# Key Bottlenecks to Economic Growth in Pakistan: An Extended Three-Gap Analysis

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**Abstract**

This paper analyzes the significance of public and private savings for sustainable economic growth in Pakistan. We formulate a three gap model and estimate it using annual data covering more than a half century period from FY1962 to FY2013. Our estimation results of extended model along with counterfactual simulation show that both foreign exchange and fiscal gaps restrain economic growth in Pakistan. The fiscal gap also appears to be a more binding constraint than foreign exchange constraint. We recommend that improving tax revenue collection can help provide the fiscal space required for ensuring long term stable economic growth.

*Keywords:* Economic Growth and Development, Three Gap Analysis, Pakistan.

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*Note*: Any errors or omissions in this paper are the responsibility of the authors. Views expressed here are those of the authors and not necessarily of the New School, Habib University and/or IBA, Karachi.

‡ Stata simulation codes of three gap model and datasets are available upon request.

# 1 Introduction

Economic analysis in Pakistan is often colored by nationalist sentiments. High level of economic development is almost seen as Pakistan's inevitable destiny, which is only constrained by a number of political factors both local and international. In more popular notions it takes the form of several conspiratorial theories that warrant no serious response. Surely, this situation may not be unique to Pakistan and such sentiments can be found in other parts of the third world as well. In Pakistan, this notion of "economic greatness" is also informed by its post-independence history. At the supposed peak of its economic performance[1] Pakistan was touted as a poster child for economic miracle. New York Times considered it to be the only country with a large population other than the Unites States of America that may become highly prosperous (quoted in Saeed, 1995). Papanek - a Harvard trained economist - eulogized Pakistan's growth prospect in much the same fashion in his work. Several part myths and legends arose from this narrative of the sixties. One of the most oft repeated part-myth and part-truth is how the South Koreans and Chinese took their growth blue prints from Pakistan of the 1960s[2]. Regardless of the veracity of these claims, this narrative seems to have imbued a "sense of loss or decline" in generations that came after the the celebrated decade of growth. Since, then economic growth has generally declined and occurred mostly in fits and starts in the country (see, Figure 2 below). Moreover much of the benefits associated with sustained economic growth seem elusive for Pakistan. Popular notions dictate that both poverty and inequality has tended to increase and development indices continue to decline. Easterly has called this "growth without development" and states that Pakistan is socially backward for its income level

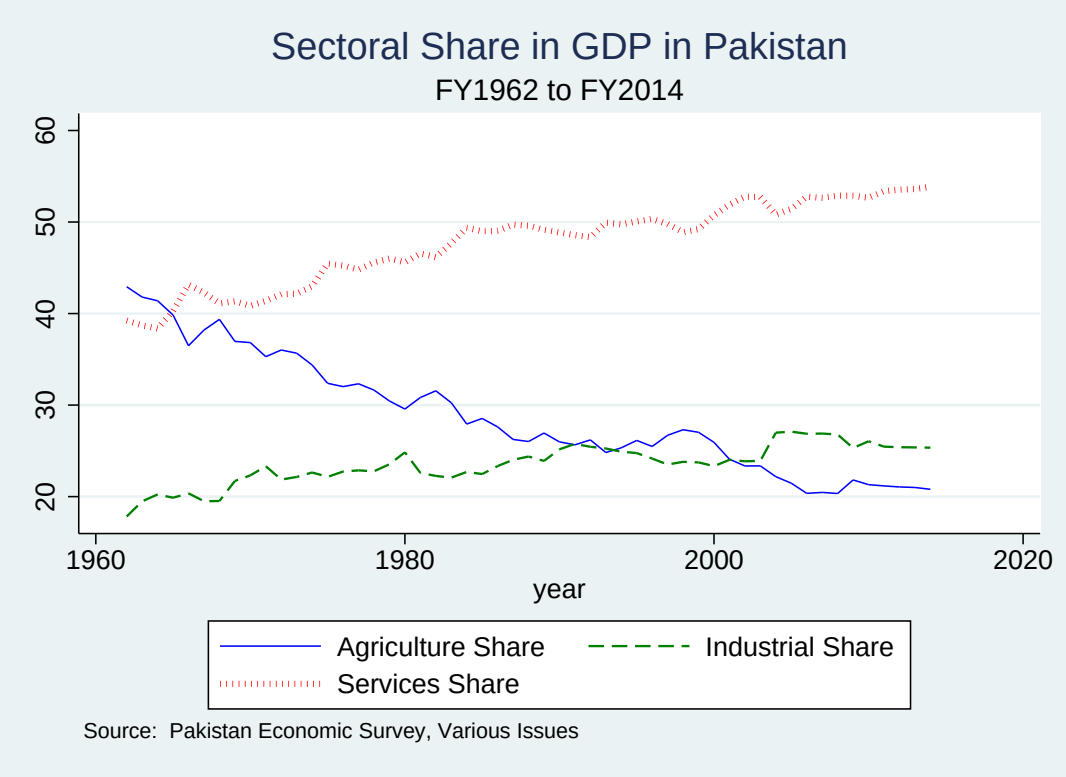
[1] 1960s but more specifically the period from 1958-67 was celebrated as the decade of growth

[2] We call these part-myths and part-truths because any concrete evidence seem to be lacking. But these notions persist very strongly. For a more recent recitation of these see Former US Ambassador to Pakistan Cameron Munter's talk at the Carnegie Endowment Fund, web link: *http://carnegieendowment.org/2012/09/25/ambassador-cameron-munter-on-pakistan/duu8*

(Easterly, 2003). A pertinent question to ask would be: What went wrong? This paper is partially an attempt to address this question.

The current size of the GDP stands around US$ 200 billion. The economy is dominated by the service sector that contributes more than 50 percent of the GDP. The industrial sector's contribution on average remains around 25%. The residual is the contribution by agriculture sector. Figure 1 below shows the sectoral shares in Pakistan's GDP for the fifty year period from Fisal Year 1961-62 to Fiscal Year(FY) 2012-13[3].

Figure 1: Sectoral Shares in GDP in Pakistan




The graph clearly shows the structural transformation that has been unfolding in Pakistan since early 1960s. In terms of contribution to GDP the agricultural share is continuously declining in Pakistan while the graph shows a steady rise in the shares of services and

[3]Fiscal Year in Pakistan is from July 01 to June 30. All economic data in Pakistan is collected for fiscal years.

industrial sectors. What is also clear is that Pakistan is neither a heavily nor an under-industrialized country. The average contribution by the industrial sector points towards a mid-income economy. The average growth rate for the past two decades has been 5.35%, which is well above its average population growth rate. The economic data from Pakistan has all the signs pointing towards a mid-sized economy.

Figure 2: Actual and HP Filtered GDP Growth Rate

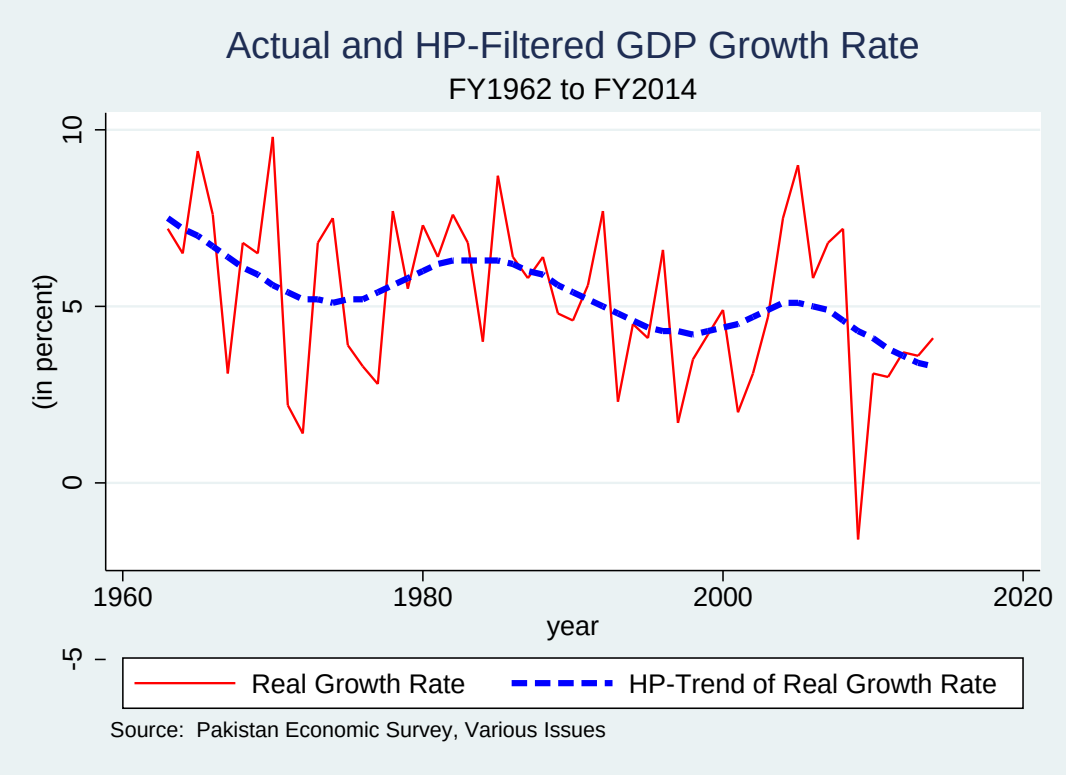



Figure 2 above shows the real economic growth rate for the time period from FY1961-62 to FY2012-13. Two observations can be made immediately. The real growth fluctuates considerably between a wide band (approximately 1.7 percent to 10 percent, except for 2010 when real growth rate was very low). The Hodrick-Prescott filtered trend of the real growth shows cyclicality and an overall downward trend. This paper is an attempt to make sense of this picture. It asks a simple question. Why Pakistan has been unable to sustain levels of growth rates that it did in its early history? We want to explore this question by

looking at the role of the state and public finance in economic growth in Pakistan.

The question just raised may seem straight forward but comprehensive answers to similarly raised questions have been equally elusive. Surely, this question can be answered in many different ways. Its generality can be both advantageous and disadvantageous. The advantage is that one can answer this question from different perspectives and historical vantage points. This allows us to provided a multi-faceted picture of economic growth in Pakistan. No picture alone can claim to have a monopoly over truth. Multiple answers can therefore enrich our understanding of Pakistan's economic growth in an historical context. The disadvantage can be that one can easily be lost in the details of attempting to answer this question in a holistic or comprehensive way and may end up at a point where confusion rather than clarity reigns supreme. We are inclined to answer this question through a more interdisciplinary manner but one that relies on a series of inter-related papers in order to construct a comprehensive picture. For the purposes of this paper it is important to establish some link if public spending can be linked (positively) with economic activity and growth. We bring more focus to our main question by raising a more specific one here. Specifically, we would like to understand if foreign and domestic savings have acted as constraints on economic growth in Pakistan. We answer this question using Three-Gap approach from structuralist macroeconomics, details of which can be found in sections to follow.

This paper is organized as follows. Section 2 presents a formal statement of three gaps model as developed by Taylor (1991 and 1993) to provided a formal framework under which economic growth in Pakistan can be evaluated. Sector 3 discusses the data used for estimating the model presented in section 2. We also present our estimated model and results thus obtained. Section 4 conclude by presenting suggestions to augment the analysis in this paper. A formal statement of the extended three gap model is provided in a separate appendix section.

# 2 Economic Growth and Three Gap Models

Economic growth at best seems an elusive concept. Economists of various schools have tried to explain but there is no agreement amongst various schools and scholars on what really causes growth.Sala-i-Martin (1997) in his famous paper ran two million regressions only to find out that there are a mere 22 (out of 59 investigated) variables that can impact economic growth in a significant way. Some of these variables are fixed in the sense that it is difficult for the economy to militate against them to ensure growth. For example, being in Sub-Saharan Africa or in Latin America impacts growth negatively but the farther an economy is from the equator (Absolute Latitude) the better it is for its growth! Also, somehow being non-christian (Muslim, Buddhist, Confucian) is good for growth but being Protestant and Catholic impacts it negatively. This is puzzling and counter- or a-historical since economic growth and progress has largely been recorded in all countries of the western Europe, North America, and Australia and Christianity hasn't really kept them from growing. The other variables in the list are not this rigid but their track record in being 'growth causing' remains just as shaky. Degree of capitalism, openness, (absence of) market distortions (in real exchange rate and standard deviation of the black market premiums), political variables (political rights, rule of law, civil liberties) all have positive impact on growth. In the real world the experience of Asian Tigers, China, and Vietnam[4] tell us a different story. From the perspective of liberal western democracies[5] Chinese growth should be a conundrum in perpetuity. In any case, the evidence for all these variables is weak and does not stand well to face the rigors of statistical tests[6].

Along side this standard neo-classical growth literature, structuralist macroeconomics suggests how different factors can act as constants on growth and income distribution

[4](And perhaps some Latin American countries in the first decade of this century)
[5]That also happen to be advanced capitalist societies
[6]McCartney (2010).

in developing world. The way these constraints acts depends on the institutional and historical circumstances of the economy under study. When analyzing economic growth, these structuralist ideas has been formalized in terms of a binding constraint on capital accumulation (see, Taylor, 1991). The idea is that the growth rate possible under some binding constraints and when these are relaxed can be understood as a "gap", which can represent a macroeconomic disequilibrium. Three possible macroeconomic gaps can act to limit growth prospects. These are the investment-saving gap, the foreign exchange or import-export gap, and the fiscal gap. We discuss this three gap model in greater detail in the next section.

## 2.1 Gap Models

Gap models have been around for some time, particularly the ones that this paper employs to understand economic growth in Pakistan.[7] The idea is that growth of capital stock (and by implication of economic activity) can take place under some binding constraint or under less strict conditions. Taylor (page 159, 1991) argues that the difference of capital stock growth rate between these two conditions can be called a "gap" (emphasis in original). Models setup for growth (and gap) diagnosis are usually set out in national account identities. Therefore, existence of a gap points towards a macroeconomic disequilibrium and the way it is balanced becomes important ( Taylor, 1991).

Chenery and Bruno (1962) introduce the idea of gaps in their pioneering paper[8]. The ideas were extended in another paper by Chenery and Strout (1966). The idea behind the model is elegantly simple. The growth models of the day for developed countries argued that growth prospects are determined by supply of factor inputs, efficiency of their

[7]In Pakistani context, two earlier studies, Iqbal (1995) and Iqbal et al.,(2000) have considered a prototype version of three gap model in their analysis of growth constraints. However, our study is based on an extended version of three gap model consistent with Taylor (1993).

[8]Taylor (1994) traces it back to Harrod-Domar's work

use, rate of population growth, and rate of savings (Chenery and Bruno, 1962). They argued that the less fortunate developing countries must consider other things including, foreign inflows (trade imbalance), the composition of present and future demand, and the (state's) ability to plan and carry out development activities. They also identify foreign inflows and savings as two gaps that constrained growth prospects in developing countries. The models developed under two gap analysis showed that these gaps must be equalized (ex post, Taylor, 1991) through some mode of macro adjustment i.e. the gaps between investment and savings and imports and exports must be equalized. As pointed out above understanding this mode (or process) of macro adjustment is important. Bacha (1990) and Taylor (1991) extended the two gap models to include a third fiscal gap. Fiscal constraints through public sector accounts introduce a gap between a potential (or desired) and an actual growth rate. The mechanism of fiscal gap acting as a constraint works through crowding in effect of public investment. Public investment attracts private investment and hence accelerate the growth process. The growth will remain slow or constrained if fiscal gap acts as a binding constraint even if the other two do not. Taylor (1993) details the application of his three gap models on various developing countries. The country studies employing the methodology find evidence of the crowding-in effect of public investment and how fiscal gaps acts as a binding constraint on growth prospects. Sepehri and Lodhi (2005) and Zhang and Chen (2010) find similar evidence for Vietnam and China, respectively, using Taylor's version of the three-gap analysis.

In the following subsection we extend Taylor (1993) formal statement of the model with some minor modification to make it suitable for an analysis of growth in Pakistan. We are now ready to specify a model and three gap equations based on Taylor's model above. Similar extensions can be found in Sepehri and Lodhi (2005) and Zhang and Chen (2010). However, we believe ours is more closer to the one mentioned in Taylor (1993).

### 2.1.1 Specification of the three-gap model

Table 1 shows the specification to be used in estimating the three gaps mentioned in the formal statement.[9] Equation (a) shows the concept of output used in this analysis. Output is defined as sum of real GDP and real intermediate imports. All other variables are scaled by potential output, $Q$, which is estimated by detrending the real Output series using a Hodrick-Prescott filter. Capacity utilization, defined in equation (b), is simply the ratio of real output, $X$ to potential output, $Q$. In a way this measure of capacity utilization measures a possible output gap as well. This specifies economic growth along Harrod-Domar lines. The rate of growth of potential output, $g$ depends linearly on real investment, $i$ as the share of potential output, $Q$. $\kappa$ measures the incremental capital-output ratio and $g_o$ measures all other factors that cause growth, say labour productivity. Macroeconomic equilibrium is given by equation (d).

Equations (e) defines total investment as sum of the private and public sector investment. Equations (f) to (l) list the equations that we estimate to calculate the three gaps mentioned in equations (n) to (p). Equation ($f$) relates private investment, $i_p$ with public investment, $i_g$ and capacity utilization, $u$. Heterodox theory predicts that public investment has a crowding in effect on private investment. $\alpha$ is therefore positive. $\beta$ is positive since a narrowing output gap (as a measure of increased economic activity) should spur in private investment. Private savings, $s_p$ in equation (g) are related with capacity utilization $u$ and transfers to the private sector from abroad, $\phi$. The relationship is fairly intuitive. Higher economic activity, as measured by $u$, can result in higher saving. If $\sigma_\phi$ is positive then this could imply that foreign transfers to the private sector offset domestic savings. Fiscal effort in equation (h) is primarily a measure of capacity utilization. Higher economic activity brings in more revenue to the government. Equations (i), (j), and (k) give the

[9]Formal statement of extended three gap model is available in Appendix.

Table 1: Specification of the Three Gaps Model

| | | | |
|---|---|---|---|
| Real Output | $X = GDP + M_i$ | | (a) |
| Capacity Utilization | $u = X/Q$ | | (b) |
| Growth Rate | $g = g_o + \kappa i$ | $g_o > 0 \; or \; g_0 < 0, \; \kappa > 0$ | (c) |
| Equilibrium | $i = s$ | | (d) |
| Total Investment | $i = i_p + i_g$ | | (e) |
| Private Investment | $i_p = i_o + \alpha i_g + \beta u$ | $\alpha > 0 \; or \; \alpha < 0; \; \beta > 0$ | (f) |
| Private Savings | $s_p = \sigma_o + \sigma_u u - \sigma_\phi \phi$ | $\sigma_o < 0 \; \sigma_u > 0; \; 0 < \sigma_\phi < 1$ | (g) |
| Fiscal Effort | $z = \psi_o + \psi_1 u$ | $\psi_o > or < 0; \; \psi_1 > 0$ | (h) |
| Intermediate Imports | $m_i = \gamma_o + \gamma_1 u$ | $\gamma_o > 0 \; or \; < 0; \; 0 < \gamma_1 < 0$ | (i) |
| Capital Imports | $m_k = \xi_o + \xi_1 i$ | $\xi_o > 0 \; or \; < 0; \; 0 < \xi_1 < 1$ | (j) |
| Exports | $e = \epsilon_o + \epsilon_u u$ | $\epsilon_o < 0 \; or \; > 0; \; 0 < \epsilon_u < 1$ | (k) |
| Foreign Savings | $s_f = m_k + m_i + m_k + j^* - e = t + \phi$ | | (l) |
| | Three Gaps Equations: | | |
| Growth Investment Equation | $i_g = [\frac{1}{(1+\alpha)}][\frac{(\bar{g} - g_o)}{\kappa} - (i_o + \beta u)]$ | | (m) |
| Savings Gap | $(1+\alpha) i_g - (\sigma_1 + z_1 - \beta) u = z_o - j^* + (1 - \sigma_2)\phi + \sigma_o - i_o + t$ | | (n) |
| Fiscal Gap | $i_g - (\pi + z_1) u = \psi_o - j^* + t$ | | (o) |
| Foreign Exchange Gap | $\xi_1 (1-\alpha) i_g + [\gamma_1 + \xi_1 \beta + \epsilon_1] u = \phi - m_c - j^* - \xi_1 i_o - \gamma_o + \epsilon_o + t$ | | (p) |

external sector of the economy and are fairly self explanatory. Equation (j) needs some explanation, however, since it is missing from Taylor's original formulation (Taylor, 1993). Following Sepehri and Akram-Lodhi (2005), we also postulate that Taylor's $(1-\theta)I$ (or $(1-\theta)i$) - the measure of share of investment met by capital imports - depends on the total investment in the economy. Equation (j) specifies the relationship[10].

Equation (m)-(p) give our growth equation and the three gap-equations. Equation (m) is obtained by plugging in equations (e) and (f) in equation (c). The growth equation shows that public investment and capacity utilization can be traded off to give macroeconomic equilibrium, Sepehri and Lodhi (2005). This allows us to treat growth rate of capacity output, $g$ as a target variable, $\bar{g}$ in equation (m). Sepehri and Lodhi (2005) also point out that one of the innovative features of the three gap analysis is its explicit consideration for the interaction between capacity utilization, $u$ and capacity growth rate, $g$. The idea is that a developing country economy can face fiscal, savings, and foreign exchange constraints that may restrict it from fully utilizing its capacity. Equation (m) therefore relates $i_g$, $u$, and $\bar{g}$. Equation (n), the investment-savings gap, gives us the maximum level of government investment possible for a given rate of capacity utilization that satisfies our macroeconomic equilibrium mentioned in (d) above. The ideas is that public and private investments are complimentary so a higher public investments crowds in private investment and increases capacity utilization. This in turn generates enough savings to finance further investments. The fiscal gap given in (o) shows that a higher capacity utilization, $u$, results in higher government revenue that can be utilized for higher public sector investment. Lastly, foreign savings gap is given by (p). There is a trade off between public sector investment, $i_g$ and capacity utilization, $u$. The logic is that a higher capacity utilization rate will result in greater demand for raw material imports. Given the foreign exchange available is relatively

[10]In the appendix we have used this idea to replace $(1-\theta)i$ with $\xi_1$ in equation 14 to calculate the foreign exchange gap.

fixed therefore, capital imports must be cut to finance intermediate imports. A cut in capital imports means lowering of capacity growth rate, (Sepehri and Lodhi (2005)).

It would be useful here to discuss how the three gaps would help us identify constraints to economic growth. A careful look at the three gap equations in the table 1 above will reveal that both investment-savings and foreign exchange gaps have constant slopes but variable y-intercepts. Both of these gaps can appear as constraints if the calibrated equations (calibrated for different years) shift over the years. For example, a downward shift of foreign exchange gap over time would reflect a worsening foreign exchange constraint for the economy. This can happen if foreign transfers to government, $t$ and foreign transfers to the private sector, $\phi$ fall from one year to another. The intercept in foreign exchange gap can also fall because of an increase in consumer goods imports, $m_c$. Similarly, the slope in savings gap can vary if $\phi$ and $t$ change. A fall in both these variables will shift the saving gap equation down in the $i_g - u$ space. Both the slope and y-intercept of the fiscal gap equation can change due to changes in public sector borrowing requirement, $\pi$ (for slope) and foreign transfers to the government, $t$ and foreign interest and loan payments, $j^*$ (for y-intercept) . In case of the fiscal gap equation a changing constraint overtime would be reflected by both a rotation and shift of the gap. In the next section, we would also analyze these counterfactual shifts over three years (fiscal years 1970, 1990, and 2010) with changes in $m_c$, $t$, $\phi$, and $\pi$.

# 3 Data and Model Estimation

Data has been compiled from various sources. Statistical data in Pakistan is mostly collected by Pakistan Bureau of Statistics and then disseminated to various other government departments/organizations. The data is collected for a the period covering the fiscal year, which starts on July 1st of a calendar year and ends on June 30 of the next calendar year.

The data published is usually of mixed quality. Often numbers published by two different departments/organizations can differ even if they are discussing the same thing (for example GDP). What is also common to see is that statistics for the same series can differ in two consecutive publications from the same government department. These issues are discussed in detail below.

Pakistan Bureau of Statistics (PBS) is responsible for collecting economy wide statistics in Pakistan. PBS compiles national accounts data and then shares it with relevant government departments and the public at large. Gross Domestic Product (GDP) measures have been re-based several times over the past 60 years or so in Pakistan. The most recently this was done was in the middle of the last decade when GDP measures were re-based to 1999-2000 from 1980-81. However, this re-basing was not simply in price terms. PBS also revised their methodology to measure economic activity and included new measures of GDP. All three components of GDP namely, agriculture, manufacturing, and services sectors were expanded to include more economic activity. Hence, this re-basing of GDP measurement was also a structural change which expanded the base over which the size of the economy is measured. A direct effect of this can be seen in almost all Government of Pakistan (GoP) publications. The GDP grows by more than 25% (both in nominal and real terms) between fiscal year (FY) 1998-99 and 1999-2000. No publication coming out of PBS or Ministry of Finance accounts for this structural change. Two main compendium of data that come out of Pakistan are Pakistan Statistical Yearbook, published by PBS, and Economic Survey of Pakistan, which is released by Ministry of Finance a few weeks before the annual budget each year. We rely on Economic Survey of Pakistan as one of the sources for the data compiled for this paper. But since GDP data has gone through several re-basings over the years and PBS has not produced a consistent time series that can account for these jumps or shifts we use a publication of State Bank of Pakistan (SBP) to by pass this problem. SBP recently produced a "Handbook of Statistics on Pakistan

Economy 2010[11]" that has a GDP at Factor Cost (in constant 1999-2000) series that accounts for these structural changes. For this reason all other nominal data for this paper has been converted in real terms (constant 1999-2000 prices). Again, PBS or Ministry of Finance do not have a particular price index for year 1999-2000. Both Economic Surveys and Statistical Yearbooks contain data that is expressed in several base years[12]. This creates further hurdles in obtaining a consistent time series data. SBP's Handbook again provides a solution to this problem. We use the 50 years series for whole sale price index based in 2000-2001 prices given in the Handbook (Chapter 2, Table 2.9). A simple arithmetic exercise then yields the whole sale price index in 1999-2000. Whole sale price index (as opposed to the consumer price index) seems to be the appropriate index for deflating the nominal data used here.

Needless to say all these troubles make life difficult for all those who fancy doing quantitative research on Pakistan. We have tried to ensure that any particular data series is obtained from one source. This can ensure consistency. Wherever numbers are missing in a particular series we have filled them up using either Economic Survey of Pakistan (various issues) or 50 Years of Statistics in Pakistan. Because of this the entire data set used here does not come from one single source. The data for imports, exports, foreign debt servicing, and stock of foreign debt are all given in millions of US Dollars. PBS has produced a 60 year series of average nominal exchange rate. We use that series to convert the data in US dollars into Pakistan Rupee terms. It is then deflated by the whole sale price index to give us real data in FY 1999-2000. Following is the description of how each series has been collected from various sources.

- *GDP at constant factor cost 1999-2000:* ( Handbook2010)

[11] A proper reference for this is missing but the Handbook can be accessed on SBP's website http://www.sbp.org.pk/departments/stats/PakEconomy_HandBook/index.htm

[12] For example the recent Economic Surveys would base constant price data in 1999-2000 prices but earlier ones would do it 1980-81 or 1989-1990

- *Whole Sale Price Index 2000-2001:* ( Handbook2010)

- *Imported Goods data*: Capital Goods $M_k$, Raw (intermediate) Materials $M_i$, and Consumer Goods, $M_c$, from Economic Survey of Pakistan, various issues. Imported Raw materials are further disaggregated into raw material for capital goods and raw materials for consumer goods. For this paper we add the two to give one series for imported raw materials.

- *Exported Goods Data, E:* From Economic Survey of Pakistan, various issues[13]

- *Private Investment, $I_p$ (Gross Fixed Capital Formation in Private Sector) and Public Investment, $I_g$ (Gross Fixed Capital Formation in Public Sector):* From 50 Years of Statistics in Pakistan (1963-64 to 1971-72) and Handbook of Statistics in Pakistan (1972-73 to 2009-2010). Economic Survey of Pakistan (2010-2013)

- *Total Revenues (Tax + Non-Tax Revenues), W:* Economic Survey of Pakistan and 50 Years of Statistics in Pakistan[14].

- *Government's Current Expenditure on Cosumption, C*: Data obtained from various issues of Economic Survey of Pakistan.

- *Government's Total Current Spending* (budgetary outlay), *G*: Economic Survey of Pakistan, various issues

- *Total Domestic Debt Servicing:* Economic Survey of Pakistan (various issues) and 50 Years of Statistics in Pakistan

- *Total Foreign Debt Servicing, J:* Economic Survey of Pakistan, various issues. Data is reported in US Dollar terms in various issues of Economic Survey of Pakistan. We

[13] various issues include: ESP1982,ESP198485,ESP198990,ESP199899,ESP200607,ESP201011,ESP201112,ESP201213
[14] These include 50yearsV2,50yearsV3,50yearsV4

converted it into Pakistan Rupee by using an average exchange rate series given on PBS website[15]

- *Stock of Foreign Debt:* (Economic Survey of Pakistan, various issues)
- Total Transfers to the private sector from abroad, $\Phi$ : Workers Remittance data obtained from Handbook of Statistics on Pakistan Economy 2010 and Economic Survey of Pakistan, various issues
- Total Transfers to the public sector from abroad, $T$: Total Foreign Aid disbursed to the Government of Pakistan. Data obtained from various issues of Economic Survey of Pakistan.
- *Average Nominal Exchange Rate:* Pakistan Bureau of Statistics website[16].

The data is used to calculate the variables mentioned in section 2.1.1 above. It is worthwhile to revisit those calculations here again to set the stage for our econometrics exercise in the next section.

Government Savings, $S_g$ is calculated as follows:

$$S_g = (W - G) - J + T = Z - J^* + T \tag{1}$$

Fiscal Effort, $Z$ is given by the difference between $W$, Government's total revenue and $G$, its current spending as laid out in the annual budget.

Public Sector Borrowing requirement is given by:

[15]The website page is http://www.pbs.gov.pk/content/detail-tables-1. The relevant table can be accessed here http://www.pbs.gov.pk/sites/default/files/national_accounts/tables/table2.pdf

[16]The website page is http://www.pbs.gov.pk/content/detail-tables-1. The relevant table can be accessed here http://www.pbs.gov.pk/sites/default/files/national_accounts/tables/table2.pdf

$$PSBR = Government\ current\ spending - local\ revenues + public\ investment + foreign\ interest\ payment - net\ transfer\ to\ government\ from\ abroad$$

$$PSBR = G - W + I_g + J - T \tag{2}$$

Foreign Savings are given by:

$$S_f = M_c + (a_o Q + a_1 \chi) + (1 - \theta)I + J^* + S_p - (\epsilon_o Q + \epsilon_1 \chi) = T + \Phi \tag{3}$$

$$S_f = T + \Phi \tag{4}$$

I calculate private savings, $S_p$from our private consumption equation (2) from above.

$$C = \chi - a\chi - \lambda S_p - (1 - \lambda)S_p - W \tag{5}$$

Since we have assumed that $\lambda = 1$, (5) can be re-written as:

$$C = \chi - a\chi - S_p - W$$

where $a\chi$ is intermediate imports. Rewriting above gives us private savings,

$$S_p = \chi - a\chi - C - W \tag{6}$$

All these variables are then scaled down by the potential output, $Q$, except for PSBR, which is scaled down by real output $X$.

## 3.1 Econometric Results

The model mentioned in Table 1 in section 2 are estimated for annual time series data from 1961-62 to 2012-13 using Auto Regressive Distributed Lag (ARDL) techniques. The results are presented below in Table (2 to 5). Before discussing the results it is pertinent to mention some of the usual problems encountered when working with time series data. All the variables that help us estimate the model in Table 2 were tested for stationarity. Dickey-Fuller (DF) test was used to test variables for presence of unit root. The choice was made after testing the variable for Auto Regressive (AR) processes. Theory suggests that for AR(1) processes a simple DF test for unit root suffices. If the for AR processes greater than 1, the Augmented Dickey-Fuller (ADF) is suggested. All variables given in Table (number here) below exhibit AR(1) process except for capacity utilization, $u$, which is tested for unit root using an ADF test. In levels, we fail to reject the null-hypothesis of presence of unit root at 1% level of significance. However, the null-hypothesis can be comfortably rejected at 1% level of significance for the first difference of the variable. This means that all variable are integrated of order 1, or I(1).

The presence of unit root can imply a long run co-integrating relationship between the variables. We estimate equations (f) to (k) using ordinary least square technique. The residuals obtained for each of this regression are then tested for unit root using a DF test. We find that we cannot reject the presence of unit root at 1% level of significance in these estimated residuals. The equations (f) to (k) are then estiamted using ARDL technique and the results are presented in table 3 below.

***Table 2: Dickey-Fuller Test for presence of unit root***

| ***Variable*** | ***Levels*** | | ***First Difference*** | |
|---|---|---|---|---|
| | $z(t)$ - statistic | Critical Value (1%) | $z(t)$ - statistics | Critical Value (5%) |
| $i_p$ | -2.776 | -4.159 | -5.298 | -3.594 |
| $i_g$ | -2.134 | -4.159 | -6.022 | -3.594 |
| $u$ | -3.149 | -4.187* | -4.090 | -3.614* |
| $s_p$ | -2.957 | -4.159 | -8.531 | -3.594 |
| $\phi$ | -1.487 | -4.159 | -6.325 | -3.594 |
| $z$ | -4.412 | -4.159 | -9.280 | -3.594 |
| $m_i$ | -2.346 | -4.159 | -6.378 | -3.594 |
| $m_k$ | -2.805 | -4.159 | -6.476 | -3.594 |
| $i$ | -3.272 | -4.159 | -5.500 | -3.594 |
| $e$ | -2.624 | -4.159 | -7.029 | -3.594 |

Table 3: Estimated Model

| |
|---|
| $i_p = 0.0522 + 0.3660i_g + 0.0711u + 0.878i_{p_{-1}} - 0.272i_{g_{-1}} - 0.124u_{_{-1}} + 0.009dum$ <br> $Adjusted\ R^2 = 0.8491,\ Breusch - Godfrey\ for\ Auto - Correlation = 0.210\ (Prob = 0.6468)$ |
| $s_p = -0.0675 + 0.4736u + -2.2501\phi - 0.332u_{-1} + 0.516s_{p_{-1}} + 1.711\phi_{_{-1}}$ <br> $Adjusted\ R^2 = 0.5322,\ Breusch - Godfrey\ for\ Auto - Correlation = 0.00\ (Prob = 0.9941)$ |
| $z = 0.1089 + 0.0348u - 0.142u_{-1} + 0.459z_{-1}$ <br> $Adjusted\ R^2 =,\ Breusch - Godfrey\ for\ Auto - Correlation = 0.120\ (Prob = 0.7290)$ |
| $m_i = 0.0524 + 0.2221u + 0.948m_{i_{-1}} - 0.269u_{_{-1}}$ <br> $Adjusted\ R^2 = 0.8642,\ Breusch - Godfrey\ for\ Auto - Correlation = 0.106\ (Prob = 0.7443)$ |
| $m_k = -0.0003 + 0.3089i + 0.576m_{k_{-1}} - 0.161i_{_{-1}}$ <br> $Adjusted\ R^2 = 0.6999,\ Breusch - Godfrey\ for\ Auto - Correlation = 0.317\ (Prob = 0.5736)$ |
| $e = 0.1929 + -0.0320u + 0.875e_{_{-1}} - 0.148u_{-1}$ <br> $Adjusted\ R^2 = 0.8722,\ Breusch - Godfrey\ for\ Auto - Correlation = 0.072\ (Prob = 0.7886)$ |

Table 4: Estimated Parameters of Interest

| *Parameter* | *Value* | *t-stat* | *p-value* |
|---|---|---|---|
| $\alpha_o$ | 0.0522 | 0.66 | 0.511 |
| $\alpha$ | **0.3660** | 2.04 | 0.048 |
| $\beta$ | 0.0711 | 0.86 | 0.395 |
| $\sigma_o$ | -0.0675 | -0.19 | 0.852 |
| $\sigma_u$ | 0.4736 | 1.29 | 0.205 |
| $\sigma_\phi$ | **-2.2501** | -2.55 | 0.014 |
| $\psi_o$ | 0.1089 | 1.03 | 0.307 |
| $\psi_u$ | 0.0348 | 0.31 | 0.759 |
| $\gamma_o$ | 0.0524 | 0.90 | 0.373 |
| $\gamma_u$ | **0.2221** | 3.64 | 0.001 |
| $\xi_o$ | -0.0003 | -0.05 | 0.958 |
| $\xi_i$ | **0.3089** | 5.47 | 0.000 |
| $\epsilon_o$ | **0.1929** | -0.40 | 0.014 |
| $\epsilon_i$ | -0.0320 | 2.56 | 0.689 |

Table 5: Calibrated Three Gap Equations

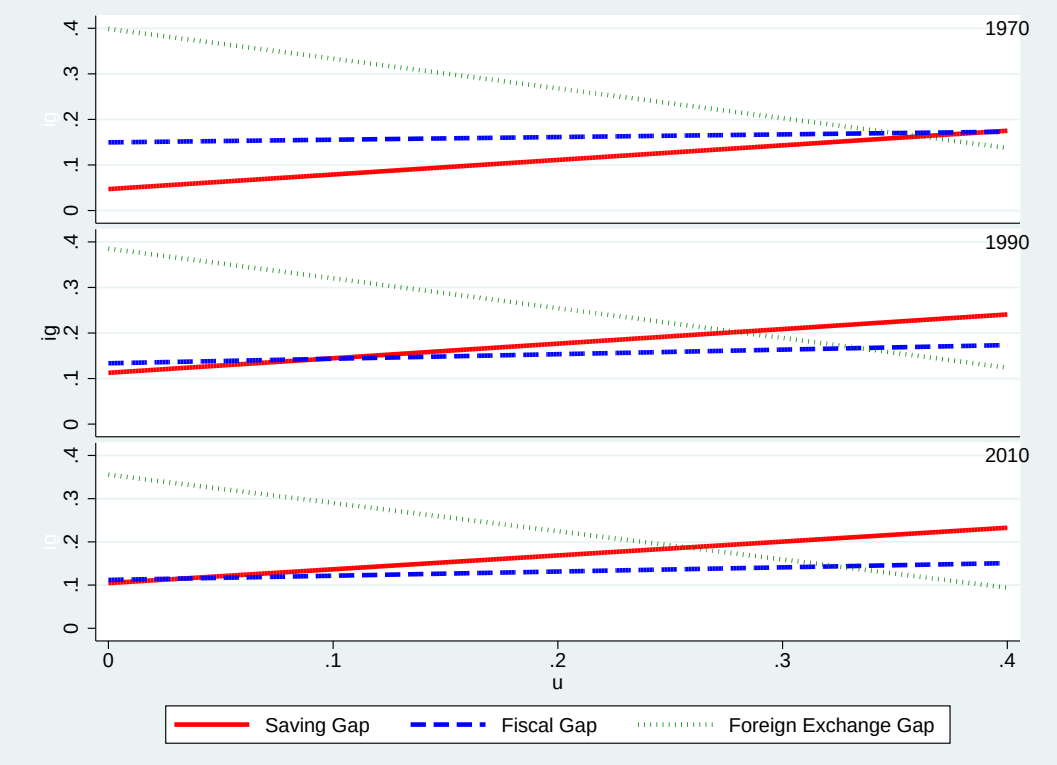
| Gaps/Calibration Year | 1970 | 1990 | 2010 |
|---|---|---|---|
| Savings Gap | $i_g = 0.047 + 0.320u$ | $i_g = 0.112 + 0.320u$ | $i_g = 0.105 + 0.320u$ |
| Fiscal Gap | $i_g = 0.150 + 0.058u$ | $i_g = 0.133 + 0.099u$ | $i_g = 0.112 + 0.098u$ |
| Foreign Exchange Gap | $i_g = 0.399 - 0.654u$ | $i_g = 0.385 - 0.654u$ | $i_g = 0.355 - 0.654u$ |

Table 4 shows the our parameters of interest with their *t-statistics* and *p-values.* The results are humbling. Values in bold are significant at 5% level of significance, the rest are all insignificant. Private investment relates positively with public investment in this specification. Caution must be exercised in establishing any sort of causality here. The other upshot of this exercises is that signs of parameters conform with our initial prediction as listed in table 1 above. Despite un-favorable results we still use these parameters to calibrate our three gap equations. The results are shown in table 5.

One can see that both savings and foreign exchange gap shift over time. Between 1970 and 1990 savings gap shifts upward. Foreign exchange gap shows an improvement between these two years and shifts up. One can see these movements in figure 3 below. Both these shifts result in an overall trade off between capacity utilization and public investment.

There is a small rotation and a downward shift in the fiscal gap between 1970 and 1990. We can see that in 1990 fiscal gap appears as a binding constraint for the level of capacity utilization afforded by foreign exchange and savings gaps. Between fiscal years 1990 and 2010 savings gap shifts downward slightly. The downward shift in foreign exchange gap appears to be more pronounced over this 20 year period. The result is a further further reduction in the level of capacity utilization (or economic activity). Fiscal gap calibrated for FY2010 shows some minor changes from the one in FY1990 but overall remains flat and again appears as the binding constraint for this reduced level of economic activity.

Figure 3: Gap Equations calibrated for Fiscal Years 1970, 1990, and 2010




As mentioned earlier, it would be prudent to analyze these shifts in terms of actual changes in foreign transfers to the private sector, $\phi$, foreign transfers to the government, $t$, consumer imports, $m_c$, foreign interest and loan payments, $j^*$, and public sector borrowing requirement, $\pi$.

Figure 4 shows foreign transfers to the government, $t$, and foreign transfers to the private sector. Both these variables have been scaled by the real output. We can see that between 1970 and 1990 $\phi$rose sharply whereas $t$ registered a minor fall. This can explain the shift in the savings gap between 1970 and 1990 i.e. it may have happened on the account of a rise in $\phi$.

Figure 4: Foreign Transfers to the Government and the Private Sector

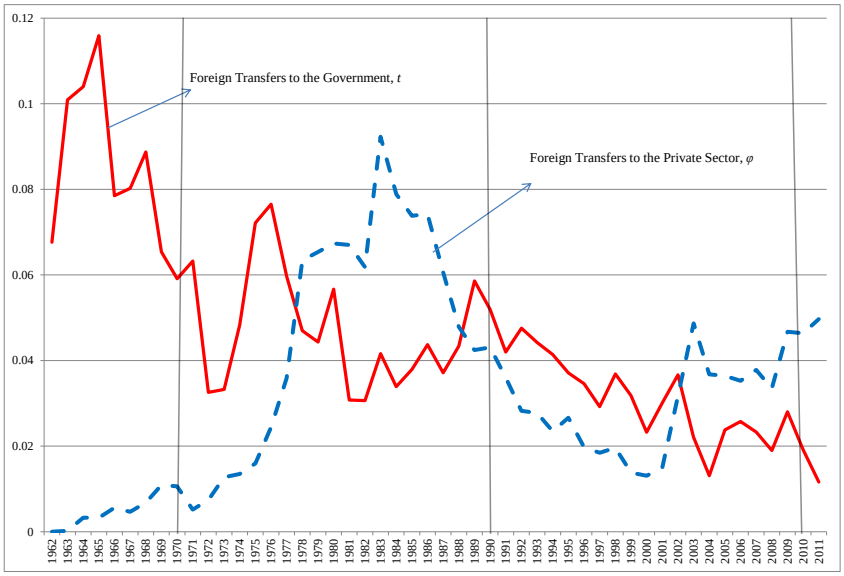



Figure 5 above shows the movement of consumer imports, $m_c$, and foreign interest and loan payments, $j^*$ over the 50 year time period. We can see that consumer imports as as share of real output rose sharply between 1970 and 1990. Similarly, the foreign interest and loan payments also registered an increase between FY1970 and FY1990. The increase was high enough to erode the net effect of foreign transfers during this time period. One can therefore see a small downward shift in the foreign exchange gap in table 5 and figure 3.

Figure 5: Consumer Good Imports and Foreign Interest and Loan Payments

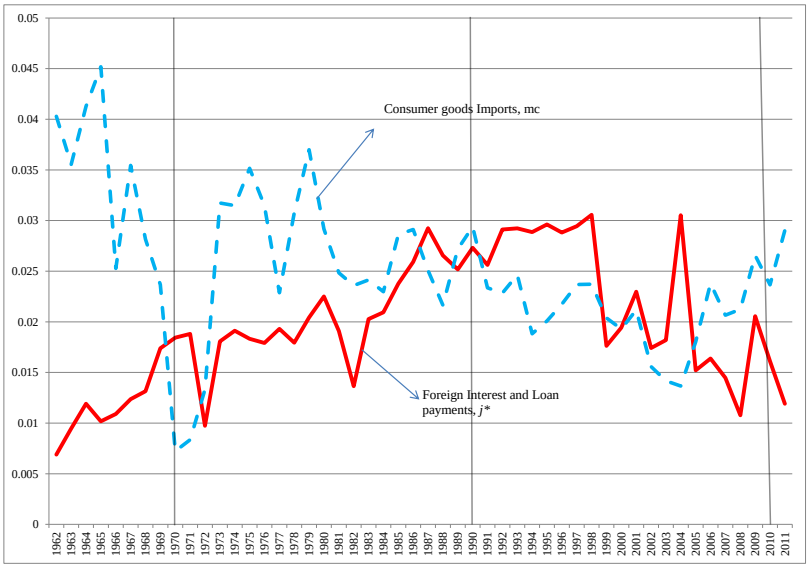



Figure 6: Public Sector Borrowing Requirement as a share of Real Output

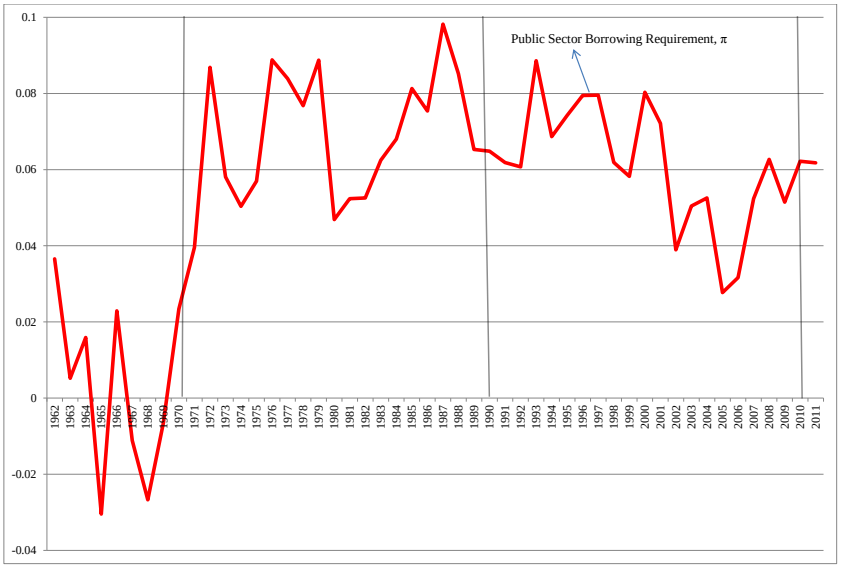


Figure 6 shows the movement public sector borrowing requirement, $\pi$(as a share of real output) with time. The graph clearly shows an increase in PSBR between FY1970 and FY1990 - it increase from just under 2.5% to a little over 6% in twenty years between FY1970 and FY1990. The effect of this is shown in table 5 where we can see that the slop for fiscal gap equation increases sharply from FY1970 to FY1990. The fiscal gap does shifts only by a small amount between these two fiscal years. This is so because the combined effect of $(t-j^*)$ that determine the shifts in the fiscal gap remains constant between FY1970 and FY1980. Between FY1990 and 2010 the PSBR fluctuates considerably but returns in FY2010 returns to its FY1990 level. This explains why the slope in the fiscal gap equation in table 5 remains constant between FY 1990 and FY 2010. The fiscal gap does register a small downward shift on the account of a fall in $t - j^*$ in its intercept. This is also evident from figures 4 and 5 above. Both show a considerable fall in $t$ and $j^*$ between FY1990 and FY2010 resulting in an overall fall in $(t - j^*)$ from FY1970 to FY1990.

# 4 Conclusion

The purpose of this paper was to identify constraints that have restricted economic growth in Pakistan. More specifically, we wanted to identify how foreign exchange availability and domestic savings can act to restrict economic growth. We use the data from fiscal year 1961-62 to 2012-2013 to estimate a three gap model for Pakistan. Our analysis show that there is a significant trade off between public investment and capacity utilization due to the foreign exchange and fiscal gap constraints. This is shown in figure 3 by a downward shift of the foreign exchange gap between FY1970 and FY2010. For both FY1990 and FY2010, fiscal gap lies below the point of intersection of foreign exchange and savings-investment gaps. Economic growth is, therefore, historically constrained by both foreign exchange and fiscal gap. Fiscal gap appears to be the binding constraint for growth prospects in

Pakistan. This requires efforts on two fronts. First, improving foreign exchange receipts by addressing the trade deficit and attracting more remittances through legal financial channels/intermediaries in the short run and an export augmenting industrial policy in the long run. Second, Pakistan needs to improve its tax revenue collection to address the fiscal constraint. However, reforming the tax system has turned out to be a major challenge for successive governments.

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# Appendix A: A Formal Statement of Three Gaps Model

Public Sector Borrowing Requirement can be stated as

$PSBR = Government\ current\ spending - local\ revenues + public$

$investment + foreign\ interest\ payment - net\ transfer\ to\ government\ from\ abroad$

$\chi = real\ output$ Sum of real GDP and real intermediate imports

Taylor bases his mode around $\chi$ and the "material balance" equation that can be stated as:

$$\chi = C + \theta I + G + E - M \tag{7}$$

where,

$\theta$ = share investment demand satisfied by goods produced domestically

$M$ = Competitive imports only

$G$ = Government's non-investment related expenditure

$E$ = Exports

Let $'W'$ be the net revenue from the private sector = tax revenue - transfers + public sector profits and C is the private consumption, then

$$C = \chi - a\chi - \lambda S_p - (1 - \lambda)S_p - W \tag{8}$$

$a$ =(import/output) ratio

$a\chi$ =real intermediate imports

$S_p$ =private savings

and $\lambda$ and $1 - \lambda$ are shares spent on asset accumulation within and outside the country.

In Taylor's scheme $(1-\lambda)$ measures capital flight. Besides capital flight $(1-\lambda)$ there are 3 other types of external transfers.

$J^*$ = foreign interest payments; Government pays$\xi$and private sector pays $1-\xi$

$T$ = Incoming Net Capital flows or foreign transfers to the government

$\Phi$ = Income net capital flow or foreign transfers to the private sector

Balance of payments can then be written as

$$M + (1-\theta)I + a\chi + (1-\lambda_p)S_p + J^* - E = \Phi + T \tag{9}$$

If we plug the balance of payment and consumption function in the "material balance" equation above we can obtain our investment-saving balance:

$$I = (W - G - \zeta J^*) + [\lambda S_p - (1-\xi)J^* + T + \Phi] \tag{10}$$

In order to use the model to explain growth and the effects of the three gaps, Taylor introduces growth analysis.

Let $Q$ be the highest potential output $\chi$ that can be achieved using existing capacity utilization. Let $g$ be the growth rate of potential output such that:

$$g = \frac{Q(t+1) - Q(t)}{Q(t)} = g_o + \kappa \frac{I(t)}{Q(t)} = g_o + \kappa i \tag{11}$$

$I(t)$ = gross capital formation in year $t$

$\kappa = incremental\ potential\ output/capital\ ratio$

$\kappa = \frac{\Delta \chi}{\Delta K}$

and $i = I/Q$

Let $i_g$ and $i_p$ be public and private investment, respectively and normalized by $Q$.

Taylor then assumes a behavioral investment function for private sector along Keynesian lines in the form:

$i_p = i_o + \alpha i_g + \beta u$, where $\alpha$ captures the crowding in/out effect of public investment on private investment and $\beta$ captures the impact of increase in economic activity on private investment. $\alpha$ could be positive or negative and $\beta$ is usually thought to be positive a accelerator here.

Overall investment can then be written as:

$i = i_g + i_p$

$i = i_o + (1 + \alpha)i_g + \beta u$

where $u$ = capacity utilization $=(\chi/Q)$

We now set up a savings function for our gap equations.

Real public savings are given by:

$$S_g = (W - G) - \zeta J^* + T = Z - \xi J^* + T \tag{12}$$

$Z$ = Net Revenue less government spending. Let $Z = Z_o Q + Z_1 \chi$ so that normalized government savings are given by:

$$s_g = \frac{S_g}{Q} = z_o + z_1 u - \xi j^* + t \tag{13}$$

where $j^* = J/Q$ and $t = T/Q$

and $z_1 > 0$ since tax revenues go up with economic activity. Taylor argues that in

addition to this the PSBR as define above should also be considered formally in the model.

Let $\pi$ be the share of$PSBR$ in total output $\chi$, so that:

$\frac{PSBR}{Q} = \frac{PSBR}{\chi}\frac{\chi}{Q} = \pi u$

so we can write normalized equation for PSBR that follows from I above

$$\pi u = i_g - (z_o + z_1 u) + \xi j^* - t \tag{14}$$

Private savings can be written as

$$s_p = \sigma_o + \sigma u - \sigma_2 \phi \tag{15}$$

where $\phi = \frac{\Phi}{Q}$

$\sigma_o$ *implicitly includes* $-(1-\xi)j^*$ = foreign interest payments. So $\sigma_o$ is in practice negative. $\sigma_o$ shifts in situations of capital flight.

$\sigma_1$ is the marginal savings rate and includes effects of transfers and taxes

$\sigma_2$ when positive means capital inflows partially substitute for domestic savings.

We can now write our third balance equation by writing uses less sources of foreign exchange.

$$S_f = M + (a_o Q + a_1 \chi) + (1-\theta)I + J^* + (1-\lambda)s_p - (\epsilon_o Q + \epsilon_1 \chi) = T + \Phi \tag{16}$$

in normalized form the above becomes,

$$s_f = m + (a_o + a_1 u) + (1 - \theta)i + j^* + (1 - \lambda)s_p u - (\epsilon_o + \epsilon_1 u) = t + \phi \tag{17}$$

We are now ready to set up our three gap equations. Capacity growth rate $g$ (or public investment $i_g$) and capacity utilization u are the variables that trade off to give macro equilibrium. Using the public and private savings defined above we can write our investment saving gap as:

$$i_o + (1 + \alpha)i_g + \beta u = z_o + z_1 u - \xi j^* + t + \sigma_o \lambda + \lambda \sigma_1 u + (1 - \lambda \sigma_2)\phi \tag{18}$$

rearranging gives

$$(1 + \alpha)i_g - (\lambda \sigma_1 + z_1 - \beta)u = z_o - \xi j^* + (1 - \lambda \sigma_2)\phi + \lambda \sigma_o - i_o + t \tag{19}$$

standard macro stability conditions exist when $\lambda \sigma_1 + z_1 > \beta$

The above can be expressed in the growth form using $g = g_o + \kappa i$ from above, and

$$g = \kappa(z_1 + \lambda \sigma_1)u + \kappa[z_o - \xi j^* + (1 - \lambda \sigma_2)\phi + \lambda \sigma_o + t] + g_o$$

The above above shows that the growth is constrained by a savings gap and by capacity utilization of according to the coefficient $\kappa(z_1 + \lambda \sigma_1)$ in Harrod-Domar form.

In similar fashion we can write our other two gaps - foreign exchange gap and the fiscal gap. Like the investment gap the other two can also be expressed in growth forms.

Foreign exchange gap can be shown to have the following form:

$$(1-\theta)(1-\alpha)i_g+[a_1+(1-\theta)\beta+(1-\lambda)\sigma_1+\epsilon_1]u = [1+(1-\lambda)\sigma_2]\phi-m_c-j^*-(1-\theta)i_o-a_o+\epsilon_o+t-(1-\lambda)\sigma_o \tag{20}$$

in growth form, the foreign exchange gap becomes,

$$g = \tfrac{\kappa}{(1-\theta)}[a_1+(1-\lambda)\sigma_1-\epsilon_1]u+\tfrac{\kappa}{(1-\theta)}([1+(1-\lambda)\sigma_2]\phi-m-j^*-a_o+\epsilon_o+t-(1-\lambda)\sigma_o)g_o$$

The fiscal gap can be written as:

$$i_g-(\pi+z_1)u = z_o-\xi j^*+t \tag{21}$$

and in growth form

$$g = g_o+\kappa i_o+\kappa[(1+\alpha)(\pi+z_1)+\beta]u+\kappa[(1+\alpha)(z_o-\xi j^*+t)]$$

To adapt this model to analyze constraints on economic growth in Pakistan we make two minor modification by making two assumption. First, we assume that $\lambda$ equals 1. This means that we are assuming that there is no capital flight from Pakistan. This is certainly a strong assumption to make but can be justified on the following grounds. The remittances (or transfers to the private sector from abroad, $\phi$) that enter Pakistan do no fully measure the transfers to the private sector from abroad. First, foreign currency is also remitted through illegal or quasi-legal means which is not recorded in the State Bank of Pakistan's official records[17]. Second, some foreign remittance is simply the capital that flew

[17]People like to hoard cash, particularly foreign currency. It is not uncommon to have a rupee bank account but keep a little foreign currency safely tucked away either (metaphorically speaking) under one's bed or in the pillow. This mistrust in the banking system for foreign currency is not entirely irrational. Government of Pakistan froze foreign currency accounts in the country after the nuclear tests of May 28, 1998.

away from the country in the first place[18]. We believe both these factors tend to offset the actual capital flight that takes place from the country and, therefore, provides us grounds for assuming $\lambda$ equals to 1. Our second assumption is related to $\xi$ - the government's share in foreign interest payments. We assume that $\xi$ is equal to 1. Private sector in Pakistan is not heavily exposed to the foreign financial markets. Private sector debt forms a miniscule portion of Pakistan's total indebtedness to foreign lending institutions. Hence, most of the interest payments are made by the government as well. Other practical concerns include data restrictions. The data on interest payments made by the private sector is not readily available. For both these reasons, we believe that we can assume $\xi$ equals 1 in our adaptation.

[18]There is no hard evidence for this except for some newspaper reports and my personal conversations with Government officials. This is the practice 'envogue' to whiten one's black money. The capital is sent out from Pakistan and then remitted from a country (mostly Middle East) where laws/rules tracking sources of ones wealth are relatively relaxed.