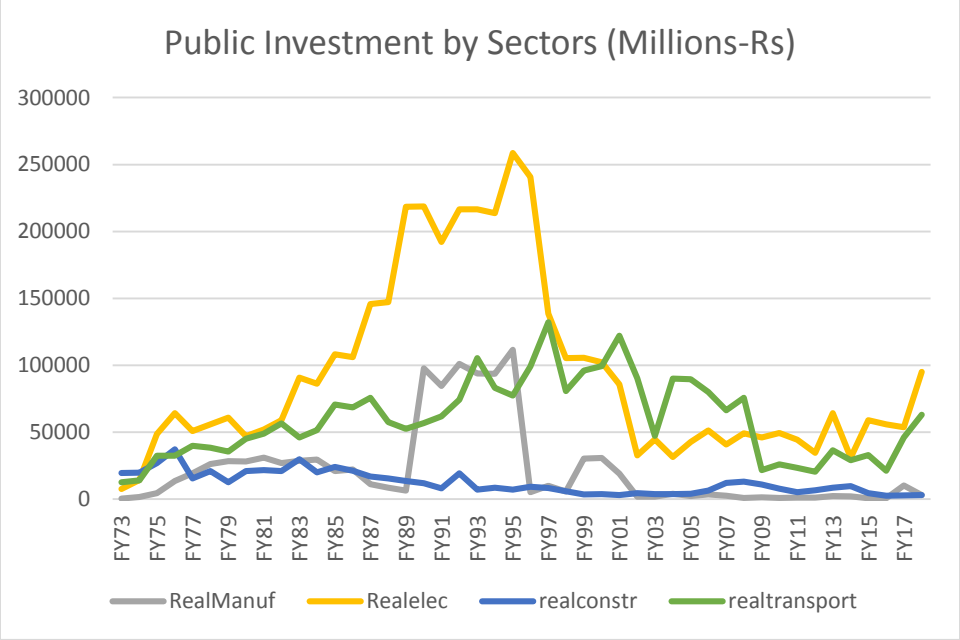
Figure 3.2: The Growth of Productive sector investment 1973-2019



We further plot the growth of productive sector investment in Figure 3.2. The average growth also seems to be more positive and higher pre 1992 as compared to post 1992. Clearly,

we have observed a declining trend and a drop in the growth of productive sector investment by 11%. This makes us proceed to observe the reason for the aggregated drop and decline of productive sector investment. Therefore, we now examine the behavior of productive sector investment in terms of its subsectors. We examine the subsectors in terms of their growth in real values.

Figure 3.3: Public Investments by Sector (Millions - Rs)



On the basis of the relative share value and fluctuations of each subsector in the total productive sector investment, we select the four major productive sectors. The sectors selected are manufacturing (RealManuf), electricity (Realelec), construction (realconstr) and realtransport

(realtransport). We plot the real values of public investment in the selected subsectors in figure 3.3.

The sector wise public investment expenditures seem to decline for all the selected sectors, especially the electricity sector.

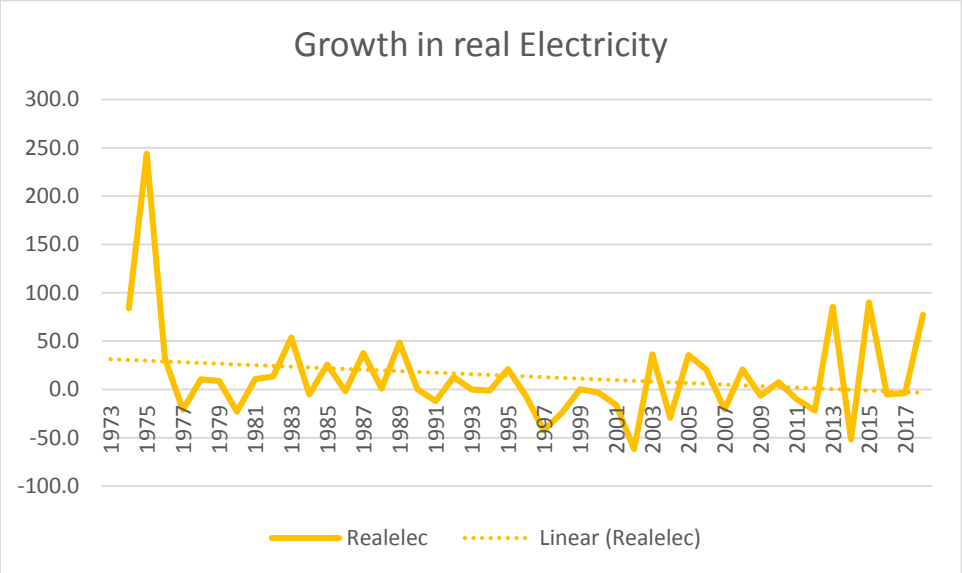
The public investment in electricity increases till the year 1993, peaks around the year 1993, after which it drastically declines.

The public investment in the transport sector increases till the year 1996, and declines afterward.

Public investment in construction seems to be on a constantly declining trend over the whole period.

While public investment in manufacturing increases till the year 1994, and then drastically declines.

Figure 3.4: Growth in Electricity



So we observe that the public investment in manufacturing and electricity seems to decline post 1992. We now proceed to study these sectors in terms of their growth rates. Significant fluctuations are seen in the growth of public investment in electricity. Therefore, we plot the growth in electricity over time in Figure 3.4. Which shows a significant decline in the growth of public investment in the electricity sector in the 90s. However, the growth of public investment in electricity slightly picks up after the year 2012.

Overall, the above exercise observes the decline in the shares and drop in growth of the productive sector investment and public investment in electricity in the 90s on the basis of trend plots. We now proceed to statistically test the observations of the above exercise.

Test B uses trend regressions to examine the shares of components of public investment in output

The trend regressions of the following form will be run on the two components of public sector investment.

$$shareIPUBR_t = \alpha_0 + \alpha_1 trend_t + e_t \qquad (5)$$

$$shareIGGR_t = \beta_0 + \beta_1 trend_t + e_t \qquad (6)$$

Where *shareIPUBR*$_t$ represents the share of productive sector investment in output in time period *t*, *shareIGGR*$_t$ represents the share of administrative services sector investment in output in time period *t*. *trend* variable represents the time trend variable. We run the above regressions for the entire time period and separately for the two time periods, pre 1992 and post 1992.

Results of Test B, using trend regressions to examine the shares of components of public investment in output

Table 3.1a: Trend Regression for a share of productive sector investment
Dependent Variable: Share of productive sector investment (shareipubr)

	(1)	(2)	(3)	(4)
	Full Sample	Pre 1992	Post 1992	Post 1992 – Pre 1992
VARIABLES	PublicInvestment Productive Sector	PublicInvestment Productive Sector	PublicInvestment Productive Sector	Chi square test
trend	-0.171***	0.0304	-0.235***	-0.265***
	(0.0139)	(0.0525)	(0.0192)	
Constant	8.541***	6.521***	10.68***	
	(0.382)	(0.599)	(0.660)	
Observations	47	19	28	
R-squared	0.772	0.019	0.853	

a. Heteroscedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. The trend coefficient differs significantly across two time periods, Pre 1992 and Post 1992.

Table 3.1b: Trend Regression for share of administrative services sector investment

Dependent Variable: Share of administrative services sector investment (shareiggr)

	(1)	(2)	(3)	(4)
	Full Sample	Pre 1992	Post 1992	Post 1992 – Pre92
VARIABLES	AdminService	AdminServiceSe	AdminServiceSe	Chi2 test

	Sector	ctor	ctor	
trend	-0.0323***	-0.141***	0.0379***	0.103***
	(0.00908)	(0.0305)	(0.0118)	
Constant	3.527***	4.762***	1.075**	
	(0.250)	(0.348)	(0.407)	
Observations	47	19	28	
R-squared	0.219	0.556	0.283	

a. HAC standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. Trend coefficient differs significantly across two time periods, Pre 1992 and Post 1992.

The results for the equation (5) are represented in table 3.1a. The left hand side variable is the share of productive sector investment (shareipubr). And the right hand side variable is the time trend (t). The significant coefficient of the trend variable, t for the overall sample, -0.171 clearly shows the declining linear trend over time. Also, the coefficient significantly declines post 1992.

The results for equation (6) are represented in table 3.1b. The left hand side variable is the share of administrative services sector investment (shareiggr). And the right hand side variable is the time trend (t). For the overall sample, the significant coefficient, -0.03, for the time trend variable shows the declining trend over time, however, the magnitude of the trend coefficient is negligible. In the sub time periods, the direction of the trend changes from Pre 1992 to Post 1992. The share declines significantly Pre 1992 and rises with a smaller magnitude Post 1992.

The results from the regression exercise indicate that the magnitude of the trend coefficient for the share of productive sector investment is greater in the overall sample and in the Post 1992 sample, as compared to the trend coefficient for the share of the general government. This suggests that the share of productive sector investment explains the declining trend of public investment.

Test C, Structural Break Analysis

The test C, structural break analysis for the disaggregated components of the public investment will be performed in two steps:

1. A structural break test at a known break date
2. A dummy regression to know the direction of change

The two step structural break analysis on the components of public investment will help us suggest the component of public investment that coincides with the drop in the growth of public investment post 1992. Recalling, we established in essay two, a structural break in the growth of public investment around the year 92. And that the growth of public investment dropped on average 5.4 percent post 1992. Therefore, to explain the drop we perform the structural break analysis for the components of public investment.

A structural break test at a known break date

To test our explanatory variables series for the single mean shift at a known break date, we use the structural break model specified to test for the break at a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \qquad (7)$$

Where y_{it} represents growth in the variable i in time period t. β_{ij} is the mean shift parameter for the growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \qquad (7\ A)$$

The known break date, TB is taken as the year 1992±1 or the year 1993 in our case. We run the above model to test the break in the components of public investment. And subsequently, test the break in the growth of the subsectors as well.

Table 3.2: Structural break test for a break date at the Year 1992 ± 1

Results: Test for the known structural break				
Variable Description	Break at the Year 1992 ± 1	Tests and Probability		
		Test	Statistics	P-Value
Real Public investment growth	**1993**	$\chi^2(1)$	**4.72***	**0.091**
Real Public Investment growth by sectors	**1993**	$\chi^2(1)$	**3.22***	**0.072**
Growth in electricity	**1991**	$\chi^2(1)$	**3.40***	**0.064**

The Wald test for the known break date using Chow's procedure is performed to determine a structural break in the components and subsectors of public investment. Table 3.2 reports the findings for the Wald test at a known break date. Of the two components of public investment, the growth in productive sector investment has a significant break in the year 1993. Subsequently, of the sub sectors of productive sector investment, the growth in electricity has a significant break in year 91.

A dummy regression to know the direction of change

The structural break analysis identified a break around the year 1992 in the growth of productive sector investment and the growth of electricity. The dummy regression will help us test the direction of change in the average growth rates. The regression can be specified as;

$$g_{it} = \beta + \theta DU_t + u_t, \qquad (8)$$

Where, g_{it} represents growth of productive sector investment and the growth in electricity. DU_t represents the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. The dummy regression allows us to test whether on average the specified growth drops or increases post 1992.

Results for a dummy regression to know the direction of change

Table 3.3 reports the results for dummy regression. The explanatory variable, in table 3.3, is the break dummy for the year 1992. For the growth of productive sector investments (ipubrgrowth), the coefficient of the break dummy variable, θ takes the value -11.06 percent and is significant. For the growth in the electricity sector (growthrealelec), the coefficient of the break dummy variable, θ takes the value -23.59 percent and is significant.

The dummy regression shows that after 1992, on average the growth of productive sector investment drops by 11 percent. And on average the growth of the electricity sector drops by 24 percent.

Table 3.3: Dummy Regression to know the direction of change

VARIABLES	(1) Dependent Variable ipubrgrowth	(2) Dependent Variable growthrealelec
dummy92	-11.06*	-23.59*

	(6.505)	(14.30)
Constant	10.50**	28.10**
	(4.983)	(11.17)
Observations	46	46
R-squared	0.062	0.058

a. HAC standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable '$Dummy92_t$'=1 for T>1992, $Dummy92_t$ =0, otherwise
c. 'ipubrgrowth' represents growth of productive sector investment. 'growthrealelec' represents growth in the electricity sector.

Test D Regression analysis to determine growth contributions

Growth regression will be used to further validate the result of the previous section. In the previous section, we found the drop in the growth of the electricity sector to occur around the same years as the drop in the growth of productive sector investment. Following that, we proceed to test whether the growth of the electricity sector is well correlated with the growth of productive sector investment in both phases. Pre 1992 when on average the growth in the electricity sector was high, we expect that it resulted in higher growth of productive sector investment. And Post 1992, when the growth in electricity drops, due to a high correlation between the two variables, it resulted in a drop in the growth in productive sector investment.

Therefore, the growth contribution regression specifies the growth of productive sector investment as a function of the growth in its sub sectors. The sub sectors have been specified as above. The regression equation of the following form is estimated;

$$ipubrgrowth_t = \alpha_0 + \alpha_1 growthagri_t + \alpha_2 growthmining_t + \alpha_3 growthmanuf_t + \alpha_4 growthelec_t + \alpha_5 growthconstr_t + \alpha_5 growthtransport_t + \alpha_5 growthrealfin_t + \epsilon_t \quad (9)$$

where, $ipubrgrowth_t$ represents the growth of productive sector investment. *growthagri* represents the growth of agriculture sector, *growthmining* represents the growth of mining sector, *growthmanuf* represents the growth of manufacturing sector, *growthelec* represents the growth of electricity sector, *growthconstr* represents the growth of construction sector, *growthtransport* represents the growth of transportation sector , *growthrealfin* represents the growth of the financial sector We are interested in the size and magnitude of coefficient, α_4, that shows the effect of growth in electricity sector on the growth of public sector investment growth. We ran this equation independently for pre 1992 and post 1992. The coefficients of the model are then tested for equality across the two time periods, pre 1992 and post 1992.

Table 3.4: Growth contributions using growth regression

Dependent Variable: Growth of productive sector investment (ipubrgrowth)

	(1) Pre92	(2) Post92	(3) Post 1992 – Pre 1992
VARIABLES	Productive sector growth	Productive sector growth	Chi2 test
growthAgri	-0.0582**	0.00595	0.055**
	(0.0366)	(0.00742)	
growthMining	-0.00456	0.0626*	0.064**
	(0.00786)	(0.0321)	
growth Manufacturing	-0.00546**	0.00654	0.011
	(0.00242)	(0.0108)	
growth Electricity	0.199***	0.346***	0.147**
	(0.0201)	(0.0950)	
growth Construction	0.109*	-0.00644	-0.102*
	(0.0492)	(0.0576)	
growth Transport	0.0807	0.268***	0.18**
	(0.0582)	(0.0834)	
growthFinancialSector	0.0560***	0.120	0.07

	(0.00883)	(0.0704)	
Constant	3.035	-6.062**	
	(2.520)	(2.693)	
Observations	18	29	
R-squared	0.932	0.803	

a. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Results for Test D,

The results of the growth regression are shown in Table 3.4. As expected, only the growth in the electricity sector variable consistently explains the growth of public sector investment in sectors across the two time periods, pre 1992 and post 1992. The growth in electricity variable (growthrealelec), coefficient shows that a 1 percent increase in the growth of the electricity sector is associated with a 0.19 percent increase in the growth of public sector investment in sector pre 1992. And is associated with a 0.34 percent increase in the growth of public sector investment in the sector post 1992. Both the coefficients are significant and positive in both time periods. The electricity sector growth coefficient has a lower value in the first phase pre 1992, and a higher value in the second phase post 1992. Therefore, we can say that the drop in productive sector investment has been significantly correlated with the drop in the growth of electricity sector.

Concluding the results of part one

The results from the empirical exercises performed under part one of this essay, the disaggregated analysis of public investment, suggest the following;

First, in terms of the shares, the research objective was to explain the declining trend in the share of public investment post 1992. Our results suggested that post 1992, the declining trend in the share of public investment is well explained by the declining trend in the share of productive sector investment.

Second, in terms of growth, the research objective was to explain the drop in the average growth of public investment post 1992. Our results suggested that component-wise, the break in the productive sector investment coincided with the break in the growth of the public investment. And further, sector-wise, the break in the growth of electricity sector coincided with the break in the growth of the public investment. The growth regression further validated that growth in electricity sector is highly correlated with the growth of productive sector investment in both the time periods, Pre 1992 and Post 1992.

This coincides with a World Bank loan for structural reforms in the power sector. These structure reforms unbundled WAPDA and led to a significant program of privatization in the power sector.

Having established that there has been a significant drop in the share and growth of the public investment, its component, and its sectors. We now proceed to explain the drop in public investment as a function of the regulatory policy environment.

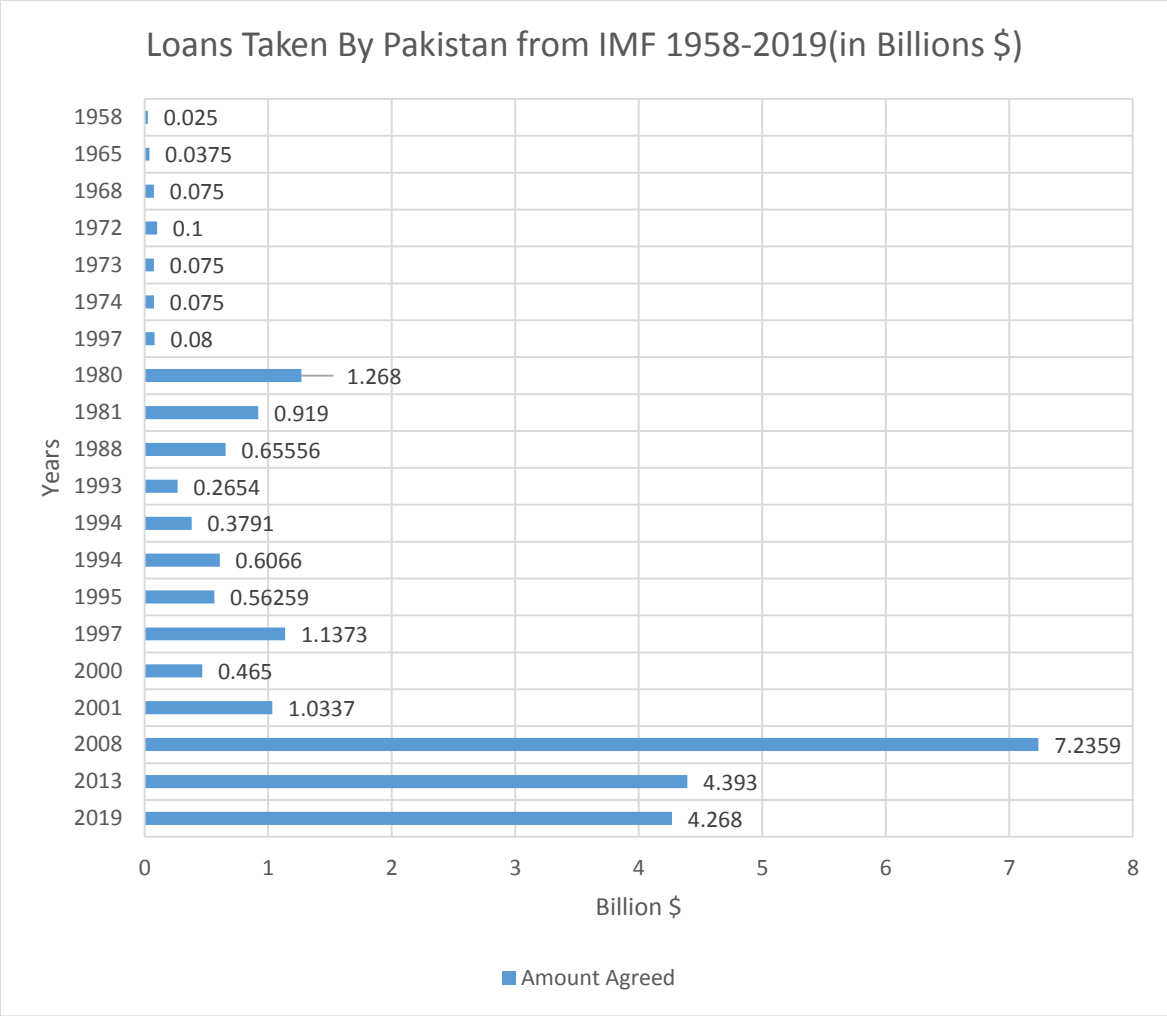
4.5.2 Empirical Methodology and Results for the Analysis of the Regulatory Policy Environment

The objective of part two of this essay is to empirically **analyze the role of the regulatory policy environment** in the behavior of public investment over time. The regulatory policy environment is based on a country's independence to formulate its macroeconomic policies. But

the past several years have seen this being strongly influenced by international organizations and may have proven ineffective for many developing countries (Simmons et.al, 2008; Shaffer 2015; Križic 2019, Abbott & Snidal 2013). One such case of regulatory ineffectiveness relates to the lending program of the International Monetary fund (IMF) which requires countries to implement a series of targeted economic reforms in exchange for loans (Reinsberg, Stubbs, Kentikelenis 2021). Based on the literature, we are also considering the IMF as a regulatory body influencing Pakistan's regulatory policy environment.

Since 1953 till date, Pakistan has entered into 23 agreements with IMF. Figure 3.5 shows the number and size of lending arrangements between Pakistan and IMF. For our analysis, we are considering the agreements from 1973-2018, a total of 14 lending agreements. In each agreement, Pakistan has been disbursed a loan with a set of macroeconomic targets to be achieved.

Figure 3.5: Loans taken by Pakistan from IMF



One of the important aims of the IMF lending arrangement is to bail out member countries experiencing balance-of-payments difficulties or financial crises while making available short term loans or financial assistance to them. In return, the bailed out countries are expected to implement a series of reforms with the IMF programs. Similarly, in the case of Pakistan, each agreement signed with the IMF has not only bailed it out from economic crises but has brought in a series of economic conditionalities to be followed. These economic conditionalities are mainly targeted towards curtailing the fiscal deficit, increasing the interest rate ceilings and devaluing or liberalizing the exchange rates. We are, however, interested in looking at a particular economic conditionality that has imposed a restriction on our fiscal outlays. And we

are measuring the effect of a particular economic conditionality through a key policy variable attached with IMF programs. The key policy variable is the targeted fiscal deficit agreed under the IMF agreement. In part one of this essay and in essay two, we empirically established a significant drop in the share of public investment and its components over time. Therefore, in order to empirically analyze the role of regulatory policy environment in shaping our public investment expenditures our conceptual framework for Part II of this essay 3, is posited thus:

The observed reduction in Public Investment in sectors observed post 1992 in Part I of this essay will be based on a drop in government expenditure. This drop in government expenditure can be explained by the following hypotheses;

H1: An observed reduction in the budget deficit will lead to a drop in government expenditure post 1992.

H2: An observed reduction in the development budget, which expands the capacity of public goods, will lead to a drop in government expenditure post 1992.

H3: The observed drop in the budget deficit will be influenced by the liberality or austerity of the regulatory policy environment, captured by the variable of the agreed budget deficit decided between the IMF and GOP.

To test these hypotheses we proceed empirically in the following way.

First, we analyze the **behavior of fiscal variables** as shares of output (GDP) over time using the following tests.

v. Test A, Trend Analysis of the fiscal variables

vi. Test C, Structural Break Analysis of the fiscal variables

Second, we analyse the **behavior of fiscal variables under the regulatory policy environment**. For which we run the following tests

i. Test A, the Trend Analysis, to graphically observe the relationship between our observed fiscal deficit and targeted fiscal deficit.
ii. Test D, Regression Analysis. To see the effect of the IMF program on the behavior of fiscal variables for the overall time period. And independently for pre 1992 and post 1992.

The fiscal variables are:

- Observed share of fiscal deficit,
- Total expenditures,
- Current expenditures
- Public investment expenditures/ development expenditures
- Total revenues, in output (GDP).

The above set of empirical tests will help us test our hypotheses.

4.5.2.1 Empirical methodology and results for the Behavior of Fiscal Variables

In this part we seek to explain a significant drop in the growth and in the share of public investment by observing the behavior of fiscal variables. The public investment dropped on average by 5.4 percent and the share of public investment in output dropped by 5 percent post 1992. Therefore, we will observe the behavior of fiscal variables over the whole time period and

across the two time periods, pre 1992 and Post 1992. Hence, the year 1992 remains our critical year. The behavior of the fiscal variables will be analyzed stepwise:

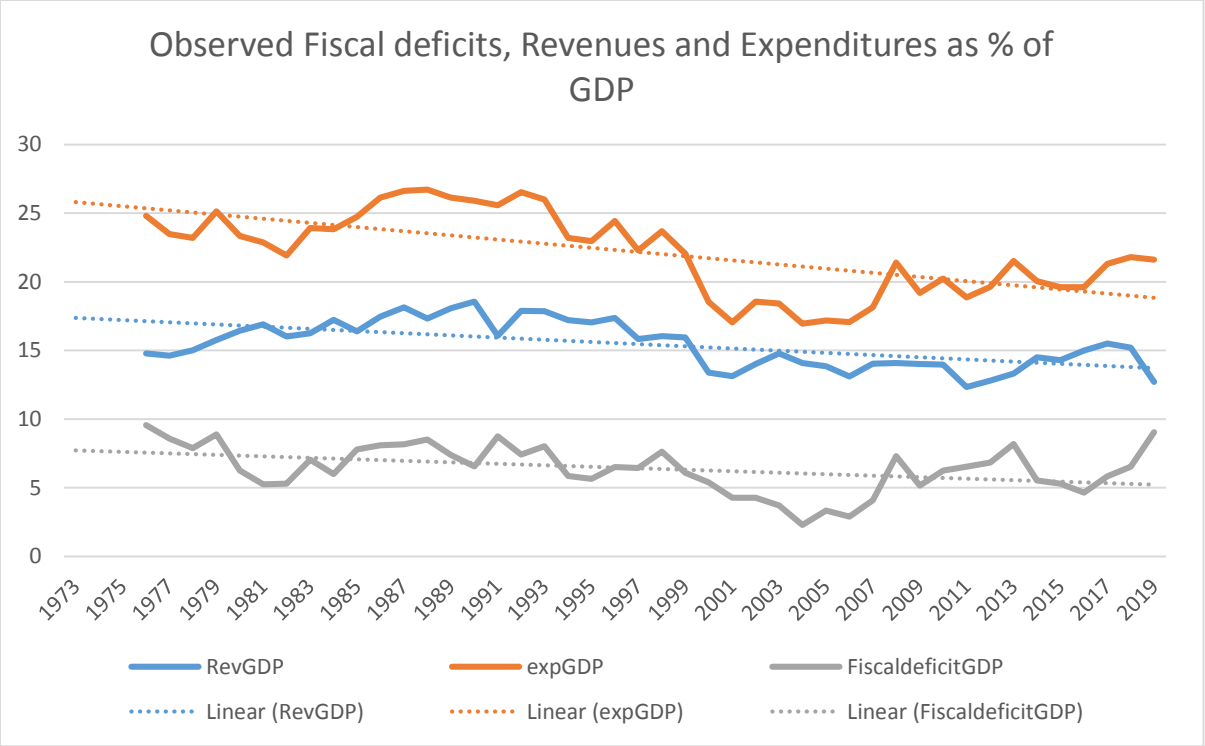
Step One: Based on equation (3), to test Hypothesis 1, we analyze the behavior of total government expenditures, total revenues, and fiscal deficits.

Step two: Based on equation (4) to test Hypothesis 2, we analyze the behavior of total government expenditures in terms of its two components. The two components are the current expenditures and the development expenditures.

Step One: Empirical Methodology and Results for the behavior of Total Government expenditures, Total revenues and Fiscal deficit

Test A; the trend analysis

Figure 3.6: Observed Fiscal deficits, Revenues and Expenditures as % of GDP



Derived from equation (3), the fiscal deficit is defined as;

Fiscal Deficit = Total Government expenditures – Total Revenues (10)

The shares of fiscal deficit (Fiscal deficitGDP), total revenues (RevGDP) and total expenditures (expGDP) in output (GDP) are shown in Figure 3.6.

Overall the share of expenditures clearly has a declining trend over time. The trend however differs pre 1992 and post 1992. Pre 1992, the trend is positive, peaking around the year 1992. And post 1992, the trend significantly declines.

The total revenues show a cyclical pattern. Showing an increasing trend pre 1992 declines post 1992 and remains constant.

Similarly, the fiscal deficit also exhibits a cyclical pattern. Showing an increasing trend till the Year 1992. Peaks around the year 1992. And then considerably drops post 1992.

Hence, from the graphical analysis we may observe that around year 1992 when fiscal deficits peaked, the government expenditures also peaked. And, when the fiscal deficits dropped after 1992, the government expenditures also dropped.

Overall, the deficit seems to be more expenditure driven than revenue driven. The results of Test A, the trend analysis suggest in support of Hypothesis 1, that there has been a significant reduction in fiscal deficits after year 1992. And the reduction in fiscal deficits has been curtailed through a reduction in expenditures rather than an increase in revenues.

We now proceed to statistically test the behavior of fiscal deficits, government expenditures, and revenues around the year 1992 through the application of test B, the structural break analysis.

Test C, the structural break analysis

The structural break analysis will be performed in two steps:

1. A structural break test at a known break date
2. A dummy regression to know the direction of change

The test will enable us to check whether the fiscal deficit, government expenditures, and revenues have shown a significant break in the year 1992, particularly the fiscal deficits. And whether the fiscal deficits are curtailed post 1992, accompanied with a significant reduction in total government expenditures.

A structural break test at a known break date

Recalling equations 7 and 7a to test our explanatory variables series for the single mean shift at a known break date, we use the structural break model specified to test for the break at a known break date:

$$y_{it} = \beta_{ij} + \epsilon_t \qquad where\ \beta_{i1} \neq \beta_{i2} \tag{7}$$

Where y_{it} represents growth in variable i in time period t. β_{ij} is the mean shift parameter for the growth rate of variable i. This model allows the coefficient β_{ij} to change after the break. If TB is the break date, the model is

$$y_{it} = \begin{cases} \beta_{i1} + \epsilon_t & if\ t \leq TB \\ \beta_{i2} + \epsilon_t & if\ t > TB \end{cases} \tag{7A}$$

The known break date, TB is taken as the year 1992 or the year 1993 in our case. We run the above model to test for the break in the fiscal variables.

Result of Chow's test for a break at Year 1992±1

Table 3.5: Test for the structural break at Year 1992±1

Variable Description	Break at Year 1992±1	Tests and Probability		
		Test	Statistics	P-Value

Tax Revenue as share in GDP	**1992**	**$\chi^2(1)$**	**9.48*** **	**0.008**
Fiscal Deficit as share in GDP	**1993**	**$\chi^2(1)$**	**5.77** **	**0.050**
Total Expenditures as share in GDP	**1992**	**$\chi^2(1)$**	**31.16*** **	**0.000**

The Wald test for the known break date using Chow's procedure is performed to determine a structural break in the fiscal variables. Table 3.5 reports the findings for the Wald test at a known break date. The table clearly highlights the importance of year 1992. The structural break around year 1992 has been shown in all of the shares of fiscal variables in GDP. Since the share of all the fiscal variables are trend stationary. We need to validate our break result in shares using the dummy regressions. Which will validate our break results and will also provide us with the direction of change post 1992.

A dummy regression to know the direction of change

The structural break analysis identified a break around year 1992 in the shares of fiscal variables. The dummy regression will help us test the direction of change and the validity of break results while controlling for the trend variable. The regression can be specified as;

$$y_{it} = \theta_0 + \theta_1 DU_t + \theta_2 trend + u_t, \quad (11)$$

Where, y_{it} represents the share of each of the fiscal variables in output (GDP). DU_t represents the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. The *trend* variable controls the trend in each variable. The

dummy regression will allow us to test whether on average the share of each fiscal variable drops or increases post 1992.

Results of a dummy regression to know the direction of change

Table 3.6 reports the results of the dummy regression. Controlling for the trend, the results suggest that the share of fiscal deficit (deficitGDP) and the share of total government expenditures (totexpGDP) falls significantly post 1992. Whereas the share of revenues (totrevGDP) remains constant. The share of fiscal deficits drops significantly, on average by 1.7 percent of GDP. The coefficient for the share of revenues came out insignificant. And the share of total expenditures drops significantly, on average by 3.2 percent of GDP. Theoretically, this drop in the deficit can be associated with two changes. Either the share of revenues is increased or the share of expenditures is fallen. In our case, the results show that the share of total expenditures has fallen. And, the revenues have remained constant.

Table 3.6: Dummy regression to know the direction of change

	(1)	(2)	(3)
VARIABLES	deficitGDP	totrevGDP	totGovtexp

			GDP
t	-0.0107	-0.0607*	-0.0515
	(0.0335)	(0.0307)	(0.0491)
dummy92	-1.720*	-0.715	-3.264**
	(0.851)	(0.780)	(1.247)
Constant	7.629***	14.11***	25.36***
	(0.535)	(0.490)	(0.783)
Observations	43	43	43
R-squared	0.318	0.409	0.527

a. HAC standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable '$Dummy92_t$'=1 for T>1992, $Dummy92_t$ =0, otherwise. 't' controls for trend.
c. 'deficitGDP' represents observed fiscal deficit as share of GDP. 'totrevGDP' represents total revenue as share of GDP. 'totGovtexpGDP' represents total government expenditure as share of GDP.

Concluding the results of the empirical tests performed to analyze the behavior of fiscal deficits, total government expenditures and revenues. It is evident that fiscal deficits have been curtailed in Pakistan. Particularly post 1992, the deficits have been significantly reduced. The reduction in fiscal deficits is mainly expenditure driven and not revenue driven.

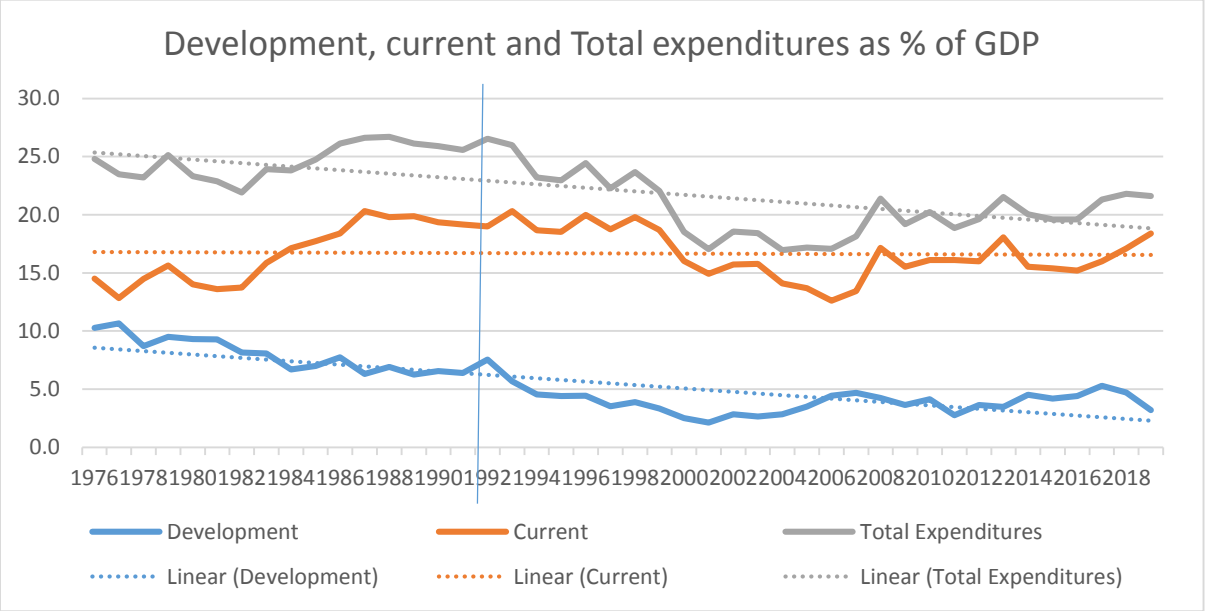
The results from step one provide support for our hypothesis 1. That in the case of Pakistan, the fiscal deficits drops post 1992, reducing government expenditure. Further, the reduction in fiscal deficits has been based on cutting expenditures and not by increasing revenues. Ergo the reductions in the fiscal deficit have resulted in a reduction in government expenditures.

Since we have seen a drop in the share of total government expenditures in this section, we now proceed to analyze the two components of total government expenditures. Therefore, the second step is to analyze the behavior of total government expenditures in terms of current expenditures and development expenditures.

Step two: Empirical methodology and results for the behavior of total government expenditures, current expenditures and development expenditures

Test A; the trend analysis

Figure 3.7: Development, current and Total expenditures as % of GDP



The total government expenditures and its two components, current expenditures and development expenditures are shown in figure 3.7. The total government expenditures can be expressed in terms of current and development expenditures, recalling from equation 4 above;

Total Government expenditures = Current Expenditures + Development Expenditures (4)

We observed in the previous section that the share of total government expenditures had a significant decline post 1992. Now we observe that of its components, the development expenditures in figure 3.7 slightly declined on trend but remained relatively high till 1992, but then declined clearly post 1992 on trend as well as on average.

The current expenditures showed a cyclical pattern. They increased on trend and remained high even after the year 1992. Slightly declined in 2005, after which they again increased on trend as well as on average.

Correlating the trends of the two components shows that the total expenditures did increase till the year 1992, followed by the increasing trend in current expenditures. But fell sharply post 1992 when the development expenditures declined. Therefore, the times when the total expenditure increases, seem more correlated with the increase in current expenditures. And, the times when the total expenditure falls seem highly correlated with the drop in the share of development expenditures. The drop is particularly evident in year 1992.

The results from the Test A, the trend analysis supports Hypothesis 2. The results suggests that the drop in the total expenditures has been largely due to reduction in development expenditures in the 90's as compared to current expenditures, which seem to be constant during the 90's.

We now proceed to statistically test the behavior of the two components of the government expenditures around year 1992 through the application of test B, the structural break analysis.

Test C, the structural break analysis of the fiscal variables

The structural break analysis of the fiscal variables will be performed in two steps:

1. A structural break test at a known break date
2. A dummy regression to know the direction of change

The test will enable us to check whether the fiscal variables, specifically the fiscal deficit has shown a significant break in the year 1992. And whether the fiscal deficits are curtailed post 1992, accompanied with significant reduction in development expenditures.

Result of Chow's test for a known break date

Table 3.7: test for known structural break

Variable Description	Known Break Date	Tests and Probability		
		Test	Statistics	P-Value
Development expenditures as share in GDP	**1992**	$\chi^2(1)$	**46.62*** **	**0.000**
Total Expenditures as share in GDP	**1992**	$\chi^2(1)$	**31.16*** **	**0.000**

The Wald test for the known break date using Chow's procedure is performed to determine a structural break in the fiscal variables. Table 3.7 reports the findings for the Wald test at a known break date. The table clearly highlights the importance of year 1992. The structural break around year 1992 has been shown in the share of development expenditures. We need to validate our break result in shares using the dummy regressions. Which will validate our break results and will also provide us with the direction of change post 1992.

Results of a dummy regression to know the direction of change

Table 3.8 reports the results of the dummy regression for the total government expenditures, current expenditures, and development expenditures. Controlling for the trend, the results suggest that of the two components, the share of development expenditures on average falls significantly by 3.2 percent post 1992. And the share of current expenditures remains constant. Therefore, the 3.2 percent of drop in total expenditures has been completely attributable to the drop in development expenditures.

The results support our Hypothesis 2 that the reduction in total government expenditures is mainly based on the reduction of development expenditures.

Table 3.8: Dummy regression to know the direction of change

VARIABLES	(1) Dependent Variable totexp	(2) Dependent Variable curexpgdp	(3) Dependent Variable devexpgdp
t	-0.0515	-0.00936	-0.0422
	(0.0491)	(0.0536)	(0.0258)
dummy92	-3.264**	-0.0599	-3.204***
	(1.247)	(1.360)	(0.655)
Constant	25.36***	16.89***	8.471***
	(0.783)	(0.854)	(0.412)
Observations	43	43	43
R-squared	0.527	0.004	0.780

a. HAC standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable '$Dummy92_t$'=1 for T>1992, $Dummy92_t$ =0, otherwise. 't' controls for trend.
c. 'totexpGDP' represents total government expenditure as share of GDP. 'curexpGDP' represents current expenditures as share of GDP. 'devexpgdp' represents development expenditure as share of GDP.

Concluding the results of the empirical tests performed to analyze the behavior of fiscal variables. It is evident that observed fiscal deficits have been curtailed in Pakistan. Particularly post 1992, the deficits have been significantly reduced. The reduction in fiscal deficits is mainly expenditure-driven and not revenue driven. Therefore, the drop in fiscal deficits has resulted in a drop in government expenditures, supporting hypothesis 1. This drop in government expenditures has been based in turn mainly on development expenditures being significantly cut down and not the current expenditures, supporting Hypothesis 2. Having observed that the fiscal deficits have declined, we proceed to test the role of the regulatory policy environment that might have an effect on the observed fiscal deficits. Accordingly, to test the regulatory role as in Hypothesis 3, we proceed to the next section.

4.5.2.2 Empirical methodology and results for the Behavior of Fiscal Variables under the regulatory policy environment

In this section, we proceed to provide the explanation to the most integral question of our study. Whether the regulatory policy environment has determined the behavior of fiscal variables. We are measuring the role of the regulatory policy environment through the introduction of a key policy variable, 'targeted and agreed fiscal deficit under the fund program'. Reemphasizing, we to our knowledge are using this variable for the first time.

Theoretically, we are positing that targeted fiscal deficits as conditionality in the agreements between Pakistan and the IMF, affect the determination of observed fiscal deficits as in hypothesis 3. Which affects total government expenditures. Which in turn affects the development expenditures. We assume, that the tighter the targeted fiscal deficit, the lower the observed fiscal deficit. And the greater the cut in government expenditures and development expenditures. Therefore, in order to empirically observe the relationship between targeted and observed fiscal deficits, we proceed in a sequential manner.

First, we perform Test A, the trend analysis for the targeted and observed fiscal deficits.

Second, we perform Test C, the dummy regression to test the direction of the change of targeted fiscal deficit post 1992.

Third, we perform Test D, the regression analysis to observe two effects

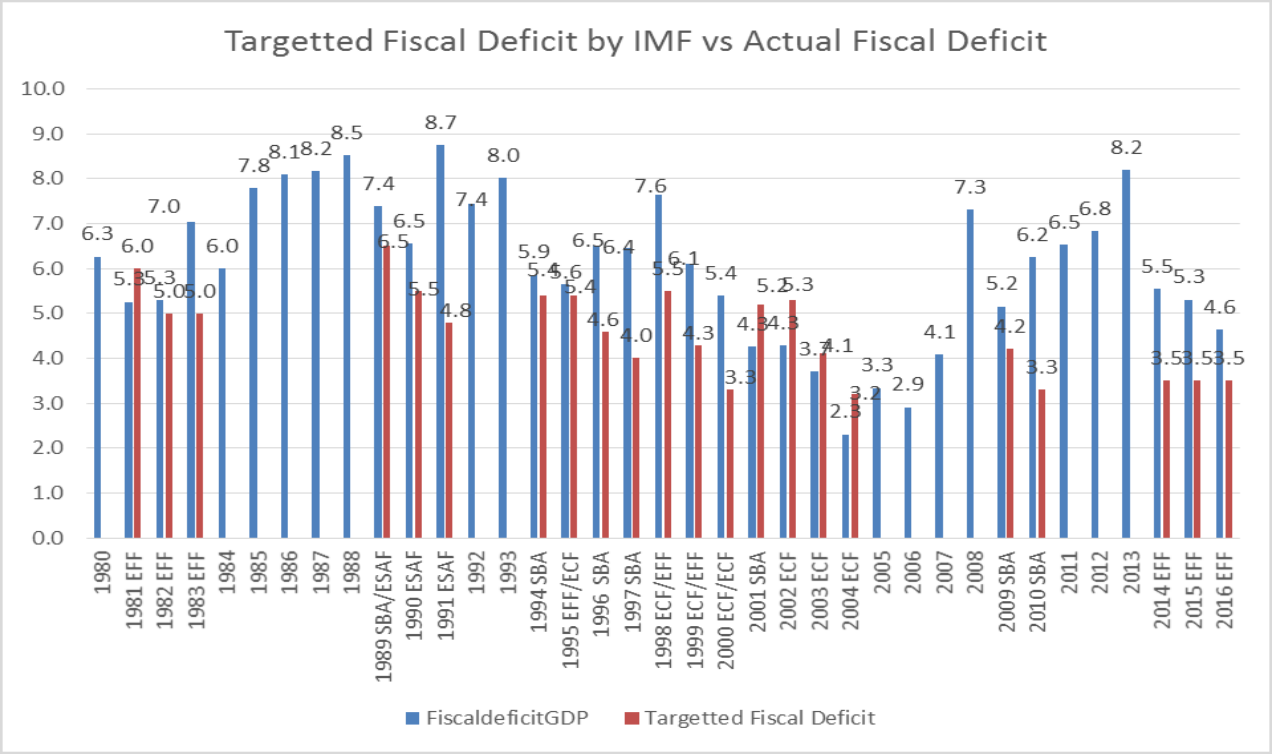
i. The relationship between targeted and observed fiscal deficits.

ii. The behavior of the fiscal variables pre 1992 and post 1992, during the time periods Pakistan is part of the IMF program as compared to the time periods when Pakistan is not part of the IMF program.

Results for Test A, the trend analysis for the Behavior of Fiscal Variable under regulatory policy environment

The figure illustrates the relationship between the targeted and the observed fiscal deficits. On the x-axis we have the time period, 1973-2018 and the episodes in which Pakistan has been the part of the IMF program. Pakistan, has been the part of IMF program at different time intervals, since year 1973 for a total of 25 years. On the y-axis we have plotted the agreed targeted fiscal deficits under the IMF programs and the observed fiscal deficits.

Figure 3.8: Targeted Fiscal Deficit by IMF vs Observed Fiscal Deficit from the years 1980-2016



Note: Figure 3.8 plots targeted fiscal deficits as red bars. The targeted fiscal deficits only appear in the years when Pakistan is part of IMF program from 1980-2016. The blue bar represents Pakistan's observed fiscal deficits.

First, analyzing the trend of the targeted fiscal deficits, till 1991 ESAF, the targeted fiscal deficits increased on trend. However, post 1991 the targeted fiscal deficits seem to decline. Meaning the targeted fiscal deficits become tighter after 1991.

Second, analyzing the trend of the observed fiscal deficits, the figure shows that till ESAF1991, the observed fiscal deficits increased on trend. However, post 1991, the observed fiscal deficits fall on trend.

Therefore, observed fiscal deficits seems to be correlated to targeted fiscal deficits. As both these deficits followed an increasing trend till 1991. And a decreasing trend after 1991.

Hence we can suggest that the targets have put pressure on observed fiscal deficits which were quite high before 1991 when no targets or relaxed targets were placed under the IMF programs. However, the conditionality becomes tighter after Year 1992. Which means the targeted deficit has been considerably lowered. The graph further shows that the trend of our observed fiscal deficits are clearly in line with the targeted fiscal deficits. Although in most of the cases Pakistan's observed fiscal deficit was higher than the ambitiously agreed targeted fiscal deficit, it still remained on the downward trend. This means that the drop in fiscal deficits post 1992 that we observed in the previous section can be significantly attributed to the regulatory policy environment. If that is the case, we should observe a significant reduction in targeted fiscal deficits post 1992. And the targeted deficits should be correlated to observed fiscal deficits. Therefore, we proceed to our next set of results.

Test C, the structural break analysis on the targeted fiscal deficits

The structural break analysis is performed in two steps:

1. A structural break test at a known break date
2. A dummy regression to know the direction of change

The test will enable us to determine whether the targeted fiscal deficits have significantly reduced post 1992. The data for the targeted fiscal deficits appear in gaps, therefore, the first step of the structural break analysis, a structural break test at a known break date, is not applicable. We perform step 2, a dummy regression to know the direction of change.

A dummy regression to know the direction of change

The dummy regression will help us test the change in the targeted fiscal deficit post 1992. The regression can be specified as recalled from equation (8);

$$y_{it} = \beta + \theta DU_t + u_t, \quad (8)$$

Where, y_{it} represents the share of the targeted fiscal deficit in output (GDP). DU_t represents the break dummy variable. The break dummy variable takes the following values $DU_t = 1$ if $t > 1992$ and $DU_t = 0$ otherwise. The dummy regression will allow us to test whether on average the share of targeted fiscal deficit drops or increases post 1992.

Results for a dummy regression to know the direction of change

Table 3.9: Dummy regression to know the direction of change

VARIABLES	(1) targeted fiscal deficit	(2) Observed Fiscal Deficit
dummy92	-1.198***	-1.720*
	(0.151)	(0.851)
trend		-0.0107
		(0.0335)
Constant	5.467***	7.629***
	(0.0382)	(0.535)
Observations	22	43
R-squared	0.321	0.318

a. HAC standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. Dummy variable '*Dummy92*$_t$'=1 for T>1992, *Dummy92*$_t$ =0, otherwise.
c. 'targeted fiscal deficit' represents targeted fiscal deficit agreed under IMF program. 'observed fiscal deficit' represents actual fiscal deficits as a share of GDP.

Table 3.9 reports the results of the dummy regression for the targeted fiscal deficits agreed under IMF program. The result suggests that the targeted fiscal deficits significantly drops, on average, by 1.1 percent post 1992. This result provides statistical significance for our argument that in fact

the targeted deficits have declined, becoming tighter post 1992. The observed fiscal deficits dropped, on average, by 1.7 percent post 1992. We now proceed to test the correlation between the targeted fiscal deficits and observed fiscal deficits.

Test D, the regression analysis to test the relationship between targeted and observed fiscal deficits

To test the relationship between the targeted and observed fiscal deficits, we run the regression of the following form;

$$OFiscalDeficit = \beta + \theta TFiscalDeficit + u \ , \qquad (12)$$

Where $OFiscalDeficit$ represents observed fiscal deficits. $TFiscalDeficit$, represents the targeted fiscal deficits. And *trend* represents the trend variable. We are interested in looking at the significance of θ. If θ is positive and significant, we may say that the observed and targeted fiscal deficits are significantly correlated. As when the targeted fiscal deficits were high, meaning relaxed, the observed fiscal deficits were high. And when the targeted fiscal deficits dropped, meaning became tighter, the observed fiscal deficits dropped as well.

Results for Test D, the regression analysis to test the relationship between targeted and observed fiscal deficits

Table 3.10: Regression to test the relationship between targeted and observed fiscal deficits

VARIABLES	(1) Dependent Variable observed fiscal deficit
Targeted fiscal deficit	0.582*
	(0.297)
Constant	3.013**
	(1.392)
Observations	22
R-squared	0.161

a. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. 'targeted fiscal deficit' represents targeted fiscal deficit agreed under the IMF program. 'observed fiscal deficit' represents actual fiscal deficits as share of GDP.'t' controls for trend.

Table 3.10 shows the results for equation (12). The coefficient for the targeted fiscal deficits in column (1), comes out to be highly significant. Which shows a high degree of correlation between observed and targeted fiscal deficits.

On the basis of the empirical tests we may suggest that there has been a drop in observed fiscal deficits post 1992. And the drop in observed fiscal deficits can be significantly attributed to the regulatory policy environment. As we observed a significant reduction in targeted fiscal deficits post 1992. And the targeted deficits are significantly correlated to observed fiscal deficits. Since, we established that the drop in the observed fiscal deficits has been associated with the drop in targeted fiscal deficits which is a good confirmation of our hypothesis 3. We now proceed to test if the behavior of fiscal variables changed post 1992. This will enable us to answer the most fundamental question, whether the drop in the public investment expenditures have been greater

during the program years. If that is the case, then we can confirm that the drop in public investment has been due to the tighter regulatory policy environment.

Test D, Regression Analysis: estimating the effect of IMF program on the behavior of fiscal variables

To see the effect of the IMF program on the behavior of fiscal variables we estimate the following equation. The equation is run for each fiscal variable independently across two time periods, Pre 1992 and Post 1992. Controlling for trends, the 'imfprog' will measure the effect of the program on the share of a fiscal variable. The regression can be specified as;

$$y_{jt} = \beta + \theta imfprog + trend + u_t, \quad (13)$$

Where, y_{jt} represents the share of each of the fiscal variable in output (GDP). The *imfprog* represents the dummy variable for the program. The program dummy takes the following values *imfprog*=1, for the years when Pakistan is the part of IMF program and *imfprog*=0, otherwise. The *trend* variable controls for the trend in each variable. The regression will allow us to test whether on average the share of each fiscal variable, when Pakistan is part of the IMF program, changes across two time periods. The coefficient θ will be tested for the equality across the two time periods, Pre 1992 and Post 1992.

Results for Test D, Regression Analysis: estimating the effect of the IMF program on the behavior of fiscal variables

Table 3.11 : Regression to estimate the effect of the IMF program on the behavior of fiscal variables

VARIABLES	(1) Pre92 devexp	(2) Post92 devexp	(3) Pre92 totexp	(4) Post92 totexp	(5) Pre92 curexp	(6) Post92 curexp	(7) Pre92 rev	(8) Post92 rev
imfprog	0.538*	-1.024**	-1.162**	-1.313	-1.701***	-0.290	-0.306	0.00702
	(0.278)	(0.409)	(0.523)	(0.963)	(0.450)	(0.769)	(0.394)	(0.518)
t	-0.303***	-0.0385	0.230***	-0.160**	0.533***	-0.121**	0.208***	-0.126***
	(0.0299)	(0.0251)	(0.0563)	(0.0590)	(0.0484)	(0.0471)	(0.0424)	(0.0317)
Constant	11.24***	5.836***	22.49***	26.74***	11.25***	20.90***	14.31***	18.96***
	(0.363)	(0.959)	(0.683)	(2.258)	(0.588)	(1.801)	(0.515)	(1.214)
Observations	16	28	16	28	16	28	16	28
R-squared	0.888	0.216	0.587	0.234	0.904	0.215	0.650	0.410

a. HAC standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
b. The dummy variable '$imfprog_t$'=1 for years when Pakistan is part of IMF program, '$imfprog_t$ =0', otherwise. 't' controls for trend.
c. All the variables used are as shares of GDP. The dependent variable used in column (1) and column (2) are development expenditures (devexp), in column (3) and column (4) are total government expenditures (totexp), in column (5) and column (6) are current expenditures (curexp), in column (7) and column (8) are total government revenues (rev).
d. The coefficient of devexp significantly differs across two time periods, Pre 1992 and Post 1992.

Table 3.12: Testing for equality of coefficient for 'imfprog' variable

Dependent Variables	Pre 1992 – Post 1992 $\chi^2(1)$
Devexp (Development expenditure)	-1.562***
Totexp (Total expenditure)	0.148
Curexp (Current Expenditure)	-1.41**
Rev(Total Revenue)	0.313

Table 3.11 reports the result of the equation (13), after controlling for the trend. The results for the development expenditures came out to be very interesting and the only significant results across the two time periods. Pre 1992, being the part of the IMF program increased the share of development expenditures on average by 0.53 percent. And Post 1992, the behavior of the development expenditure considerably changes. As, post 1992, being the part of the IMF program dropped the share of development expenditures, on average, by 1 percent. The two coefficients, pre and post 1992 also differ significantly from each other as shown in Table 3.12.

4.6. Conclusions and Policy Implications

Conclusions of Parts One and Two of Essay Three

Part One of this essay established that the drop in the share of public investment post 1992 was based on a drop in the share of public investment in the productive sectors particularly electricity. As opposed to the share of public investment in administrative services which remained constant between pre 1992 and post 1992. Further, the drop in growth in public investment post 1992 is also explained by the drop in growth of public investment in productive sectors post 1992. Again growth in public investment in administrative services remained constant in the two periods, pre 1992 and post 1992.

Part two of this essay then argued that the drop in public investment post 1992 had to be explained through government expenditures. Government expenditures are function of tax revenues and budget deficits according to our Keynesian analytical macro framework.

Government expenditures were observed to drop significantly post 1992. This drop in government expenditure was observed to be a significant drop in budget deficits post 1992.

Confirming hypothesis 1. While tax revenues remained constant between the two periods pre 1992 and post 1992. So, clearly GOP, forced by the need to reduce budget deficit, did this by reducing government expenditures, rather than raising tax revenues. We further hypothesized that the reduction budget deficits leading to a reduction in government expenditures would be based on a cut in the government development expenditures, rather than a cut in the government recurrent expenditures. Hypothesis two was well supported by the evidence.

The fundamental question then becomes what kind of regulatory policy environment influenced the observed drop in budget deficits. The variable constructed to represent the liberality or austerity of the regulatory policy environment was the size of the agreed budget deficit, decided between the IMF and GOP. These agreed budget deficits were seen to drop after the 1991 agreement and for all the subsequent agreements. And the agreed budget deficits were seen to be well correlated to the observed budget deficit. Supporting our hypothesis 3, the regulatory policy environment heavily influenced by the agreed budget deficits, between the IMF and GOP, became significantly more austere post 1992.

Policy Implications

The essay establishes strong links between public investment and its sectoral components. And further public sectoral investment and development expenditures seem to be strongly correlated to IMF reductions in agreed and observed fiscal deficits imposed by the external regulatory policy environment.

There are two clear policy options to fund an increase in public investment and productive sector investment to enhance total investment and output growth.

The first policy option is to enhance tax revenues to enhance public investment without raising the observed fiscal deficits. Pakistan has not followed this option as tax revenues have fallen.

The second policy option is to increase observed fiscal deficits. Pakistan followed this option till 1992. Until when observed fiscal deficits allowed public investment to increase and enhance total investment and output. Post 1992, Pakistan's regulatory policy environment changed and it came under stringent IMF conditionality. This conditionality led to a series of agreed targeted fiscal deficits which reduced observed fiscal deficits post 1992.

The existential question for Pakistan's economy is how to raise its very low investment as a share of GDP which has now slumped to 15%. A balanced growth path is clearly needed. One which incentivizes private investment and increases public investment to enhance total investment. Therefore, if the private investment is shy in the shorter run, public investment has to be increased to increase total investment. Again balance is a need in funding public investment both from increasing revenues and prudent increases in the public deficit.

5. Conclusions of Essay One, Two and Three, and Policy Implications

This thesis aims to establish the determinants of Pakistan's long run GDP growth. Essays One, Two, and Three have focused on explaining the long run growth of output through its structural determinants in a General Equilibrium analysis.

A review of the development literature on Pakistan, and structural literature on Pakistan, showed that both had only partial explanations for long run growth. A review of the cyclical literature on Pakistan showed that it also had a partial explanation and of very short run growth.

A partial explanation of growth implies that it is based on an analysis of only one market, which is defined as partial equilibrium. Or an analysis of only a few of the key markets required still falls short of general equilibrium. General equilibrium is then defined as an analysis of all key markets, to explain long run growth.

All of the development literature is partial equilibrium, being based on an analysis of one or two markets.

For instance, the two gap model of the sixties identified only two macro variables causing growth, savings, and foreign exchange. Two huge missing variables in that model are consumption, and government expenditure. The Socialist Seventies identified the major causal variable of GDP growth to be government investment and consumption. Missing private investment and tradeables. The Revivalist Eighties returned to a growth model led by private investment, ignoring consumption and government expenditure. The Liberalizing Nineties and the Social Reforming Hundreds have sought to increase private investment by liberalizing regulatory structures, without examining investment outcomes in the real economy, all the while

reducing government development expenditures. Additionally, analyses of growth over the last two periods have identified just one major constraint on GDP growth, foreign exchange, harking back to the two gap model.

Our argument in analyzing this development literature has been that, while each of these variables identified in different policy regimes, as determining GDP growth, may be necessary, but is not sufficient by itself. This is termed partial equilibrium analysis, based on examining one particular market. What is better is to examine all these variables put together in a conceptual framework called general equilibrium analysis. Which is an analysis of all the major markets, goods, money, labor, tradeables, and global capital flows.

The structural literature moves towards such a general equilibrium analysis a bit better. For Pakistan, the review of the structural literature shows a large explanatory bias towards the exogenous demand variables and the monetary variables, rather than domestic demand variables to explain long run growth. The decomposition of domestic demand variables, into consumption and investment is consistently missing in the literature except in one paper but which then misses government expenditure.

These gaps in the literature on Pakistan led us to develop a general equilibrium framework, based on the Keynesian mother macro equation of explaining output on the left hand side of an equation, through the macro aggregates on the right hand side of the equation, comprising consumption, investment, government expenditures, and tradeables. We went further in our conceptual framework, to posit not only a relationship between the left hand side dependent variable and the right hand side explanatory variables. But also to posit relationships between the right hand side explanatory variables themselves. This was primarily between the right hand side explanatory variables of investment and consumption, through the Kahn-Keynes multiplier.

Essay One

Essay One explained the observed drop in Pakistan output growth between two time periods, pre 1990, and post 1990. We started our empirical analysis with a structural break analysis, using the procedures proposed by Bai and Perron (1998, 2003), henceforth BP, Andrews (1993) and Chow (1960) and using a dummy regression. We then applied a Markov Switching Regime Model.

We found a significant structural break for the year 1992. Running a dummy regression for this known break date, found that GDP growth dropped by 1.84% after 1992.

A Markov Switching Regime Model further strengthened and supplemented the argument for distinction between the two time periods, and demonstrated that in the high growth period, both the highs and the lows in GDP growth rates, have been higher than the highs and the lows in the low growth period.

Further, the probability of switching from a low growth regime to a high growth regime has also been higher in the pre 1992 high growth period, compared to the post 1992 low growth period.

Next our analytical strategy proceeded to establish which of the explanatory macro aggregates follows this pattern of high GDP growth in the pre 1992 period, and low GDP growth in the post 1992 period.

Our results suggested that after 1992, on average investment growth drops by 3.11 percent. And the break in investment growth coincided with the break in GDP growth. Having established that of all the explanatory macro aggregates only investment growth had a significant drop post 1992, following the drop in GDP growth, we proceeded to the next step of testing whether GDP growth was indeed a function of its explanatory macro aggregates.

As expected, only the investment growth variable consistently explains GDP growth across the two time periods, pre 1992 and post 1992. The investment growth variable showed that a 1 percent increase in investment growth was associated with a 0.24 percent increase in GDP growth pre 1992. The coefficient of investment growth dropped post 1992 and was associated with a 0.17 percent increase in GDP growth. Both the coefficients were significant and positive in both time periods. The investment growth coefficient had a higher value in the first phase pre 1992, and a lower value in the second phase post 1992. And the drop in investment growth coefficient was highly significant between the two phases, pre 1992 and post 1992. All the results showed the investment growth variable to be major determinant of output growth.

Having established that the drop in Pakistan's GDP growth between the two time periods pre 1992 and post 1992, is well explained by the drop in investment growth. The essay has attempted to go further. The theoretical framework adopted of the Kahn Keynes investment multiplier being based on Marginal Propensity to Consume (MPC), implied that there could be two channels working to determine long run GDP growth, the investment channel and the consumption channel.

The estimated results showed that the MPC in the high growth phase pre 1992, was 68.5 percent and highly significant. And the MPC, in the low growth phase post 1992, was 76.4 percent and again highly significant. We then ran a Chi square test which confirmed that the two coefficients, representing MPC values, were significantly different. Therefore, we can say that high GDP growth in the first phase, pre 1992, is explained by high investment growth. And that the Marginal Propensity to Consume in this phase is low. Making this high GDP growth phase investment led. And that the Low GDP growth in the second phase, post 1992, is again explained

by low investment growth. And the Marginal Propensity to Consume, in this phase is higher. Making this phase consumption led.

Summarizing, Essay 1 establishes investment growth as the main driver of GDP growth. And that on average the investment growth drops by 3.11 percent. And the break in investment growth coincides with the break in GDP growth. Hence, observing a similar declining trend for GDP growth and investment growth. We then needed to provide a theoretical and empirical methodology to explain the discrete drop in investment. Having established investment as a major determinant of high GDP growth in Essay One. We then needed to explain in Essay Two the determinants of investment in turn.

Essay Two

Essay two has focused on explaining the observed drop in Pakistan investment growth between the two time periods, pre 1992 and post 1992. It has done this by examining the impact on investment, of the macro aggregate determinants of investment. These are the supply side determinants of investment, and the demand side determinants of investment.

The empirical results for the supply side determinants, savings, and inflows, suggest that

a. Pre 1992, the growth in investment and the share of investment in output were increasing. Also, the share of inflows had an increasing trend.
b. Post 1992, when the growth in investment and the share of investment declined, the share of inflows also exhibited a declining trend.
c. Pre 1992 and Post 1992, in both the time periods, of the supply side growth variables, inflows growth remained significantly correlated with the investment growth.

d. The negative relationship between savings and inflows supports Griffin Enos hypothesis, suggesting that they are substitutes.

These sets of conclusions, hence, provide us with good evidence that the drop in investment growth post 1992 is significantly associated with the drop in the growth of inflows post 1992, on the supply side.

The empirical results for the demand side determinants, public investment, and private investment, suggest that:

a. Observing the growth of the demand side determinants of investment, there is a significant break in public investment growth in the year 1992. And public investment growth dropped on average 5.4 percent after the year 1992. Hence, we can say that the better explanatory variable, coinciding with the downward trend in investment growth post 1992 is public investment growth.
b. Observing the shares of the demand side determinants, the share of private investment has remained constant. Over the time period 1973-2019, the share of public investment has significantly declined by 5.04 percent, post 1992.
c. The growth in investment is significantly correlated to the growth in public investment for the entire period and sub periods, even controlling for the growth in private investment.

These sets of conclusions, hence, suggest that public investment explains the drop in aggregate investment. Our last set of empirical results in essay two is based on the two testable hypotheses, pointed out in the literature. One is Keynesian crowding in hypothesis. And other is the

Ricardian crowding out hypothesis. The two hypotheses test the relationship between the demand side determinants, public investment, and private investment. Our results suggest that,

- Private investment has no significant correlation with public investment in the full sample.
- This implies the rejection of the Ricardian hypothesis that public investment crowds out private investment.
- The decreasing share of public investment over time also rejects the Ricardian hypothesis.
- Because as the public investment share drops, it should have crowded in increasing the private investment share.
- But, the Private investment share remains constant at a very low level of approx 12% of GDP.

And the reduction in public investment over time accounts for the drop in the total investment over time. Which in turn accounts for the drop in GDP over time. This is a qualified acceptance of the Keynesian hypothesis that public investment crowds in aggregate investment. Therefore, Essay two suggested to us that of the demand side determinants, the growth and the declining share of public investment explain the drop in the growth of investment post 1992.

Essay one and essay two suggest that the structural breaks, in the GDP growth, the investment growth, and the public investment growth, coincide at 1992. Using structural break analysis, all three macro aggregates exhibited a structural break in the year 1992. After the year 1992, the average growth in GDP dropped by 1.84 percent, the average growth of investment dropped by

3.11 percent, and the average growth of public investment dropped by 5.4 percent. Regression analysis shows investment growth as a significant determinant of the drop in GDP growth. And, the public investment growth as a significant determinant of the drop in investment growth.

Essay Three

Therefore, in essay three of our thesis, we have attempted to explain the behavior of public investment over time in two parts. The first part, looks at a disaggregated analysis of public investment, in terms of its sub sectors. And the second part look at the impact of the regulatory policy environment on the observed drop in public investment post 1992.

The results from the empirical exercises performed under part one, the disaggregated analysis of public investment, suggest the following;

First, in terms of the shares, the research objective was to explain the declining trend in the share of public investment post 1992. Our results suggested that post 1992, the declining trend in the share of public investment is well explained by the declining trend in the share of public investment in the productive sectors.

Second, in terms of growth, the research objective was to explain the drop in the average growth of public investment post 1992. Our results suggested that component-wise, the break in the public investment in the productive sectors coincided with the break in the growth of public investment. And further, sector-wise, the break in the growth of electricity sector coincided with the break in the growth of public investment. The growth regression further validated that growth in electricity sector is highly correlated with the growth of public investment in the productive sectors in both the time periods, Pre 1992 and Post 1992.

Having established that there has been a significant drop in the share and growth of the public investment, its component, and its sector. We now proceeded to explain the drop in public investment as a function of the regulatory policy environment.

The results from the empirical exercises performed under part two, the analysis of the regulatory policy environment, suggest the following;

On average, there has been a significant drop in the observed fiscal deficits of Pakistan post 1992. This drop in observed fiscal deficits has resulted in a drop in government expenditures post 1992. Rather than an increase in tax revenues. Which remain constant over both time periods pre 1992 and post 1992. The drop in observed fiscal deficits and government expenditures post 1992 has been based on a drop in development expenditures. Rather than a drop in recurrent expenditures which remain constant over the two time periods pre 1992 and post 1992.

Moreover, the observed fiscal deficits seem to be driven by targeted fiscal deficits under the Fund programs. Therefore, we suggest that as the regulatory policy environment became more austere, it added pressure to the observed fiscal deficit. And the government which did not have the capacity to increase its revenue base curtailed the fiscal deficit through government expenditure. Particularly, compressing development expenditures. The essay suggests that the regulatory policy environment has definitely a role to play in shaping the behavior of our fiscal variables. Which in turn is directly related to the growth of public investment variables in Pakistan. The findings have some strong policy implications.

Policy Implications

The essay establishes strong links between growth, investment, public investment, and its sectoral components all of which dropped post 1992. Further government expenditures and observed fiscal deficits seem to be strongly influenced by the regulatory policy environment, given by the tighter IMF conditionality on agreed fiscal deficits.

There are two clear policy options to fund an increase in public investment and public investment in the productive sector to enhance total investment and output growth.

The first policy option is to enhance tax revenues to enhance public investment without raising the observed fiscal deficits. Pakistan has not followed this option as tax revenues have fallen.

The second policy option is to increase observed fiscal deficits. Pakistan followed this option till 1992. Until when observed fiscal deficits allowed public investment to increase and enhance total investment and output. Post 1992, Pakistan's regulatory policy environment changed as it came under tighter IMF conditionality. This conditionality lead to a series of agreed targeted fiscal deficits which reduced observed fiscal deficits post 1992.

The existential question for Pakistan economy is how to raise its very low investment as a share of GDP which is now slumped to 15%. A balanced growth path is clearly needed. One which incentivizes private investment and increases public investment to enhance total investment. Therefore, if the private investment is shy in the shorter run, public investment has to be increased to increase total investment. Again balance is need in funding public investment both from increasing revenues and prudent increases in public deficits.

At the time of writing this thesis, Pakistan is immersed in another balance of payments crisis, with the 2018-22 policy regime, straddling political divides but facing the same challenges. With

fiscal deficits and CA deficits mounting, the 22nd IMF agreement with GOP has resulted in one major change in macro fundamentals from the past, the exchange rate has become market based. Given the weak macro fundamentals under which this exchange rate has become market based, the Rupee has depreciated significantly. Leading arguably to huge capital outflows as Mahmood and Chaudry aver (2021). And contributing significantly to imported inflation (Mahmood, Chaudhry, Tanvir & Sajid, 2022). Both factors affect domestic private investment. So Pakistan's perennial problem after 1992, remains one of investment and growth. Which this thesis seeks to modestly contribute to understanding.

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Annexures

Summary of the review of International Literature and literature on Pakistan on the determinants of long run and short growth of output

A1.1 International Structural Literature

Paper Reference	Functional Form	Hypothesised signs/significance	Gap in Literature
Paper 1: Antolin-Diaz, J., Drechsel, T., & Petrella, I. (2017). Tracking the slowdown in long-run GDP growth. *Review of Economics and Statistics*, *99*(2), 343-356.	$Y_g = f(Y/L_g, LHours_g)$ Note: Y_g is GDP growth rate, Y/L_g growth in workers productivity, $LHours_g$, growth in hours worked.	Y/L_g: positive and significant $LHours_g$: positive and significant The decline in long-run GDP growth are entirely accounted for by a decline in labour productivity trend.	Two ways to decompose growth. 1. Production Function based 2. Macro component based Productivity itself is a variable to be determined by the macro aggregates. Therefore, we are choosing analysis of macro aggregates.
Paper 2: Oreiro, J. L., Nakabashi, L., Costa da Silva, G. J., & Guimarães e Souza, G. J. (2012). The Economics of Demand Led-Growth Theory and Evidence for Brazil. *cepal Review*, *106*, 151-168.	$Y=f(X, I, G_c, M2)$ Note: Y is real GDP, X exports, I investment, Gc government consumption, M2 money supply.	All variables positive and significant. Due to financial crises fiscal expansion driven model has to be replaced by export led growth model in Brazil.	Partial Analysis: Missing variables are Consumption, budget balance and current account balance.
Paper 3: Prasad, E. S. (2011). Rebalancing growth in Asia. *International Finance*, *14*(1), 27-66.	$Y = f(G_c, C_p, I, X-M, N_g)$ Note: Where Y is both real GDP and GDP growth, Gc is government consumption, C_p is private consumption, I is investment, Ng is growth rate in employment.	Cross country comparison, China: lowest share of C_p, highest I growth, lowest rate of employment growth relative to output growth.	Partial Analysis: Misses cyclical variable, budget balance.

Paper 4: Oreiro, J. L. (2011). Macroeconomic constraints to growth of Brazilian economy. *Brazilian Journal of Political Economy*, *31*(5), 874-879.	Y_g = f(I, X_g, Gc_g, $Xre^{MIS}g$, Y_{t-1g}) Note: where,Y_g is output growth, I is level of investment, X_g is rate of growth of exports, $Gc_g$is rate of growth of government consumption, $Xre^{MIS}{}_g$is rate of growth of exchange rate misalignment.	I: positive and significant X_g :positive and significant Gc_g :positive and significant $Xre^{MIS}{}_g$: negative and significant Y_{t-1g}: positive and significant	Missing private consumption.
Paper 5: Denizer, C., Desai, R. M., & Gueorguiev, N. (1990). Macroeconomic Constraints for Medium Term Growth and Distribution: A Model for Chile. *World Bank Policy Research Working Paper*, (400).	Y_g= f(Xre, CU, Y_g*) where Xre is real exchange rate, CU capacity utilization, Y_g*growth rate in potential GDP	Xre: negative under saving constraint, and positive under export gap constraint. CU: positive under saving and fiscal constraint, and negative under export gap constraint. g^{Y*}: negative under saving constraint, and positive under export gap constraint.	Partial Analysis. Missing consumption
Paper 6: de Freitas, F. N., & Dweck, E. (2013). The pattern of economic growth of the Brazilian economy 1970–2005: a demand-led growth perspective. In *Sraffa and the Reconstruction of Economic Theory: Volume Two* (pp. 158-191). Palgrave Macmillan, London.	Y_g= f(C, I, G, X, M)	G (public sector expenditures) highest share in growth rate in all time periods. Brazil followed 'government demand led growth pattern'.	Comprehensive analysis of structural variables. Misses cyclicality determinants of budget deficit.
Paper 7: Clementi, F., Gallegati, M., & Gallegati, M. (2015). Growth and cycles of the Italian economy since 1861: The new evidence. *Italian Economic Journal*, *1*(1), 25-59.	Y_g = f(C, I, G, X, M) Note: Yg is GDP growth rate.	C: positive and significant determinant in all time periods. I: positive and significant determinant in all time periods.	Comprehensive analysis of structural variables. Misses cyclicality determinants of budget deficit.

		G, X and M: positive and significant determinant in specific time periods.	

Conclusions for our work

- The most comprehensive analysis of output growth using both structural and cyclical variables is given by Freitas et al., (2013) and Clementi et al., (2015). However, both are missing the cyclicality determinant of the budget balance.

A1.2 Pakistan Structural Literature: Examines the impact on output of long run macro change in structural variables

Paper Reference	**Functional Form**	**Hypothesised signs/significance**	**Gap in Literature**
Paper 1: Shahbaz, Muhammad, Khalil Ahmad, and A. R. Chaudhary. "Economic growth and its determinants in Pakistan." The Pakistan Development Review 47.4-II (2008): pp-471	Y/pop = f_n (Crpr, FDI, REM, (X+M/Y), p^o) Note : Crpr credit to private sector, REM remittances, X+M/Y trade oppeness, p^o inflation.	Crpr: positive and significant FDI: positive and significant REM: positive and significant X+M/Y : negative and significant p^0: negative and signifiant	Partial Analysis. Missing Consumption, Investment, Revenues, and Expenditure. Explanatory bias towards exogenous demand rather than domestic demand.
Paper 2: Iqbal, Z., & Rehman, Q. N. (1995). Constraints to the economic growth of Pakistan: a three-gap approach [with comments]. *The Pakistan development review*, *34*(4), 1119-1133.	Yp=fn(Xre,CU,ΣDW) Note: Xre real exchange rate, CU capacity utilization, ΣDW world demand.	Xre: significant CU: significant ΣDW: significant	Partial Analysis. CU does act as proxy for total demand. But need decomposition of domestic demand into Consumption, Investment, and Government Expenditures

Paper 3: Qayyum, A., Khawaja, I., & Hyder, A. (2008). Growth diagnostics in Pakistan. European Journal of Scientific Research, 24(3), 433-450.	$Y= f_n(r_{dom}, \Pi/I)$ Note:r_{dom} cost of finance, Π/I return on economic activity.	r_{dom}: insignificant Π/I: significant	Partial Analysis Missing Variables: Investment, consumption and government. Over emphasis on price incentives, cost of borrowing and profitability.
Paper 4: Iqbal, Z., James, J., & Pyatt, G. (2000). Three-gap analysis of structural adjustment in Pakistan. Journal of Policy Modeling, 22(1), 117-138.	$Y = f_n(CI_{pr}, CI_{pub}, Surp_{pub}, G_c, Xre, P_{dom}, p_{oil}, I/Y_{gulf}, TOT)$ Note: CI_{pr} inflows to private sector, CI_{pub}, inflows to public sector, $Surp_{pub}$ surplus to public sector, G_c government consumption, Xre real exchange rate, P_{dom} domestic price, p_{oil} petroleum index, I/Y_{gulf} investment as share of gulf GDP, TOT terms of trade.	CI_{pr}: positive and significant CI_{pub}: positive and significant $Surp_{pub}$: positive and significant G_c: negative and significant X_{re}: negative and significant P_{dom}: negative and significant p_{oil}: negative and significant I/Y_{gulf}: positive and significant TOT: negative and significant	Missing variables: Consumption and Investment
Paper 5: Mahmood, T., & Arby, M. F. (2012). Business cycles in Pakistan. International Journal of Business and Social Science 3(4).	$Y = f_n (m_2, p^o)$ Note:M2 money supply growth, p^o inflation	m_2: insignificant p^o: negative and significant	Very partial equilibrium analysis. Observing monetary phenomenon only.
Paper 6: Khan, U. E., & Jawed, S. M. (2019). Dynamics of business cycle and long-term economic growth of Pakistan. *Theoretical & Applied Economics*, *2*(2).	$Y_{t1}=f_n(\Delta Y_{to}, \Delta R_{to}, \Delta p^o_{to}, \Delta res_{to}, \Delta FDI_{to}, \Delta BOT_{to}, \Delta Debt_{to}, \Delta(X+M/Y)_{to}, Y_{to}, R_{to}, p^o_{to}, res_{to}, FDI_{to}, BOT_{to}, Debt_{to}, (X+M/Y)_{to})$	Y_{to}: positive and significant R_{to}: positive and significant p^o_{to}: negative and significant res_{to}:positive and significant $FDI_{to:}$ positive and significant	Missing variables: Consumption, Investment and Government Expenditure

	Note: Y_{to} is previous year GDP, Rrevenues, p^o inflation, resgrowth in forex reserves, FDI, BOT balance of trade, Debt, (X+M/Y)trade openness.	BOT_{to}: negative and significant $Debt_{to}$: insignificant $(X+M/Y)_{to}$: negative and significant	
Paper 7: Chaudhry, Khan and Pasha (2017), Comparison of Various Business Cycle Models for Pakistan, SBP working series.	$Y = f_n(C, I, Nx, X+M/Y)$	C: positive and significant I: positive and significant Nx: positive and significant X+M/Y: significant	Missing Variable: Government budget balance. Otherwise very comprehensive explanatory variables
Paper 8: Chaudhry and Pasha (2013). The RBC View of Pakistan: A Declaration of Stylized Facts and Essential Models. SBP working series	$Y= f_n(C, I_{dom}, FDI)$	All variables are significant and positive	Missing variables: current account balance and government budget balance.
Paper 9: Jamil and Irfan Monetary Policy, Business Cycles and Sectoral Response in Pakistan2016 Economica	$Y_{sec}/Y_{tot}=f_n(r_{to}, p^o_{to}, (Y_{sec}/Y_{tot})_{to})$ Note: Y_{sec}/Y_{tot} ratio of sectoral output to total output, rcall money rate, p^o inflation.	r_{to}: negative p^o_{to}: negative Y_{sec}/Y_{totto}: Livestock sector and small medium sector significant	Sectoral analysis.Does not look at aggregate output

Conclusions for our work:

The structural literature should establish the domestic and exogenous determinants of demand for output.

But, decomposition of domestic demand variables, into consumption, C, and investment I, is consistently missing, except in one paper Chaudhry, Khan and Pasha. But which then misses Government Expenditures E.

The structural model has long antecedents, in identifying constraining gaps on growth in Pakistan. Studies began with simple two gap models, with savings being shy of investment, and foreign exchange gaps to import needed capital goods. These argued for foreign aid to gradually first fill the lesser foreign exchange gap, and then the larger savings gap. More recent studies have incorporated a third gap in the government's budget, running deficits between expenditures and revenues.

Overall analysis of both sets of literature, cyclical and structural, shows that each does not include the other comprehensively. The cyclicality literature is very weak in incorporating structural variables. The structural literature does not comprehensively incorporate cyclical factors, the budget balance and the CA balance.

Therefore, there is theoretical space to explain output through a marrying of both sets of explanatory variables, cyclical and structural.

This General Equilibrium analysis of output, in Essay 1, should provide an explanation of its major determinants, whether structural or cyclical or a complex combination of both.

The structural variables that are observed to be significant in Essay1, like Consumption and Investment, can then be explained in turn through their own determinants, through a partial equilibrium analysis in Essay 2.

While the cyclical factors that are observed to be significant in Essay 1, budget balances and CA balances can then also be explained in turn through their own determinants, through another partial equilibrium analysis in Essay 3. In addition essay 3 will examine relationship between the cyclical variables and structural variables which is a test of Ricardian equivalence.

A1.3 International Cyclical Literature

Paper Reference	Functional Form	Hypothesised signs/significance	Gap in Literature
Paper 1: Aghion, P., Marinescu, I., Caballero, R. J., & Kashyap, A. K. (2007). Cyclical budgetary policy and economic growth: What do we learn from OECD panel data? *NBER Macroeconomics annual*, *22*, 251-297.	Yp_g = f(R-E_c, FD, FD* R-E_c) Note: Yp_g is GDP per capita growth rate, R-E_c counter cyclicality of budget deficit, FD financial development.	R-E_c : positive and significant FD : positive and significant FD* R-E_c: negative and significant	Partial Analysis of cyclicality: missing current account balance.
Paper 2: Fatas, A. (2000). Do business cycles cast long shadows? Short-run persistence and economic growth. *Journal of Economic Growth*, *5*(2), 147-162.	Y_g = f(employment, rate of innovation, fiscal policy shock, research activity) Persistence = f(Y_{AVGg}) Note: where Persistence measures extent to which annual fluctuations are mean reverting. Y_{AVGg} is average GNP growth rate.	All variables are positively related to growth. Recession→ rate of innovation↓→research activity falls↓ → employment ↓ Y_{AVGg} = positive and significantly correlated.	Misses the underlying drivers correlating short run fluctuations with Long run trend: budget balance, current account balance, consumption and investment
Paper 3: Summers, L., Carroll, C., & Blinder, A. S. (1987). Why is US national saving so low? *Brookings Papers on Economic*	S = f(R-E, GNP gap, p^o, capital gains, t) Note: S is national savings rate, p^o is inflation and t is time trend.	R-E: negative and significant Rejects Ricardian Equivalence.	Good test of budget deficit, but missing test of current account balance.

Activity, *1987*(2), 607-642.			

Conclusions for our work:

- Cyclicality is not tested comprehensively. The literature tests well for budget deficits but misses out current account balances.
- The cyclical literature does not combine cyclical determinants with structural determinants.

The literature on Pakistan

There are two broadly competing models seeking to explain Pakistan's growth at a macro level. A cyclical model and a structural model. Both have limitations, and preclude the other. A more comprehensive explanation will have to rely on both.

A1.4 Cyclical Literature: Examines impact on output of short run macro fluctuations in the budget balance and CA balance

Paper Reference	**Functional Form**	**Hypothesised signs/significance**	**Gap in Literature**
Paper 1: Haque, N. U., & Montiel, P. J. (1993). Fiscal adjustment in Pakistan: Some simulation results. Staff Papers, 40(2), 471-480.	$Y= f_n (G_c, G_I, R)$ Note: G_c is public consumption, G_I is public investment, R is public revenues.	Gc: negative and significant GI: negative and significant R: positive and significant	Missing Variable: Current Account balance
Paper 2: Khan, M. A., & Saeed, S. (2012). Twin deficits and saving-investment nexus in Pakistan: evidence from Feldstein-Horioka puzzle.	$(X-M)/Y = f_n \{(R-E)/y, I/Y$ Note : X-M curent account balance, R-E budget balance, I	(R-E)/Y: positive and significant I/Y: negative and significant	The paper does not explain output. Just examines correlation between the budget balance and the CA balance.

Journal of Economic Cooperation and Development, *33*(3), 1-36.	Investment		
Paper 3: Qureshi 2011, Calibrating And Estimating RBC for Pakistan, DPRC Working Paper Series	$Y=f_n$ (C, I, K, L) Note: C consumption, I investment, K capital stock, L labour supply	Government spending shock reduces C, I, K and L and hence output.	Missing variable: current account balance. Establishes Ricardian Equivalence through crowding out.

Conclusion for our work:

The cyclicality literature for Pakistan is based largely on tests of Ricardian Equivalence. That unfinanced budget deficits, will crowd out increases in consumption and investment, as papers 1 and 3 do. So unfinanced budget deficits become unsustainable because they do not generate additional growth to finance them in the future. So short run cyclicality actually constrains longer run growth.

Further, the cyclicality literature shows that budget deficits are financed through CA balances, as paper 2 shows.

For a GE analysis, we seek to explain output Y, in terms of all its cyclical determinants. So output, Y should be a function of both balances, budget and CA

$Y = fn (R - E) + (X – M)$

A3.1

Variables	Definition	Data Source
1. Public Investment	The public investment is the value of the gross fixed capital formation (GFCF) done by the government: According to national income accounts, "GFCF is measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets. GFCF may also take the form of improvements to existing fixed assets, such as buildings or computer software that increase their productive capacity, extend their service lives, or both.''	National income Accounts, PBS
2. Public Investment in the sectors	Public investment in commodity producing sectors and services sector	National income Accounts, PBS
3. General Government	Public investment in services sector mainly public administration and defence and other social services.	National income Accounts, PBS
4. Fiscal Deficit	Total Expenditure minus Total Revenues	Ministry of Finance, Pakistan
5. Total Expenditures	Current Expenditures + Development Expenditures	Ministry of Finance, Pakistan
6. Current Expenditures	Expenditures (non-development) relating to the ongoing costs of the government, such as salaries and contingent expenditures.	Ministry of Finance, Pakistan
7. Development Expenditures	Development expenditure component of fiscal outlays equals net investment by the public sector in Pakistan.	Ministry of Finance, Pakistan

8. Total Revenue	Inflow of cash, arising as a result of collections received in a given reporting period.	Ministry of Finance, Pakistan
9. Targeted Fiscal Deficit	The targeted fiscal deficit agreed between Pakistan government and IMF on the approval of loan.	IMF archival database. Letter of Intent/Agreement between Pakistan and IMF, 1973-2018. Provided bilateral to researcher.