Dynamic Behavior of Investment, savings and Economic Growth in Pakistan

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Dedicated to my ever loving parents,
brothers and sisters

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DYNAMIC BEHAVIOR OF INVESTMENT,SAVINGS AND ECONOMIC GROWTH

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CHAPTER I

BACKGROUND AND STATEMENT OF THE PROBLEM

1.1 INTRODUCTION

Of the large number of factors which influence the growth rate of an economy , is the level of investment, which is normally shown as a percentage of the Gross National Product, is amongst the most important. The amount of investment under taken is financed from either domestic savings or foreign resource inflows. The movement of these three important variables, i.e. gross fixed investment , gross domestic savings , and foreign resource inflows together with the breakdown of investment and savings between the private and public sectors, tells us a great deal about the pace and the process by which the economy is trying to develop itself.

There has emerged a plentiful literature on the determinants of private investment in developed countries, both for theoretical models (Nickell 1978, Artus and Muet 1986) and empirical results with different specifications (Abel 1980 and Artus and Muet 1984). However, studies on developing countries are limited.

Pakistan has been pursuing the policy of credit rationing in the past [as the monetary policy in Pakistan has been implemented through the use of credit rationing (Khan A.H.(1988)

and Fry (1982)]. Credit rationing is a major impediment to financial deepening , hence to savings, investment and output growth. The policy of credit rationing has created excess demand for investment in the country. So actual investment in fixed capital in Pakistan is constrained by the availability of limited savings. The empirical evidence shows that Pakistan's economy is consumption oriented, so marginal propensity to save out of total income, has remained generally very low. The financial resources available to the country have not been high enough to sustain , a long term large scale investment program. As a result of this phenomenon , there has emerged a wider gap between investment and savings. The availability of limited savings has stagnated economic growth in the country. In addition to that , given the limited amount of financial resources available , the government may attempt to siphon off the resources by dint of its dominant role which will adversely affect private investment and most likely would lead to fall in the total investment in the country as well. Aggregate investment , a prominent source of growth in total income may affect total level of income adversely in the country and hence economic growth.

Public and private sector investment are the major determinants of the overall growth in an economy. It is a well accepted proposition that in developing countries private and public investments are related [Galbis (1979), Heller (1975), Tun Wai and Wong (1982)], although there is considerable uncertainty about whether , on balance , public sector investment raises or lowers private investment. In broad terms , public sector investment can cause crowding out if it utilizes scarce physical and financial resources that would otherwise be available to the private sector , or if it produces marketable output that competes with private sector output.

Yet public investment that is related to infrastructure and the provision of public goods can also clearly be complementary to private investment. Public investment of this type can enhance the possibilities for private investment and raise the productivity of capital, increase the demand for private output through increased demand for inputs and ancillary services, and augment overall resource availability by expanding aggregate output and savings. The overall effect of public investment on private investment and their impact on output growth will, therefore, depend on the relative strength of these various effects, and there is no a priori reason to believe that they are necessarily substitutes or complements.

Although public sector investment has played a significant role in accelerating the pace of economic growth in Pakistan, but the contribution of public sector to output growth has been much below expectations. The economic history of Pakistan reveals that the share of public investment in total fixed capital formation has remained generally higher, although there has been sharp fluctuations in both the categories of investment. In any case, whether the fluctuation in the investment and the consequent shift in the sectoral composition of investment affects aggregate investment and growth depends on many factors in specific situations, and no a priori conclusion seems possible without utilizing the framework of a complete model of investments, savings and output growth. The model is to be discussed in subsequent chapters.

In developing countries the rapid growth of public sector during the past few decades was viewed as an important means for accelerating the pace of economic growth. In most developing countries , particularly in Pakistan , public sector now accounts for a prominent share of total production and investment. But the contribution of public sector to growth has

been much below expectations. In many cases public enterprises require large subsidies from the government and impose a significant fiscal burden on the economy, which leads to the notion that the private sector is much more productive than the public sector. However little empirical work has been done in this field so that the proposals that emphasize the private sector vis-a-vis the public sector rest largely on theoretical considerations.

Recent work by Khan and Reinhart (1990) is an important exception. Using Cross section data for the seventies of 24 developing countries, they show that the arguments favoring the private sector in adjustment programs have empirical support. Khan and Reinhart estimate a growth model in which the effect of private and public investment on growth is separated. A comparison of the marginal productivities of the two types of investment allows them to conclude that *"all in all, there does seem to be some merit in the key role assigned to the private investment in the development process by supporters of market - based strategies."* [(Khan and Reinhart (1990)].

It is widely believed by the policy makers and analysts in developing countries that public investment provides a significant stimulus to private investment and thereby serves as a powerful instrument of stabilization and growth policies. Although this belief is part of conventional wisdom, it has not been properly tested against empirical evidence. In fact, the set of interrelationships between private and public investment has remained generally unexplored in the empirical literature on developing countries, although the broader topic of the impact of public spending on private investment, especially its financial aspects, has been extensively analyzed for developed countries.[1]

The purpose of the present research is to investigate the effects of public investment on private investment in a neoclassical framework, along with the incorporation of constraint on the investment imposed by the availability of limited savings for an underdeveloped country like Pakistan, where the policy of credit rationing has created excess demand for investment in the country. The rationale for incorporation of constraint on the investment imposed by the availability of savings needs some justification.

A clear consensus has emerged in recent years that, in contrast to developed countries one of the principal constraints on investment in an underdeveloped country is the quantity, rather than the cost of financial resources. The rates of return on investment in these countries typically tend to be quite high, whereas the real interest rates on loanable funds are kept low by the government for variety of reasons. In such circumstances the investor cannot be expected to equate the current marginal product of capital to its service cost. Indeed , because the total amount of financing is limited and the price mechanism is not allowed to operate smoothly , it would seem legitimate to hypothesize that private investor in a developing country is restricted by the level of available financing. Any effect exerted by the rate of interest on private investment is not direct within this rationing framework but , rather, occurs via the channel of financial savings.

In addition to that the present study will attempt to find out the determinants of private investment and hence the effects of private and public sector investment on output growth in Pakistan. An important feature of the present study is the inclusion of user cost of capital to wage ratio (rental - wage ratio) in the determination of gross domestic private investment.

Neoclassical framework suggests that rental-wage ratio may exert a negative substitution effect on gross domestic private investment on one hand , and a positive efficiency effect on output , on the other.

1.2 OBJECTIVES OF THE RESEARCH

The main objectives of the research reported in this thesis are as follow

1) Formulation of the empirical relationship between public and private sector investment and the their linkage with output growth in Pakistan.
2) To findout the determinants of gross domestic private investment in Pakistan.
3) To examine the role of interest rate policy , with a focus on its effects on aggregate investment and economic growth .
4) To test whether increased public investment raises the demand for output of the private sector; which thereby influences output expectations and investment requirements of private sector.
5) To highlight the channels through which interest rate effects are manifested on investment and savings.
6) To test whether credit rationing or financial repression is an impediment to financial deepening, hence to savings , investment and growth in Pakistan.

1.3 PUBLIC AND PRIVATE SECTOR INVESTMENT : TRENDS IN PAKISTAN

Pakistan has faced a chronic shortage of investible funds for most of its years of existence. Successive governments in the country have launched investment programs without taking into account domestic resource availability. The rate of saving has been higher during the past decade. However, it is still not high enough to sustain a long term large scale investment program. In this section we will analyze the trends of investment and savings in Pakistan and the mix of private versus public investment in total gross fixed capital formation.

Private investment at constant prices of 1980-81, which had declined to just over rupees 20200 million in 1971-72 and 1972-73, plunged further to rupees 14699 million in 1973-74. This was in response to the government's nationalization drive, began in January 1972. In January 1974, banks and financial institutions were also nationalized , and private investment fell further to rupees 13703 million in 1974-75.Public investment on the other hand,almost doubled in terms of constant prices to rupees 23513 million in 1974-75. The government undertook an ambitious investment program in 1973-74 in accordance with its avowed aim of shifting the country's industrial policy emphasis from consumer goods industries to capital goods industries. The government also aimed at building an infrastructure to support this industrial base. Public investment thus sustained the level of gross domestic investment. However, inspite of this , gross domestic investment as a proportion of *GNP* slumped to 11.25 percent and 11.97 percent in 1972-73 and 1973-74 respectively.

In 1974-75 , the investment was largely concentrated in agriculture and small scale industry. Gross domestic investment was equal to 14.44 percent of the *G.N.P.* in that year. A

resurgence of investment took place in the mid- 1970's. However , 1977-78 and 1978-79 investment slumped once more in terms of 1980-81 constant prices. In terms of current prices , there was a marginal increase in both public and private investment.

The resurgence of investment in terms of current as well as constant prices began from 1979-80 onwards. The martial law government that came to power in 1977 instituted a number of economic reforms aimed at liberalizing the economic climate and decontrolling the industry. Agro-based industries were denationalized in September 1977. The government announced that it would follow a long term policy of introducing a mixed economy in the country, retaining only basic industries in the public sector. Other incentives given to private sector entrepreneurs included the reduction in the interest rate on investment loan in July 1978, and the announcement of a tax holiday for industrial units being set up in certain specified underdeveloped areas. Despite this resurgence in private investment, it accounted for only 36.10 % of total gross fixed capital formation.

Investment exhibited a positive trend throughout the 1980's with both private and public investment on the increase. The mix of private & public investment is, however, tilted in favor of public sector investment. In 1983-84, private investment was 40 % of total fixed investment in the country. This percentage increased by one point for the next two years, but fell again to just over 40 % in 1986-87. Public investment surged as the new government's five point program for economic development went into operation. Public sector investment peaked in 1986-87 and subsequently went into decline. In 1988, the Pakistan government made an agreement with the *I.M.F.* and World Bank for the retrenchment of series of loans under

structural adjustment facility. The Structural Adjustment Loans *(SALs)* are essentially Conditional loans given on the understanding that the recipient government will proceed to fulfill certain conditions regarding macroeconomic policy. The *SALs* conditionalities also include measures to privatize and deregulate the economy.

In December 1988, a new government came to power, with a promise to start a process of de-regulation. However privatization efforts did not gain momentum till two years later when yet another political government came to power with a manifesto pledging extensive privatization. Although *I.M.F.* conditionalities regarding the budgetary deficits were not adhered to, private investment did receive a boost. It rose to 18.08 % of total investment in 1991-92. (The data on relevant facts and figures is given at the end in appendix).

1.4 DATA SOURCES

The Basic sources for the time series data used in this study are "Economic survey of Pakistan",various issues, "International Financial Statistics" *(IFS)* International Monetery Fund,various issues. Annual Report of State Bank of Pakistan, various issues. Gross private & public investment data are based essentially on national sources. The data were all deflated by the *GDP* deflator (1980-81 = 100) to express them in real terms. However Gross private & public investment data were deflated by private investment and public investment deflators, respectively. Data on wage rates has been taken from "social indicators of Pakistan,"Federal Bureau of Statistics, Government of Pakistan, various issues. The period of analysis covered in this study ranges from 1971-72 to 1994-1995.

1.5 ORGANIZATION OF THE STUDY

Chapter 1 Provides brief statement of the problem, background and objectives of the study , data sources and public and private sector investment - trends in Pakistan. Chapter 2 reviews existing and past literature on the subject matter. Methodology , data definitions and model specification along with its derivation are presented in chapter 3. The estimates of the model, empirical results and discussions are described in chapter 4. Chapter 5 provides conclusion of the study and policy guide lines.

Notes

1. For a review of the literature on the effects of government expenditure on capital formation in the context of developed countries, see von Furstenberg and Malkiel (1977). For some empirical work on private investment functions for developing countries, with public investment as an explanatory variable, see Wai and Wong (1979).

CHAPTER II

SURVEY OF LITERATURE

2.1 INTRODUCTION

Although in recent years a broad consensus has emerged regarding the theoretical literature on investment. A number of hypotheses have been advanced to explain the variations in the private investment activity observed in developing countries generally and in Pakistan particularly. This variety to some extent reflects the certainty about the form of private investment function for these countries. The neoclassical flexible accelerator model has been the most widely accepted general theory of investment behavior and empirical tests of the model using data from several industrial countries have been quite successful [(for example, Bischoff (1969, 1971), Hines and Catephores (1970), Jorgenson (1967, 1971), and Clark (1979)].

Ever since the publication of Jorgenson's (1967,1971) seminal contributions, the neoclassical model of investment has served as a theoretical foundation for estimating investment function in industrialized countries. In case of developing countries, however there exits a large gap between the modern theory of investment and the investment functions that have been estimated.

2.2 SURVEY OF LITERATURE

In most less developed countries the public sector's role in planning and implementation of development projects has been considerable. The rising level of public expenditure has been fueled by capital inflows from public and private sources abroad, and by mobilization

of domestic resources through taxation and local borrowing. Critics argue that foreign capital inflows have resulted in increased public and private consumption rather than increased investment and have contributed less to growth than was anticipated.

Heller (1975) has examined these issues by developing a cross section time series econometric model of public sector of eleven African countries. The econometric model focuses on the interactions among several categories of public expenditure and of domestic and foreign revenue,(Grants Vs loans). The results suggest that aid not only increases investment, but simultaneously facilitates a reduction in the level of domestic taxes and borrowings. However, the magnitude of these effects and the precise response of public consumption to aid varies according to the type of aid. Grants have a stronger pro consumption bias, whereas loan are more pro investment. The model also confirms that only a small proportion of marginal tax increases is allocated to investment , with the bulk used for public consumption.

The empirical research by **Abe, Fry et al. (1977)** presents a pooled time series estimate of McKinnon-Shaw saving function using 116 annual observations from sample of six countries, Japan, Republic of China, Republic of Korea, Pakistan, Thailand and Turkey. In preliminary estimates for each individual country, appropriate tests were performed for heteroskedasticity and autocorrelation. Since neither were found, so coefficients were estimated using pooled time series estimation. The study employed Generalized Least Square *(GLS)* procedure using estimated variances to correct for the problem of different variances of the error term for each country. The empirical results

support the view that financial restriction holds domestic saving below the level which would occur under the policy of financial liberalization. There may, however, be a trade off between the level of domestic saving and the efficiency with which saving is allocated to investment. The deposit rate of interest used as a proxy for nominal interest rate on all financial assets exerts a positive and expected inflation a negative influence on the domestic savings ratio, indicating that foreign saving has been substituted for domestic saving.

Fry (1978) presents an empirical tests of the models of finance in economic development developed by McKinnon and Shaw (1973). The study also tests their alternative theories of the way in which financial conditions affect saving and economic growth. The results of pooled time series analysis using annual observations for seven Asian less developed countries *(LDCs)* support the view that the financial conditions do influence saving and growth. However, Mc Kinnon loses and Shaw wins their disagreement over the transmission mechanism in empirical test for ten Asian *LDCs*-the seven listed above plus Pakistan, Sri Lanka and Thailand. Two Stage Least Square with country Dummy variables *(2SLSDV)* estimates show that the real rate of interest has a positive effect on the domestic saving and economic growth in Asian *LDCs* under analysis. Hence, Mc Kinnon and Shaw's stress on the importance of financial conditions in the development process is fully justified. The demand for money estimates, however, do not support McKinnon's complementary hypothesis, which is based on the assumptions that

investment is, in the main, self financed, and money is the predominant financial repository of domestic saving in these countries.

The studies by Heller (1975), Abe , Fry et al. (1977) and Fry (1978) show no concern of public investment with that of private investment and hence their relationship with output growth. Therefore the present study would cover these features.

Masih (1979) has analyzed the role of financial institutions (bank and non-bank) in financing private investment in Pakistan. The econometric model used for the study covers three five-year plan of Pakistan (1955-56 through 1969-70). Some of the functional relationships of the parameters in the study are found by *OLS* and others by *2SLS*. However, the parameters of the equations don't show any noticeable discrepancies. Econometric analysis tends to indicate, among other things, that private investment in Pakistan during the period under review was related directly not to the interest rate but to the flow of funds because private investment was constrained mainly not by lack of demand for funds for investment but by a lack of supply of funds. In other words, private investment was linked to the availability of funds rather than to the price of funds since loan rate, like many other rates of interest, was controlled and set far below the equilibrium rate of interest. The findings of the present study about the effects of disequilibrium interest rate setting appear to be consistent with the views of Shaw (1973) and McKinnon (1973) in regard to financial repression in economic development.

Fry (1980) has presented a quantitative estimate of the cost of financial repression in seven Asian developing countries. Financial repression is interpreted as the

technique of holding institutional interest rates below their market equilibrium levels. *2SLS* estimates show that saving is affected positively by the real deposit rate of interest, as is real money demand. Under disequilibrium interest rate conditions, higher savings which raise real money demand increase the real supply of credit. Credit availability is an important determinant not only of new investment but also of capacity utilization of entire capital stock. Hence the growth rate itself is affected positively by real deposit rate of interest through two channels-first, the volume of saving and investment and second, capacity utilization of entire capital stock i.e., measured incremental capital/output ratio. The study also provides additional evidence on real credit availability mechanism which comes from pooled time series, cross country analysis of interdependency of saving, investment and growth in sixty one developing countries. National saving rate has been found to be affected positively by growth and per capita *GNP*. On the same lines, growth and domestic credit to *GNP*, both have a positive and significant influence on investment rate.

The empirical analysis conducted by Fry (1980) on saving behavior in Asian countries leaves open the question as to what is the mechanism bringing about saving and investment equilibrium. A recent study of saving-investment process in a sample of Latin American countries by **Leff and Sato (1980)** suggests that institutional credit conditions could well be the primary equilibrating mechanism. Leff and Sato point out that institutional interest rates are usually held well below their market equilibrium levels in

developing countries. For doctrinal and political reasons, the governments in these countries generally do not permit interest rates to move sufficiently to clear the financial markets. Rather, the monetary authorities create new credit more or less independently of domestic savings, often in response to the government deficit. Changes in the volume of real credit, in turn, influence the change in capital stock because *LDC* firms are generally very dependent on credit to finance investment. The study also stresses the importance of changes in the supply of real credit in determining the rate of economic growth. So any initial disequilibrium gap can be widened through the effect of investment on growth and the subsequent feedback's from growth to both savings and investment rates.

The empirical research by Masih (1979), Fry (1980), Leff and Sato (1980) is unable to provide an integrated framework of public and private sectors investment and their linkage with output growth , which is well considered in our study by incorporating the special features of the less developed economies.

Wai and Wong (1982) examines a modified version of flexible accelerator theory of investment with particular reference to developing countries. The empirical results for five countries tend to confirm that government investment, the change in bank credit and capital inflow to private sector play important roles in determining private investment. The contributory effects and crowding out effect of government investment are assessed within context of recursive model. Empirical evidence from annual data on five developing countries for the period of 1960-75, using single equation econometric

technique, confirms that government investment is the most important explanatory variable in Greece (balanced growth), Korea (industrial specialization) and Malaysia (primary specialization). Bank credit is most important in Thailand (balanced growth) while capital inflow is most important in Mexico (import Substitution).

The study has assumed very limited period for analysis and ignored the crucial role of credit rationing in *LDCs* and hence its impact on excess demand for investment. In addition, no proper allowance has been made for savings and their impact on economic growth. So the present study would take into account the relevant deficiencies.

High fiscal deficits push up interest rates and crowd out private investment. Different mixes of tax increases and/or spending reductions can be expected to have different effects on private investment. In particular, due to institutional and political rigidities in the ability of governments to reduce current public expenditures, fiscal adjustments often take the form of reduced public investment, some of whose components may be complementary with private investment.

In fact, the empirical evidence from data on twenty four developing countries analyzed by **Blejer and Khan (1984)** indicates that public investment in infrastructure is complementary with private investment whereas other types of public investment are substitutes. The study has adopted *Restricted Classical Linear Regression* method, that permits identification of individual parameters, for the data pooled over the period 1971-79. The model hypothesizes that the response of private investors depends upon three main factors, stage of cycle, availability of financing, level of public sector investment. The

study also distinguishes between infrastructure and non infrastructure components of public sector investment by experimenting with various proxies. Hence the coefficient of infrastructure investment is expected to be positive; and that of non infrastructure to be negative in case of real "*crowding out*" and positive in case of "*crowding in*". Estimates of change in Bank credit to private sector and private capital flows have been found positive in all equations of regression. Public sector investment has a positive effect on private investment , whereas the change in the government investment has a negative effect. On the basis of these particular results, it could be argued that it is not the level of public investment that crowds out private sector, because the coefficient , though carrying a positive sign, is not statistically significant; rather, it is the change in public investment that appears to have strong crowding out effect.

De Melo & Tybout (1985) in an econometric analysis have tried to test whether the liberalization of Uruguay's financial sector and the associated improvements in the real yields on bank deposits significantly influence the level of savings and capital formation (investment), as the "*financial liberalization*" would predict. The study found that saving behavior exhibited a clear shift with financial liberalization. During the 1960s, savings were sensitive to foreign capital inflows and appeared to have been influenced by various policies associated with "*financial repression*". During the 1970s, when there were no restrictions on foreign borrowings, savings were strongly negatively correlated with the real exchange rate, as there were no restriction on private foreign borrowings.

Nonetheless, controlling for the effect of real exchange rate variations, private savings rates shifted upward with the implementation of financial reforms. The study also found a positive response of savings rate to real interest rates in the prereform period but no such response after financial liberalization. On the investment side, the study found that standard accelerator effects were significant throughout the sample period (1962-83). This suggests that the Uruguayan economy was not savings constrained, despite the presence of "*financial repression*" in the prereform years.

None of the studies , such as Blejer and Khan (1984) and De Melo & Tybout (1985) address the special features of developing countries - the financial repression which creates excess demand for investment and crowding out through non price rationing mechanism. This aspect is well taken and addressed in our analysis for Pakistan.

Aslam (1987) has examined the role of foreign capital , national income , rate of inflation and growth rate of income, using multiple regression analysis in the context of savings and investment for Pakistan for the period of 1963-64 to 1984-85. The results reported in the study show that net aggregate foreign capital exercises a negative influence on domestic savings and is significant at conventional levels. National income exercises a positive and significant effect on domestic savings. The growth rate is insignificant at conventional levels. Private capital inflow exercises a complementary effect on investment whereas public capital inflow plays no significant role in increasing investment. Bank credit exerts a positive and highly significant influence on investment. Changes in the

Gross National Product *(GNP)* has been found insignificant in all the specifications of the investment functions.

Sundararajan (1987) has specified and estimated a structural model of saving, investment , and growth for Korean economy during 1963-81. The analysis takes into account the simultaneous linkages between these variables. *2SLS* estimates suggest that although the direct effects of interest rates on household saving and private fixed investment are weak , the direct effects on corporate saving and output are strong. The rental wage ratio i.e. the relative cost of capital to labor, has a strong positive effect on the productivity of capital and hence on output. Consistent with this effect on productivity, corporate savings are also positively and strongly linked to the cost of capital. The overall direct effect of interest rates on household saving is, however, weak, because the significantly positive response of household saving to unregulated market rate is partly offset by its strong negative response to the bank interest rate. The direct effect of interest rate on private fixed investment is negligible because investment is mainly determined by the availability of saving and the level of expected output.

Blassa (1988) reports Cross Section statistical results showing that public and private investment are negatively correlated, with a one percent increase in public investment being associated with 0.55 percent decline in private investment. Furthermore the study finds a negative correlation between the share of public investment in total investment and the size of incremental output - capital ratios, arguing for a lower efficiency of public investment relative to private investment.

Khan.A. H.(1988) has extended the work of Blejer and Khan (1984) by disaggregating the consistent private investment function into manufacturing and agriculture. Time series data for the period 1959-60 to 1985-86 for Pakistan has been analyzed using single equation method of estimation. The results indicate that the response of private investment to *"general market conditions"* appears to be strong as the coefficient for the variable is statistically significant at 5% level across specifications and is positive. The sign of coefficient of bank credit is positive and is statistically significant at 5% level. The coefficient of public investment has turned out to be statistically significant with positive sign confirming its complementary role in case of Pakistan at disaggregated level. Another interesting result reported in the study is the negative sign of *"general market conditions"* with private investment in Agriculture sector which implies that agriculture sector in Pakistan is operating above capacity and investment in this sector was constrained by resource availability.

Chhibber and Wijnbergen (1988) have attempted to show that government policies have a marked impact on private investor behavior, through a variety of channels, in Turkey. The results obtained by *2SLS* econometric technique for the period of 1970-86 manifest that real cost of borrowing exerts highly negative significant influence on private sector investment provided that taxes are taken into account. The results also confirm the hypothesis that credit to the private sector influences private investment positively. Impact of expected output, proxied as lagged *GNP* is highly significant and positive. The study also found the non infrastructure component of public investment to have a negative effect

and that of infrastructure component to have no significant direct effect on private investment.

The studies by Aslam (1987), Blassa (1988), Khan.A.H. (1988), and Chhibber and Wijnbergen (1988) don't provide an integrated framework of public and private sector investment and hence their impact on output growth for developing countries. This subject is hence the concern of present analysis.

Khan and Reinhart (1990) have formulated a simple growth model to analyze the differential effects of public and private sector investment on output growth. The study covers the cross section sample of 24 developing countries on the sample period 1970-79 and results support the notion that private investment has a large direct-effect on growth than does public investment. The empirical results found in the study indicate that private and public investment do appear to have different effects on the long run rate of economic growth. In other words the marginal productivities of private & public investment differ in developing countries. Furthermore and perhaps more relevant to the debate on market based reforms, private investment plays a much larger role in the growth process than does public investment. The study finds that at best public investment has no statistically significant effect on growth.

Sarmad's (1991) work is the extension of Khan & Reinhart's (1990) study. The study by Sarmad uses the cross section data for some developing countries (those included in the Khan & Reinhart (1990) plus some others). The study analyses the impact of public & private investment on economic performance in different decades and sub periods.

During 1970-79, public investment has been found insignificant on economic growth. Only private investment contributes to economic growth positively. Public investment has shown a larger concern than private investment to economic growth during 1980-1987. In this period, public & private investment both influence economic growth significantly and positively, but the impact of former is far larger than that of later.

Greene & Villanueva's (1991) study analyses the determinants of private investment for 23 developing countries for the sample period of 1975-87. The main findings of the study are that ratio of public sector investment to *GDP* was on balance complementary to private sector investment. Private investment has also been influenced positively by the lagged value of per capita real *GDP* growth rate. Real interest rate has been found to affect private investment negatively as it would increase the user cost of capital and hence increases the volume of financial savings. The results of the regressions estimated over the subperiods, 1975-81 and 1982-87, respectively suggest that findings reported in the regression for the entire sample period (1975-87) mask rather different effects of certain macro economic variables during two sub periods.

Khan and Reinhart (1990) , Sarmad (1991) and Greene and Villanueva (1991) take no account of saving constraint behavior of a developing country which contributes to its economic growth. This aspect of developing country is addressed in our study for Pakistan.

Morisset (1991) developed a model to examine the direct and total effects of a variety of policies on private investment and other endogenous variables of the model.

Simultaneous equation model has been used for Argentina for the period 1962-86, which takes into account various direct and indirect relationships among external debt,investment and economic growth. *3SLS* estimates of the regression analysis show that stock of debt appears to be positive on consumption and capital flight and negative on private investment and bank deposits. The estimated coefficient of additional foreign resources to the public sector is positive on public investment and the impact of an increase in public foreign debt service is negative on public investment. The effect of capital inflow to the private sector seems to be positive on consumption and the demand for bank deposits , but negative on private investment. The model is reestimated assuming that debt overhang did not exist before 1982 and the estimated results obtained with this alternative measure suggest the previous reported results i.e. the impact of total stock of debt measured from 1982 is positive on private consumption & capital flight and negative on private investment and bank deposits. The production level appears to be influenced positively by private investment and negatively by public investment.

Serven and Solimano (1991) have recently estimated the private investment function using the cross section data for the years 1972-87 for twelve developing countries. The results obtained indicate that real output growth exerts a positive effect on private investment rate. Foreign debt which measures the degree of economic instability affects positively suggesting that complementary relationship between both investment categories dominate in the sample under consideration. In contrast, the effect of the real exchange rate is very small and insignificant.

Oshikoya (1994) has conducted the empirical research on determinants of domestic private investment for several African countries such as Morocco, Mauirituis, Tunisia, Cameroon, Malawi,Tanzania,Kenya,and Zimbabwe for the sample period of 1970 - 1988. The private investment equation is estimated by *OLS* method on separate pooled data for middle income countries - Cameroon , Mauritius, Morocco, and Tunisia and for low income countries - Kenya, Malawi & Tanzania over the entire period. The estimation results confirm that real *GDP* growth rate has a positive impact on private investment. *GDP* growth is significant at 5% level for low income countries for sample period (1970-88). In contrast real output growth rate is negatively related to private investment at the 1% level for Cameroon. Public investment has been found positively related to private investment in both groups of countries. Credit availability , debt service ratio and lagged private investment have similar effects on private investment behavior in both country groupings. The estimated results confirm that domestic credit available to private sector is a major determinant of private investment in low countries as well as middle income countries.

The studies by Morisset (1991), Serven and Solimano (1991) and Oshikoya (1994) make no proper allowance for credit rationing and financial repression in a developing country by postulating a direct linkage between savings and speed of adjustment of fixed capital stock to tne desire level. These aspects are properly incorporated in the present study for Pakistan.

CHAPTER III

METHODOLOGICAL FRAMEWORK

3.1 INTRODUCTION

The specification of the model[1] uses an adaptation of the neoclassical theory of investment behavior as developed by Jorgenson[2]. The Jorgenson version is itself a variant of flexible accelerator model of investment, with capital-output ratio allowed to vary with relative prices of capital input. The adaptation of neoclassical framework has two novel features: the inclusion of the effects of public investment and incorporation of the constraint on investment imposed by the availability of savings. The crowding out effect of public investment is specified in a general fashion, which encompasses not only the crowding out in the financial market- the traditional notion of crowding out- but also the crowding out in the market for real resources. Moreover, in most developing countries, the crowding out of private investment occurs mainly through some non price rationing mechanism. Also, in these countries, excess demand for investment exists, stemming partly from widespread financial repression, therefore, actual investment in fixed capital is constrained by the availability of savings. Since monetary policy in Pakistan has been implemented through the use of credit rationing,hence confirming the existence of financial repression in Pakistan. Credit rationing in *LDCs* is justified as a disequilibrium phenomenon caused by legal ceilings on interest rates. These features of developing countries are built into the present study by specifying a separate aggregate

domestic saving function and by postulating a direct linkage between saving and the speed of adjustment of the fixed capital stock to the desired level.

The model consists of functional relationships for private fixed investment, public fixed investment, aggregate savings, output and several definitional identities. Public investment is no more treated as exogenous as many studies have assumed. So the model is adapted by including public investment as a behavioral function. The notations and complete list of variables is presented at the end of this chapter.

3.2 PRIVATE INVESTMENT BEHAVIOR

A private investment function has been derived by modifying the neoclassical theory of investment in order to incorporate some of the channels through which public investment influences private investment. The neoclassical theory suggests that private investment is positively related to the expected output level and negatively related to the ratio of user cost of capital to wage rate. The neo classical model can be considered as a combination of the traditional flexible accelerator model, which emphasizes the reaction of capital stock to output, and the neoclassical principle that an optimal set of inputs is dependent on their relative prices. The adjustment of capital stock to its desired level is assumed to occur with a lag, as in flexible accelerator models. The private investment also depends upon the capital stock of public sector and the investible funds available to private sector, and that

these variables capture important channels of influence from public investment to private investment.

It is assumed that the private sector determines its desired level of capital by minimizing total cost *(T.C.)*, defined as the discounted present value of future costs including both the costs of production and the costs of acquiring capital[3]. The cost of producing the planned private sector output QP^* is a function not only of the planned output level but also of the private capital stock KP and the available infrastructure represented by the government capital stock KG. The acquisition cost of capital is primarily the value of net investment and replacement investment at current prices[4], hence it is nothing but the value of gross fixed investment. Thus the objective function is to minimize

$$TC \equiv \int_0^{\infty} \exp\left(-\int_0^t R(s)ds\right)\left[C_t\left(QP_t^*, KP_t, KG_t\right) + PI_t\left(K P_t + \delta_p KP_t\right)\right]dt, \qquad (3.1)$$

where :

$R(s)$: short term interest rate,

PI : price of capital goods,

δ_p: rate of depreciation of private capital,

$\int_0^t R(s)ds$: long term discount rate defined as the integral of short term interest rates,

KP: net investment,

$KP_t + \delta_p KP_t$: gross fixed investment.

The term within the square brackets in eq. (3.1) is the sum of the cost of production and cost of acquiring additional capital.

The Euler condition for minimization is given by the expression

$$\frac{\partial TC}{\partial KP_t} - \frac{d}{dt}\left(\frac{\partial TC}{\partial KP_t}\right) = 0.$$

Applying Euler condition on eq. (3.1) implies

$$\exp\left(-\int_0^t R(s)ds\right)\left[\frac{\partial C_t}{\partial KP_t} + PI_t\,\delta_p\right] - \frac{d}{dt}\left[\exp\left(-\int_0^t R(s)ds\right)PI_t\right] = 0.$$

Completing the differentiation and rewriting implies

$$\exp\left(-\int_0^t R(s)ds\right)\left[\frac{\partial C_t}{\partial KP_t} + (PI_t\,\delta_p) - PI_t + (PI_t\,.R(t))\right] = 0.$$

The above equation can be rewritten to express the first-order condition as

$$\frac{\partial C}{\partial KP_t} = U_t, \qquad (3.1')$$

where :

U_t: user cost of capital, given by

$$U_t \equiv PI_t\left[R(t) + \delta\right] - PI_t, \qquad (3.1'')$$

where :

$R(t)$: nominal short term lending rate.

Eq. (3.1') states that capital should be acquired in the current period until the reduction in the present and future costs, owing to a unit of additional capital, equals the current user cost of capital. It is interesting to note that although the long term rate is used to discount

future costs in defining the total cost, in defining the user cost of capital the appropriate interest rate is the short term rate[5].

From the first-order condition for the cost minimization, an expression for the desired capital stock of the private sector can be derived using a specific cost function. If it is assumed that the production function is Cobb-Douglas,

$$QP_t = A_t \left(KG_t\right)^{\alpha_0} \left(KP_t\right)^{\alpha_1} \left(L_t\right)^{\beta}; \qquad A_t > 0,\ \alpha_0 > 0, \alpha_1 > 0,\ \beta > 0.$$

where L denotes labor input, and A denotes the effects of shifts in the production function owing to technical change, then the variable cost function can be expressed as

$$C_t = W_t L_t = W_t \left(QP\right)_t^{\frac{1}{\beta}} \left(A_t\right)^{\frac{-1}{\beta}} \left(KG_t\right)^{\frac{-\alpha_0}{\beta}} \left(KP_t\right)^{\frac{-\alpha_1}{\beta}}. \tag{3.2}$$

where :

W: nominal wage rate

Differentiating the above cost function with respect to KP_t and substituting in the Euler condition we obtain the following expression

$$W_t \left(QP_t\right)^{\frac{1}{\beta}} \left(A_t\right)^{\frac{1}{\beta}} \left(KG_t\right)^{\frac{-\alpha_0}{\beta}} \left(-\frac{\alpha_1}{\beta}\right) \left(KP_t\right)^{-\frac{\alpha_1}{\beta}-1} = U_t \tag{3.3}$$

Eq. (3.3) can be rewritten to obtain the desired level of capital stock KP^*_t that corresponds to the expected or planned output level QP^*_t.

$$KP_t^* = const \left(\frac{U_t}{W_t}\right)^{\frac{-\beta}{\alpha_1 + \beta}} \left(KG_t\right)^{\frac{-\alpha_0}{\alpha_1 + \beta}} \left(QP_t^*\right)^{\frac{1}{\alpha_1 + \beta}} \tag{3.4}$$

An interesting implication of the above equation is that if the private sector productive capacity is improved by an increase in public sector capital stock ($\alpha_0 > 0$),

then, ceteris paribus, such an increase will reduce capital requirements of the private sector. Thus in this formulation, public investment facilitates production in the private sector by lowering the cost of producing private sector output. In other words, public investment provides some of the facilities that the private sector would have to provide for itself in the absence of public investment. Hence the private sector's capital requirements are lowered by public investment. Eq. (3.4) also implies that an increase in the rental-wage ratio reduces the desired capital stock owing to capital-labor substitution[6].

Eq. (3.4) is linearized for estimation purposes.

$$KP_t^* = d_0 - d_1\left(\frac{U_t}{W_t}\right) + d_2 QP_t^* - d_3 KG_t \qquad (3.4')$$

The private sector's desired capital stock is a linear function of the rental-wage ratio, the planned level of private sector output, and the public sector capital stock. The determination of the planned output and the mode of adjustment of actual capital stock to the desired capital stock need to be specified in order to derive the final form of the investment function. The planned private sector output is assumed to be a function of the current and past levels of output, as well as of the public sector capital stock.

$$QP_t^* = A_0 + a(L)QP_t + A_1 KG_t \qquad (3.5)$$

where *a(L)* is the lag operator. An increase in the public sector capital stock raises private sector output expectations, because this increase represents potential additional demand for private sector products when these public investment projects mature. The effects of current demand for private sector output owing to current investment and production

activities of the public sector is already subsumed in the private sector output variable in Eq. (3.5).

It is assumed that there is a partial adjustment of the private sector's actual capital stock to its desired level.

$$KP_t - KP_{t-1} = b_t(KP_t^* - KP_{t-1}) \tag{3.6}$$

Eq. (3.6) states that only a proportion of the gap between the desired capital stock and the existing capital stock is closed in given period.

The speed of adjustment, b_t, is assumed to vary in response to the ease with which private investment can be financed. It is specified as

$$b_t = b_0 + b_1\left[\frac{(S_t - IG_t)/PI_t}{KP_t^* - KP_{t-1}}\right] \qquad b_1 > 0 \tag{3.7}$$

The variable influencing the speed of adjustment stands for the total financing available to the private sector in real terms $(S\text{-}IG)/PI$, relative to the required investment, $KP_t^*\text{-}KP_{t-1}$.[7] The financing available to the private sector is nothing but the difference between the aggregate savings, S (including foreign savings) and the public sector investment, IG; since this difference is merely gross private investment - in both fixed assets and inventories of the private sector - Eq. (3.7) also determines the allocation of private domestic investment between plant and equipment on one hand and inventories on the other.

Using Eqs. (3.4'), (3.5), (3.6) and (3.7), provided that private sector gross fixed investment IP_t is

$$IP_t = (KP_t - KP_{t-1}) + \delta_p KP_{t-1} \tag{3.8}$$

where δ_p denotes the rate of depreciation, the following investment function for the private sector is obtained.

$$IP = B_0 + B_1\left(\frac{U}{W}\right) + B_2 a(L)QP + B_3 KG + B_4\left[\frac{(S - IG)}{PI}\right] + B_5 KP_{-1} \qquad (3.9)$$

where :

$$B_0 = b_0 d_0 + b_0 d_2 A_0 \qquad B_1 = -b_0 d_1$$

$$B_2 = b_0 d_2 \qquad B_3 = -b_0 d_3 + b_0 d_2 A_1$$

$$B_4 = b_1 \qquad B_5 = \delta_p - b_0$$

The signs of the coefficients B_2 and B_4 are expected to be positive, while the signs of B_1 and B_5 are expected to be negative. The sign of B_3 is, however, indeterminate. If it is positive, then the positive demand - inducement effect of public investment is larger than the opposite effect, owing to public investment aiding private sector production.

The resource availability variable, *(S-IG)/PI*, captures important channels through which crowding out of private investment occurs in many developing countries. The view of crowding out represented by this variable is more general than the traditional view that refers to crowding out in the financial markets. It is more general, in that it takes into account both the crowding out that occurs through competition in the markets for real resources, such as cement, steel and imported materials, as well as the nonprice rationing of financial and real resources. The crowding out can occur both through an increase in prices and interest rates following an increase in the public investment and through some nonprice rationing mechanism such as licensing or other controls. The specification chosen here emphasizes the nonprice rationing aspects, since price and quantity controls are

pervasive in developing countries[8]. Moreover, in many developing countries, self financed investment is important and therefore the availability of self financing for acquiring fixed capital is a critical aspect. This, as well as nonprice rationing aspect, is best taken into account by postulating a direct linkage between total resource availability and fixed investment.

3.3 PRODUCTION FUNCTIONS

Private sector output is assumed to be a function of the capital stock in the private and public sectors, and the rental-wage ratio.

$$QP = C_0 + C_1 KP + C_2 KG + C_3\left(\frac{U}{W}\right) \qquad (3.10)$$
$$C_1 > 0;\ C_3 > 0$$

This equation has been derived by rewriting Eq. (3.3) and then linearizing it. This specification is consistent with the empirical observation that the possibility of substitution of capital for labor exists only for new capital that has yet to be installed, but the factor intensity implicit in the existing capital stock cannot be readily altered in response to the changes in relative price of capital. Thus, the capital-output ratio is assumed to be fixed *ex post*; but *ex ante*, it varies with the rental-wage ratio and the public sector capital stock. Output is determined by the available capital stock and by the currently feasible capital-output ratio. It is assumed that the labor supply is highly elastic. Thus, employment is assumed to be demand-determined -a valid assumption for developing economies with

surplus labor.

The public sector output , QG, is assumed to be a linear function of public sector capital stock.

$$QG_t = e_1 + e_2 KG_t \qquad (3.11)$$

This formulation is valid for the determination of the output of the public enterprise sector; however, a more sophisticated formulation is required to explain the output of the general government. This complication is ignored here.

3.4 SAVINGS FUNCTION

Real domestic savings, SD/P, are assumed to be a function of the real interest rate facing consumers and the distributed lag in income.

$$\frac{SD}{P} = D_0 + D(L)Q + D_1\left(i - \frac{PC}{PC}\right) \qquad (3.12)$$

Real interest rate is computed as the difference between the short term deposit rate i and the rate of increase in consumer prices. The specification of a distributed lag in output is consistent with several alternative models of saving behavior; the specific model best suited for an economy has to be determined on an empirical basis and can be inferred from the estimated lag distribution of the output variable[9].

3.5 PUBLIC INVESTMENT FUNCTION

There is plentiful literature describing the sources of variation in private investment activity in developing countries. There has been, however, relatively few attempts to test the behavior of public investment empirically. For a recent exception see Morisset (1991). Morisset (1991) incorporates public investment as a behavioral equation in his study. Hence to capture the several interactions among different economic functions, the present analysis treats public investment as a behavioral entity.

The following behavioral function is to be estimated in the present analysis.

$$IG_t = g_0 + g_1 FB_t + g_2 Q_t + g_3 IG_{t-1} \tag{3.13}$$

3.6 DEFINITIONAL IDENTITIES

The model is completed by including the relevant definitional identities. Gross domestic product, Q, is the sum of the output of the private and public sectors.

$$Q = QG + QP \tag{3.14}$$

Aggregate savings is the sum of domestic SD and foreign savings SF.

$$S = \left(\frac{SD}{P}\right) + SF \tag{3.15}$$

Private and government capital stock can be obtained by the perpetual inventory method.

$$KP = (1 - \delta_P) KP_{t-1} + IP \tag{3.16}$$

$$KG = (1 - \delta_G) KG_{t-1} + IGF \tag{3.17}$$

where δ_p denotes the rate of depreciation of the private capital stock, δ_i denotes the rate of depreciation of the public sector capital stock, and IGF denotes the public gross fixed investment.

Total public sector investment IG is the sum of gross public fixed investment and the public inventory investment.

The analysis is conducted within the framework of a growth model that is designed to highlight the role of public investment. The model consists of relationships explaining public and private investment, savings and growth, and it incorporates several channels through which public investment influences private investment. First, public investment competes with the private sector for scarce physical and financial resources and thereby exerts a negative influence on private investment, atleast in the short run. Second, to the extent that public investment complements private investment by creating infrastructure and raising the productivity of private capital stock, private investment requirements per unit of output are reduced. Third, increased public investment raises the demand for output of private sector; it thereby influences expectations and investment requirements of private sector. Finally, public investment raises aggregate output and savings, supplementing the economy's physical and financial resources, and thus offsets atleast a part of any crowding out effects on private investment. These channels of influence of public investment account for most of its immediate and final effects and are explicitly built into the structure of the model. Within this framework, present study addresses the critical issue of whether the positive effects of public investment are strong

enough to offset its negative effects. This issue is clearly important in assessing the growth effects of stabilization programs involving control of public expenditures.

3.7 THE COMPLETE MODEL

The behavioral equations for private investment (3.9) , private and public sector output (3.10 & 3.11) , Domestic savings (3.12) and public investment (3.13), together with the definitional identities (3.14-3.17), constitute a complete model of savings , investment and growth. All behavioral equations would be estimated and tested simultaneously to capture the integrated relationships among several variables that are emphasized in the classical and modern theories of investment.

3.8 WORKING OF THE MODEL

The working of the model can be illustrated by considering the effects of an increase in public investment, ceteris paribus. An initial one-shot increase in real fixed investment by the public sector raises public sector output, the private sector's actual and expected output, and aggregate domestic savings, while simultaneously absorbing part of the savings to finance the increased public investment. If there is a negative effect owing to a net reduction in the availability of savings to the private sector (crowding out) that more than offsets the positive effects of increased private sector output and output expectations, then private fixed investment falls; if not, private investment rises. The resulting changes in the capital stock of the private sector together with the desired capital stock in the next

period, determine the level of private investment in the next period. Similarly, changes in savings in the initial period generate adjustment in savings in subsequent periods. In this dynamic framework, the effects of public investment on growth depend critically on the differences in the marginal productivity of capital in the public and private sectors.

Assuming that there is a full or partial crowding out of private investment in the initial period, the change in total output will depend on whether the increased public sector output owing to the increase in public investment exceeds or falls short of the reduction in private output owing to a reduction in private investment. If there is no crowding out, the effect on total output is clearly positive.

3.9 VARIABLES' DEFINITIONS, AND METHODOLOGY

The definitions and construction of the important variables are as follow

IP = Gross private fixed capital formation (in real terms)

IG = Gross public fixed capital formation (in real terms)

U = User cost of capital defined as

$$U = \frac{R \cdot PI}{CPI}$$

The methodology for calculating out user cost of capital is adopted by Haq and Montiel (1991).

Where R is interest rate defined as

$$R = \frac{i - CPI}{1 + CPI}$$

as calculated by Sundararajan (1987).

W = wage index at constant prices of 1980-81

Q = Aggregate real output (based on old methodology) at constant prices of 1980-81

$(S - IG)/PI$ = Total financing available to the private sector (in real terms)

Where :

S = Aggregate savings (National + Domestic)

PI = Investment deflator

TKS= Total capital stock[10]

short term real lending rate (RIR_1) calculated as

RIR_I = Short term lending rate (i)- *CPI*

Where :

CPI = Rate of increase in consumer price index at 1980 - 81 = 100

SD/P = Real domestic savings

S = Real Aggregate savings defined as

S= (Total savings / *RGDP*) x100

The methodology for construction of Aggregate Saving variable is adopted by De Melo and Tybout (1985).

Where :

RGDP = Real aggregate output at constant prices of 1980-1981 = 100

SF = Real foreign saving defined as

SF=(Foreign savings / *RGDP*) x 100

as calculated by De Melo and Tybout (1985)

Where :

SF = National savings - Domestic Savings

GQ = Real *GDP* growth (%)

FB=Foreign Borrowings or external debt disbursed during the period

(in real terms)

All the variables are expressed in millions of national currency unit at constant prices of 1980-81.

Notes

1. MODEL ADAPTATIONS

The Model specification is slightly altered to reflect the lack of data on certain variables and the strong multicollinearity between some time series. Because of lack of separate *GDP* series for private and public sectors ,total *GDP* is used as an explanatory variable in the private investment function instead of private sector *GDP*. This modification does not constitute a specification error because public sector output is assumed to be a function of public sector capital stock , and , therefore the coefficient of public sector capital stock in the private investment function reflects the implicit subtraction of public sector output from total output. As a result only the interpretation of the coefficient is affected , and no specification bias is involved.

In the original model, private investment is assumed to be a function of public capital stock and private capital stock. But the series generated for the public and private capital stock do not provide satisfactory results. So *"public fixed investment"* is used as a substitute or proxy for the *"public sector capital stock"*. Similarly private and public capital stock variables are replaced *by "private fixed investment"* and *"public fixed investment"* respectively in the aggregate output function.

2. The Initial statement of Jorgenson theory can be found in Jorgenson (1963); for later surveys, see Jorgenson (1971) and Clark (1979).

3. The common assumption that firms maximize profits is not necessary for deriving the neoclassical investment function ; the assumption that firms minimize total cost is sufficient. See Hall (1977).

4. The acquisition cost includes , in addition to the purchase cost (the value of investment) , other costs such as costs of installation , which are ignored here for the sake of simplicity.

5. The appropriateness of the short term rate is emphasized in Hall (1977), who derives this result in a discrete time framework.

6. The use of rental wage ratio as a determinant of the desired capital stock is not common in the investment literature ; exceptions are Jorgenson (1967) and McLaren (1971)

7. This technique of introducing variability in the speed of adjustment is similar to the one used by Coen (1971)

8. If the role of price mechanism in the crowding out process is to be emphasized , then the model should be extended to endogenize interest rates and the relative price of capital input. However , we have preferred to focus on the typical case of rigidity in interest rate and the relative price of the capital and to treat these variables as exogenous. Also , no account is taken of crowding out of private investment through increases in the general price level , which results in the transfer of resources to the public sector via an inflation tax.

9. Leff and Sato (1975) have argued that saving should depend on first difference in income. Alternatively , one can specify that savings depend on the first difference in permanent income. Another common specification is that savings depend on permanent income and transitory income , with different marginal propensities for each type of income. All of these formulations can be captured by a general distributed lag in income. The estimated shape of distributed lag should reveal the correct underlying structure.

10. Taken from the study of Kemal (1993), Sources of Growth in Pakistan'seonomy, Working Paper of the Sub-committee on Sources for the Eighth Five Year Plan, Islamabad:PIDE.

CHAPTER 1V

EMPIRICAL RESULTS AND DISCUSSIONS

ESTIMATION PROCEDURE

Since the application of Ordinary Least Squares *(OLS)* to an equation belonging to a system of simultaneous equations yields biased and inconsistent estimates, the obvious solution is to apply other methods of estimations which give better estimates of parameters.For that purpose, we have applied *2SLS* to estimate the model of Investment ,Savings and output Growth. All parameters in the model are in linear form.

All behavioral functions (described in chap-3), such as real private investment, real aggregate output , real aggregate savings and real public investment have been estimated by using time series data for the period of 1971-72 to 1994-95, for Pakistan.

Estimation Results of Private Investment Equations

Table 4.1
(Selected Private Investment Equations, 1972-95)

$$IP_t = \underset{(-3.18)}{-5542.5} - \underset{(-4.07)^{*}}{0.105 Q_{t-1}} - \underset{(-3.10)^{*}}{225130.31\ (U/W)_{t-1}} + \underset{(6.54)^{*}}{0.118\ TKS} \qquad (4.1)$$

$$+ \underset{(1.91)^{***}}{0.042\ (S\text{-}IG/PI)} + \underset{(3.41)^{*}}{0.419\ IP_{t-1}}$$

$R^2 = 0.99$ $\quad Adj\ R^2 = 0.99$ $\quad D.W. = 1.9$ $\quad F\text{-}Stat = 459.15$

$$IP_t = \underset{(0.176)}{-295.02} - \underset{(-2.48)^{**}}{0.083\ Q_{t-1}} - \underset{(-1.33)^{****}}{9516.85\ (U/W)_t} + \underset{(3.88)^{*}}{0.084\ TKS} \qquad (4.2)$$

$$+ \underset{(3.34)^{*}}{0.092\ (S\text{-}IG/PI)_t} + \underset{(2.62)^{**}}{0.442\ IP_{t-1}}$$

$R^2 = 0.98$ $\quad Adj\ R^2 = 0.98$ $\quad D.W. = 1.61$ $\quad F\text{-}Stat = 220.15$

$$IP_t = \underset{(-4.59)}{-8110.99} - \underset{(-2.61)^{**}}{0.064\ Q_{t-1}} - \underset{(-2.65)^{**}}{14566.1\ (U/W)_{t-1}} + \underset{(4.53)^{*}}{0.074\ TKS} \qquad (4.3)$$

$$+ \underset{(2.36)^{**}}{0.310\ IG_t} + \underset{(3.73)^{*}}{0.472\ IP_{t-1}}$$

$R^2 = 0.99$ $\quad Adj\ R^2 = 0.99$ $\quad D.W. = 2.06$ $\quad F\text{-}Stat = 381.52$

Note : Figures in Parenthesis refer to t-statistics.

*The coefficients are statistically significant at 1% level.
**The coefficients are statistically significant at 5% level.
***The coefficients are statistically significant at 10% level.
****The coefficients are statistically significant at 15% level.

PRIVATE INVESTMENT AND OUTPUT

Three of the estimated equations for real gross fixed capital formation in the private sector (real private investment) are reported in table 4.1. In general, the model of private investment seems quite well specified and , on the basis of the values obtained for the coefficient of determination (R^2) , appear to fit the data satisfactorily. The estimates of real private investment equations reveal that private investment is primarily determined by the supply of investible funds available to the private sector; the coefficient for the resource availability variable *(S-IG/PI)*, which influences the speed with which actual investment adjusts to the desired level, is highly significant with positive sign at 1% level in eq.(4.2) , and at 10% level of significance in another specification, eq.(4.1). Desired private investment, however, is mainly influenced by the lagged level of output. It can be observed from the results that lagged value of real output enters with a negative sign and that the estimated coefficient , is significantly different from zero at 1% level across specifications, such as eqs (4.1) ,(4.2) ,(4.3) , of table 4.1. The negative sign of output with private investment implies support for the hypothesis that investment is positively related to the degree of capacity in the economy. since output is above its trend level , the economy can be viewed as operating above capacity and hence investment is constrained by resource availability in Pakistan , as private investors tend to react slowly in such a situation.Our findings support the argument of Blejer and Khan (1984), Khan.A.H. (1988), and Oshikoya (1994). Khan.A.H. (1988) found that general market conditions proxied by growth rate of *GDP* have a negative influence on the private investment in Agriculture

sector of Pakistan. Oshikoya (1994) Concludes that real output growth rate is negatively related to private investment for comeroon.

The immediate influence of government investment in crowding out private investment is measured by the coefficient of the variable, *S-IG/PI* , which measures the resources available to the private sector and is obtained as the difference in real terms between aggregate savings and total public sector investment. The coefficient of this variable measures the effect of resource availability on the speed of adjustment of the actual capital stock to the desired level.

The strong statistical significance of the variable measuring the resources available to the private sector i.e. *(S-IG/PI)*, shows that public sector investment may crowd out private investment in the very short run. But public sector investment also raises the productivity of private capital stock , as it complements private investment by creating infrastructure. Public investment also raises aggregate output, output expectations , and savings , supplementing the economy's physical and financial resources , and thus offsets the immediate crowding out effects on private investment operating through resource constraint variable. The positive coefficient of public investment with high statistical significance in the private investment function (Eq.3) , Table 4.1 , reveals that the public sector investment in Pakistan complements private sector investment in the long run. This finding supports the arguments of Ahluwalia (1982) and Srinivasan and Narayana (1977) while it differs with Sundaragan and Thakur (1980) and Blejer and Khan (1984).

A test of neoclassical framework is given by the statistical significance of rental -wage ratio. The rental - wage ratio has a significantly negative substitution effect on private investment as well as a significantly positive efficiency effect on output in Pakistan. Moreover, the relative price effects occurred with a time lag of one year both in case of investment and output functions (specification 4.1 and 4.3, table 4.1 and specification 4.2, table 4.2 respectively). Thus the evidence suggests that an increase in the interest rate and hence rental price of capital tends to depress investment demand significantly in Pakistan (with a lag of one year in the first specification) reflecting the substitution of capital for labor. The significant positive coefficient for the rental wage- ratio in specifications 4.1 and 4.2 of the production functions table 4.2 can be interpreted as supporting the hypothesis that an increase in interest rates, and hence the rental price of capital - increases the overall efficiency of capital and hence output by permitting a shift of resources to more productive sectors and by encouraging more productive use of capital within each sector. This positive effect of rental - wage ratio on output stimulates investment demand more than offsetting any negative substitution effect on private investment. Thus increase in interest rate can stimulate investment demand even within the strictly neo classical framework adopted here.

Since the series generated for the private and public sectors capital stock for Pakistan do not lead to conclusive and meaningful results, so the study has incorporated private and public sector investment as proxies for private and public sector capital stock in the private investment and aggregate output functions respectively.

The coefficient $(\delta_p - b_0)$ of the initial private capital stock (proxied by private sector investment) is the difference between the rate of depreciation and the speed of adjustment of the private capital stock. It follows from the results of the all specifications of the private investment function (table 4.1), that the coefficients of initial private capital stock are almost 0.45 , which are significantly different from zero at 1 % and 5 % levels. This result indicate that the speed of adjustment is conditioned by the policy environment which has been more flexible toward the private sector in Pakistan.

The impact of a change in output on private investment is spread out over a longer time period in Pakistan as is obvious from the results of the equations of private investment, where the real private investment is affected by a lag distribution of the level of real output. A unit increase in aggregate output raises private investment by about 0.07 units in Pakistan.

The public sector capital stock (proxied by public sector investment) has a positive coefficient in the private investment function for Pakistan which is significantly different from zero at 5% level. Analogously, the very coefficient of public sector capital stock is statistically significant with a positive sign at 10% level in the aggregate output function. The coefficient of public sector capital stock in the output function is far larger than that of public sector capital stock in the private investment function. Given the fairly large coefficient of public sector capital stock in the output function (1.34) for Pakistan (table 4.1.A), the fairly small coefficient (0.31) in the investment function implies a strong effect of public sector capital stock on private sector's output expectations. These results of the

present study are in complete accordance with the one concluded by Sundarargan and Thakur (1980), who have also found a positive relationship of the public sector capital stock with that of private investment and aggregate output. They have also reached the same conclusion that public sector capital stock has a strong effect on private sector's output expectations in Korea, as suggested by the fairly large coefficient of public sector capital stock in output function.

The positive coefficients of total capital stock *(TKS)* in private investment and output equations imply a strong effect of total capital stock on output expectations and hence aggregate output. The coefficients of total capital stock are statistically significant at 1 % level across specifications of both private investment and aggregate output.

2SLS Estimates of Investment , Saving and Output Growth.

Table 4.1.A

(1971-72 - 1994-95; N = 24)

Dependent variables	IP_t	Q_t	S_t	IG_t
Intercept	-8110.99	-31360.0	7.89	1818.60
	(-4.59)	(-3.65)	(2.29)	(0.94)
Q_{t-1}	-0.064	0.409		
	(-2.61)**	(3.11)*		
$(U/W)_{t-1}$	-14566.1			
	(-2.65)**			
TKS	0.0736	0.283		
	(4.53)*	(3.29)*		
IG_t	0.310	1.34		
	(2.36)**	(2.03)***		
IP_{t-1}	0.472	2.61		
	(3.73)*	(4.16)*		
Q_t			3.155	
			(3.44)*	
IG_{t-1}				0.784
				(9.55)*
RIR_t			0.192	
			(1.80)***	
S_{t-1}			0.158	
			(0.66)****	
GQ				332.49
				(1.57)****
FB				0.266
				(2.53)**
R^2	0.99	0.99	0.74	0.96
$Adj\ R^2$	0.99	0.99	0.68	0.95
$D.W.$	2.06	1.78	1.5	2.05
$F\text{-}Stat.$	381.52	2779.2	13.93	133.32

Notes : Figures in parentheses below the coefficients refer to t - statistics.

* The coefficients are statistically significant at 1-percent level.
** The coefficients are statistically significant at 5-percent level.
*** The coefficients are statistically significant at 10-percent level.
**** The coefficients are statistically significant at 15-percent level.

Estimation Results of Output Equations

Table 4.2
(Selected output Equations, 1972-95)

$$Q_t = \underset{(-2.79)}{15435.58} + \underset{(3.39)^{*}}{1.98\ IP_{t-1}} + \underset{(1.63)^{*****}}{48826.90\ (U/W)_t} + \underset{(3.19)^{*}}{0.287\ TKS} + \underset{(3.94)^{*}}{0.544\ Q_{t-1}} \qquad (4.1)$$

$R^2 = 0.99$ $\quad Adj\ R^2 = 0.99$ $\quad D.W. = 1.8$ $\quad F\text{-}Stat = 2574.2$

$$Q_t = \underset{(1.49)}{11582.70} + \underset{(4.80)^{*}}{3.91\ IP_t} - \underset{(-1.27)^{****}}{0.760\ IG_{t-1}} + \underset{(2.13)^{***}}{75996.53\ (U/W)_{t-1}} + \underset{(10.57)^{*}}{0.772\ Q_{t-1}} \qquad (4.2)$$

$R^2 = 0.99$ $\quad Adj\ R^2 = 0.99$ $\quad D.W. = 1.9$ $\quad F\text{-}Stat = 2292.60$

$$Q_t = \underset{(-3.65)}{31360.0} + \underset{(4.17)^{*}}{2.61\ IP_{t-1}} + \underset{(2.03)^{***}}{1.34\ IG_t} + \underset{(3.29)^{*}}{0.282\ TKS} + \underset{(3.12)^{*}}{0.408\ Q_{t-1}} \qquad (4.3)$$

$R^2 = 0.99$ $\quad Adj\ R^2 = 0.99$ $\quad D.W. = 1.8$ $\quad F\text{-}Stat = 2779.67$

Note : Figures in Parenthesis refer to t-statistics.

*Thcoefficients are statistically significant at 1% level.
**The coefficients are statistically significant at 5% level.
***The coefficients are statistically significant at 10% level.
****The coefficients are statistically significant at 20% level.
***** The coefficients are statistically significant at 15% level.

AGGREGATE OUTPUT

Real Aggregate output is determined by total capital stock *(TKS)* , rental - wage ratio, lag of real private investment and real public investment. This is illustrated in table 4.2, which presents a set of output equations estimated using different specifications. The coefficients of determination of the estimated equations are high, and the explanatory variables are statistically significant and have the expected signs.

The output equations in table 4.2 illustrate the strong positive impact of rental wage ratio on the productivity of capital, Eqs. (4.1) and (4.2). The significant positive coefficient of rental- wage ratio in eq. (4.2) can be interpreted as supporting the hypothesis that an increase in the cost of capital and hence relative price of capital- increases the overall efficiency of capital by permitting a shift of resources to more productive sectors, and by encouraging more productive use of capital within each sector. It is obvious from the results that the coefficient of the rental wage ratio though possess an expected positive sign, failed to reach the 5 percent level of significance in equation (4.1). However it is significant at the level of 15%.

Real private investment (a proxy for private sector capital stock) seems to affect aggregate output positively , as the coefficient of this variable is significant at 1% level across specifications (eq. 4.1 and eq. 4.2, table 4.2). A unit increase in the private sector capital stock (proxied by real private investment) raises the aggregate output by 1.9 units and 2.61 units across specifications of aggregate output and the increase in the output is spread out over one year , in specification (4.1) and (4.3). However , the estimates of equation (4.2) of aggregate output indicate that current output is affected by current

private sector capital stock and estimated coefficient (3.91) is fairly large as compared to that of the other specification.

Similarly , the public sector capital stock (proxied by real public sector investment) has a significant impact on aggregate output with a positive sign , and the estimated coefficient is statistically different from zero at 10% level in eq. (4.3) of aggregate output. The very estimated coefficient of public sector capital stock is also found to have a positive effect on the level of private investment in the private investment function, but this coefficient is fairly large in the output equation as compared to that of private investment equation. The larger coefficient of public sector capital stock in output function for Pakistan implies that public sector capital stock exerts a strong positive effect on output expectations and hence , the level of aggregate output.This finding supports the argument of Sundararajan and Thakur (1980), where they have reached the conclusion that public sector capital stock is positively correlated with aggregate output in case of Korea.

Although the data on segregated private & public sector capital stocks were not available , we have also tried to see the impact of total capital stock *(TKS)* on aggregate output level. It can be seen from the results that the coefficient of total capital stock is statistically significant at 1% level and bears a expected positive sign in specifications (4.1) and (4.3), although the very variable has been dropped from the second specification of aggregate output function.

Estimation Results of Saving Equations

Table 4.3
(Selected Saving Equations, 1972-95)

Aggregate Savings

$$S_t = 11.28 + 0.738\ GQ + 0.541\ RIR_1 - 1.324\ SF + 0.614\ S_{t-1} \qquad (4.1)$$
$$(2.46)\quad (2.05)^{****}\quad (4.04)^{*}\quad (-3.67)^{*}\quad (3.73)^{*}$$

$R^2 = 0.76$ $\quad Adj\ R^2 = 0.69$ $\quad D.W. = 2.00$ $\quad F\text{-}Stat = 11.41$

$$S_t = 9.547 + 0.297\ RIR_1 - 0.595\ GQ + 0.769\ S_{t-1} \qquad (4.2)$$
$$(1.95)\quad (2.26)^{**}\quad (-1.41)^{****}\quad (3.77)^{*}$$

$R^2 = 0.58$ $\quad Adj\ R^2 = 0.49$ $\quad D.W. = 1.5$ $\quad F\text{-}Stat = 6.97$

$$S_t = 8.13 + 0.20\ RIR_1 + 3.326\ Q_{t-1} + 0.150\ S_{t-1} \qquad (4.3)$$
$$(2.32)\quad (1.86)^{***}\quad (3.34)^{*}\quad (0.61)^{****}$$

$R^2 = 0.73$ $\quad Adj\ R^2 = 0.77$ $\quad D.W. = 1.53$ $\quad F\text{-}Stat = 13.43$

Real domestic savings

$$SD/P = -2.15 + 0.118\ RIR_1 + 0.248\ GQ + 1.153\ (SD/P)_{t-1} \qquad (4.4)$$
$$(-0.88)\quad (1.65)^{****}\quad (1.08)^{*****}\quad (5.71)^{*}$$

$R^2 = 0.68$ $\quad Adj\ R^2 = 0.62$ $\quad D.W. = 1.49$ $\quad F\text{-}Stat = 10.93$

Note : Figures in Parenthesis refer to t-statistics.
*The coefficients are statistically significant at 1% level.
**The coefficients are statistically significant at 5% level.
***The coefficients are statistically significant at 10% level.
****The coefficients are statistically significant at 15% level.
*****The coefficients are statistically significant at 20% level.

Real Aggregate Savings

The estimated equations for real gross saving and real gross domestic saving are presented in table 4.3. The equations provide a reasonable good explanation with actual data and indicate that real returns to financial assets and distributed lag in total real income are major determinants of aggregate savings.

The specification eq. (4.3) shows a positive relationship between real interest rate and real gross savings. The coefficient of real interest rate is significantly different from zero at 10% level. Thus , the finding is in complete agreement with that of Sundararajan and Thakur (1980), who favor a positive relationship between the real interest rate and aggregate saving behavior in India. It seems that higher interest rates serve to raise the efficiency of capital and there by stimulate economic growth, which in turn, stimulates savings. The results of an examination of the lag distribution of real aggregate output in eq. (4.3) , given in Table (4.3) , shows that real aggregate savings are strongly related to aggregate income level in the economy, as the coefficient of this variable is statistically significant at 1% level. Current period savings are also affected by past level of saving in Pakistan, but the coefficient of this variable is not significant. However we keep this lag distribution of endogenous variable to remedy the high autocorrelation problem in the saving function.

Apart from determinants of real aggregate saving, we have attempted to show how real domestic savings are determined in Pakistan. Empirical results show that real interest rate has also been found affecting positively the real gross domestic saving behavior in

Pakistan, along with a similar positive impact of growth of total income on real domestic saving. However, growth of total income is only significant at 25% level. Real domestic Savings are also sensitive with the past level of domestic savings in Pakistan as is shown in specification (4.4).

Following the methodology of De Melo and Tybout (1985), we have also estimated a saving function as estimated by De Melo & Tybout. The results of the present study are in complete accordance with those concluded by De Melo & Tybout (1985). Ratio of total savings to *GDP* has been found to be determined by real *GDP* (output) growth, real interest rate, and ratio of foreign savings to *GDP*. The coefficients of all the variables are statistically significant at conventional levels with reasonable R^2 and Durbin - watson statistics. Real interest rate has been found to affect aggregate savings to *GDP* ratio positively and the coefficient of this variable is significantly different from zero at 1% level, as is shown in eq. (4.1), table 4.3. The empirical results also show that real income growth variable is statistically significantly at 10% level and exerts a positive impact on aggregate savings/*GDP* ratio. As for as the foreign savings are concerned the present finding also confirms the result of De Melo & Tybout (1985), who conclude that foreign savings may crowd out domestic savings by allowing residents to consume more at any given rate of capital accumulation. In our analysis the estimated coefficient of the foreign saving/*GDP* ratio is statistically significant at 1% level indicating that foreign saving has crowded out domestic savings in Pakistan. Foreign saving may in fact substitute for domestic saving by making the government less enthusiastic about its revenue generation

efforts, the nation could increase its consumption expenditures and/or liberalize imports. The results of the estimated coefficient reveal that 1 unit increase in foreign savings has crowded out domestic savings by 1.32 units.

Estimation Results of Public Investment Equations

Table 4.4
(Selected Public Investment Equations, 1972-95)

$IG_t = 1818.60 + 0.266\ FB + 322.67\ GQ + 0.784\ Ig_{t-1}$ (4.1)
(0.939) (2.53)** (1.58)*** (9.55)*

$R^2 = 0.96$ $AdjR^2 = 0.95$ $D.W. = 2.05$ $F\text{-}Stat = 133.32$

$IG_t = 3490.05 + 93114.8\ FB/GDP + 432.38\ GQ_{t-1} + 0.68\ IG_{t-1}$ (4.2)
(1.55) (2.50)** (1.51)**** (5.36)*

$R^2 = 0.95$ $Adj\ R^2 = 0.9$ $D.W. = 2.08$ $F\text{-}Stat = 101.05$

$IG_t = 5794.29 + 0.112\ FB + 0.028\ Q_t + 0.503\ IG_{t-1}$ (4.3)
(3.55) (1.20)***** (2.63)** (3.57)*

$R^2 = 0.96$ $Adj\ R^2 = 0.96$ $D.W. = 1.95$ $F\text{-}Stat = 166.2$

Note : Figures in Parenthesis refer to t-statistics.

*The coefficients are statistically significant at 1% level.
**The coefficients are statistically significant at 5% level.
****The coefficients are statistically significant at 15% level.
****The coefficients are statistically significant at 20% level.
***** The coefficients are statistically significant at 25% level.

REAL PUBLIC INVESTMENT

The estimated equations for Real public investment presented in table 4.4, provide a good explanation with the actual data. The results corresponding to the public investment functions are , on the whole satisfactory and signs of the coefficients are mostly as expected. The statistical significant coefficients and the reasonable value of Durbin - Watson *(D.W.)*, the adjusted coefficient of determination (R^2) and *F*- statistics suggest an appropriate specification of the public investment function for Pakistan.

A positive relationship is found between real foreign borrowings and real gross fixed capital formation by public sector. The coefficient of real foreign borrowing is statistically significant at 5% level (eq. 4.1, table 4.4). The finding supports the economic theory, that foreign borrowing is one of the external source of finance for public sector capital formation. Hence more external borrowing from abroad has boosted public investment in Pakistan. Thus , the finding is in complete agreement with Morisset (1991), who concludes a positive relationship between public sector investment and foreign external borrowings in a simultaneous model fitted for an under developed country like Argentina.

Another specification (eq. 4.2, table 4.4) of public sector investment also supports the positive relationship between foreign borrowing to *GDP* ratio and public sector gross fixed capital formation. The coefficient of foreign borrowing to *GDP* ratio is highly significant at 5% level.

Public sector investment is also sensitive to the total income in the economy. The coefficient of the real output growth bears a positive sign in both specifications but they are significant at the level of 15%, although in the second specification, real output growth affects the public sector investment with a lag of one time period. Of course , past level of public sector investment also determines the current capital formation in public sector. It is evident from the results that previous year capital formation is much important factor for the current year capital formation by public sector in Pakistan. The coefficient of this variable is highly significant at 1% level across specifications and exerts a positive influence on the current public sector capital formation.

CHAPTER V

CONCLUSIONS AND POLICY IMPLICATIONS

The study was focused to postulate and estimate a dynamic model of public investment, private investment, savings and their linkage with output growth in Pakistan. The model has been designed to highlight the impact of public investment on private investment and growth by incorporating the various channels of influence from public investment to private investment. In the short run, public investment crowd out private investment on one hand as the highly positive significant coefficient of resource constraint variable *(S-IG/PI)* supports the hypothesis. On the other hand , public investment raises the productivity of private capital stock, as it complements private investment by creating infrastructure. So private investment cost requirements per unit of output are reduced. The empirical findings of this study indicate that public investment in Pakistan, has played a dual role i.e. crowding out of private investment on one hand in the short run and complementing private investment through infrastructure development on the other in the long run. These findings are supported by significant positive coefficient of public sector investment in the private investment function specification along with the positive coefficient *(S - IG/PI)*, of resource constraint variable.

Apart from raising the output expectations and investment requirements of the private sector , public sector investment has raised aggregate output and therefore improved

savings capacity, supplementing the economy's physical and financial resources and thus offsets part of initial short term crowding out effects on private investment.

The modified neoclassical framework for explaining private investment provides an excellent fit for output and investment in an underdeveloped country like Pakistan. The immediate crowding out of public investment, operating through constraining the availability of rescurces to the private sector, lowers the speed of adjustment of the private sector capital stock. As government of Pakistan has been following the policy of administering the nominal interest rates in the financial sector throughout past, there exists excess demand for private investment funds in Pakistan. So actual investment in fixed capital is constrained by the availability of limited savings. Since Pakistan's economy has been operating above capacity, so the response of private investment to changes in output has been observed as negative. The relative cost of capital is found to have a strong positive efficiency effect on capital along with a negative substitution effect on private investment behavior. Domestic savings behavior in Pakistan has been observed strongly sensitive to real interest rate and growth in real income. Increase in both , the real interest rate and income has generally tended to boost the domestic savings in Pakistan explaining the positive correlation.

The study incorporates the effects of interest rate changes that operate through their influence on the cost of capital as well as through the real interest rate for savings. These variables , in turn, influence the desired level of capital stock and its productivity, as well as the availability of savings (and thereby, the speed of adjustment of actual capital

stock to the desired level). The empirical results indicate that an increase in the interest rate in Pakistan has a significant negative substitution effect on investment and significant positive effect on savings. However, the efficiency effect of higher interest rate which raises the output growth and efficiency of capital, stimulates investment demand, counter acting negative substitution effect on private investment in Pakistan.. Thus the study highlights the channels through which interest rate effects are manifested and makes it possible to test various propositions of the classical and modern theories of interest rates.

The study also addresses the determinants of public sector investment within the present context. This incorporation of public sector investment as an econometric function in a simultaneous framework is an advancement over the earlier studies, where most of the times public investment function has not been tested empirically in a proper way . The results of the study establish a positive and direct link of public investment with that of foreign borrowing and output growth.

The policy implications of the exercise are straight forward.The authorities should make sure that the real financial resources to the private sector should not be curtailed. Otherwise it would be expected to have adverse effects on the level of private investment and to lead to a reduction in the economic growth. In general, attempts by the public sector to absorb a large share of domestic financial resources would tend to crowd out private investment to some extent. By the same token , if the total supply of foreign financing (foreign saving) to the country is limited , the amount available for the private

sector would tend to grow smaller as the public sector borrowings increase. Although this latter type of crowding out may not be quantitatively large in relation to domestic financial crowding out, nevertheless , the government must be conscious of the possibility.

APPENDIX I

TABLE 1

GROSS FIXED CAPITAL FORMATION

(Rs. Million)

Years	Private Sector(at Current prices)	Private Sector(at Constant prices 1980-81=100)	Public Sector (at Current Prices)	PublicSector(at Constant Prices 1980-81=100)
1971-72	3546.0	20220.0	3267.0	14702.0
1972-73	3726.0	20254.0	3920.0	17650.0
1973-74	3840.0	14699.0	6774.0	21246.0
1974-75	5208.0	13703.0	11010.0	23513.0
1975-76	7771.0	16675.0	16287.0	27883.0
1976-77	9215.0	17697.0	18642.0	28397.0
1977-78	10254.0	18205.0	20251.0	27423.0
1978-79	11271.0	18895.0	21856.0	28264.0
1979-80	14925.0	21512.0	26420.0	28584.0
1980-81	21609.0	21609.0	26099 .0	26099.0
1981-82	23331.0	22473.0	31258.0	29871.0
1982-83	26758.0	24988.0	35003.0	32515.0
1983-84	21418.0	27470.0	37794.0	32973.0
1984-85	37840.0	30663.0	42085.0	35985.0
1985-86	39959.0	31653.0	47586.0	38157.0
1986-87	44349.0	31437.0	55691.0	41534.0
1987-88	51769.0	3230.08	59497.0	39669.0
1988-89	64162.0	35197.0	69008.0	42103.0
1989-90	76563.0	39057.0	71513.0	42214.0
1990-91	91226.0	40203.0	86420.0	43668.0
1991-92	118878.0	44903.0	106482.0	47609.0
1992-93	134768.0	46551.0	121876.0	49869.0
1993-94	150369.0	47539.0	130508.0	48009.0
1994-95	173660.0	48468.0	155051.0	49739.0

Source:Pakistan Economic Survey(Various issues),Ministry of Finance, Government of Pakistan.

TABLE 2

PRIVATE AND PUBLIC SECTORS INVESTMENT AS PERCENTAGE OF TOTAL GROSS FIXED CAPITAL FORMATION AT CURRENT PRICES.

(In percent)

Years	Private Sector	Public Sector	Total
1971-72	52.05	47.95	100.00
1972-73	48.73	51.27	100.00
1973-74	36.18	53.82	100.00
1974-75	32.11	67.89	100.00
1975-76	32.30	67.70	100.00
1976-77	33.08	66.92	100.00
1977-78	33.61	66.39	100.00
1978-79	34.02	65.98	100.00
1979-80	36.10	63.90	100.00
1980-81	39.27	60.73	100.00
1981-82	36.43	63.57	100.00
1982-83	38.31	61.69	100.00
1983-84	40.42	59.58	100.00
1984-85	41.38	58.62	100.00
1985-86	41.17	58.83	100.00
1986-87	40.67	59.33	100.00
1987-88	42.07	57.93	100.00
1988-89	42.14	57.86	100.00
1989-90	46.81	53.19	100.00
1990-91	47.41	52.59	100.00
1991-92	48.08	51.92	100.00
1992-93	47.01	52.98	100.00

Source :Calculated from appendix table 1

TABLE 3
GROSS DOMESTIC INVESTMENT AND NATIONAL SAVINGS AS PERCENTAGE OF GNP (AT CURRENT PRICES)

(In percent)

Years	Gross Domestic Investment	National Savings
1971-72	13.99	12.70
1972-73	12.72	13.94
1973-74	13.09	10.13
1974-75	16.22	8.32
1975-76	18.04	12.80
1976-77	18.59	13.91
1977-78	16.72	14.68
1978-79	16.65	13.56
1979-80	17.17	14.47
1980-81	15.82	14.58
1981-82	16.43	13.51
1982-83	15.73	16.17
1983-84	15.39	14.35
1984-85	15.45	11.89
1985-86	15.29	15.49
1986-87	16.03	14.93
1987-88	15.65	12.82
1988-89	17.04	12.35
1989-90	16.43	13.52
1990-91	16.46	14.48
1991-92	17.89	12.97
1992-93	18.32	13.67

Source : Calculated from Appendix Table 1

APPENDIX II

Table 1
2SLS Estimates of Investment , Saving and Output Growth.
(1971-72 - 1994-95; N = 24)

Dependent variables	IP_t	Q_t	S_t	IG_t
Intercept	-8110.99	11582.7	7.89	1818.60
	(-4.59)	(1.49)	(2.29)	(0.94)
Q_{t-1}	-0.064	0.772		
	(-2.61)**	(10.56)*		
$(U/W)_{t-1}$	-14566.1	75996.4		
	(-2.65)**	(2.12)**		
TKS	0.074			
	(4.53)*			
IG_t	0.310			
	(2.36)**			
IP_{t-1}	0.472			
	(3.73)*			
Q_t			3.16	
			(3.44)*	
IP_t		3.90		
		(4.79)*		
IG_{t-1}		-0.80		0.784
		(-1.27)****		(9.55)*
RIR_t			0.192	
			(1.80)***	
S_{t-1}			0.158	
			(0.66)****	
GQ				332.49
				(1.58)****
FB				0.266
				(2.53)**
R^2	0.99	0.99	0.73	0.96
$Adj\ R^2$	0.99	0.99	0.68	0.95
$D.W.$	2.06	1.89	1.47	2.05
$F\text{-}Stat.$	381.2	2292.63	13.93	133.32

Notes : Figures in parentheses below the coefficients refer to t - statistics.
* The coefficients are statistically significant at 1-percent level.
** The coefficients are statistically significant at 5-percent level.
*** The coefficients are statistically significant at 10-percent level.
**** The coefficients are statistically significant at 15-percent level.

Table 2
2SLS Estimates of Investment , Saving and Output Growth.
(1971-72 - 1994-95; N = 24)

Dependent variables	IP_t	Q_t	S_t	IG_t
Intercept	-8110.99	-15435.58	8.132	1818.60
	(-4.59)	(-2.78)	(2.32)	(0.94)
Q_{t-1}	-0.064	0.543	3.33	
	(-2.61)**	(3.94)*	(3.34)*	
$(U/W)_{t-1}$	-14566.1			
	(-2.65)**			
TKS	0.074	0.287		
	(4.53)*	(3.19)*		
IG_t	0.310			
	(2.36)**			
$(U/W)_t$		48867.78		
		(1.63)****		
IP_{t-1}	0.472	1.98		
	(3.73)*	(3.39)*		
RIR_1			0.20	
			(1.86)***	
S_{t-1}			0.149	
			(0.612)****	
FB				0.266
				(2.53)**
IG_{t-1}				0.784
				(9.55)*
GQ				332.49
				(1.57)****
R^2	0.99	0.99	0.73	0.96
Adj R^2	0.99	0.99	0.67	0.95
D.W.	2.06	1.78	1.53	2.05
F-Stat.	381.52	2574.2	13.43	133.32

Notes : Figures in parentheses below the coefficients refer to t - statistics.

* The coefficients are statistically significant at 1-percent level.
** The coefficients are statistically significant at 5-percent level.
*** The coefficients are statistically significant at 10-percent level.
**** The coefficients are statistically significant at 15-percent level.

Table 3
2SLS Estimates of Investment , Saving and Output Growth.
(1971-72 - 1994-95; N = 24)

Dependent variables	Q_t	IP_t	S_t	IG_t
Intercept	-15435.58	-295.02	8.132	1818.60
	(-2.79)	(-0.177)	(2.31)	(0.94)
IP_{t-1}	1.98	0.442		
	(3.38)*	(2.62)**		
Q_{t-1}	0.543	-0.083	3.23	
	(3.94)*	(-2.48)**	(3.34)*	
$(U/W)_t$	48867.78	-9516.85		
	(1.63)****	(-1.33)****		
TKS_t	0.287	0.085		
	(3.19)*	(3.88)*		
(S-IG)/PI		0.092		
		(3.34)*		
RIR_t			0.200	
			(1.86)***	
S_{t-1}			0.149	
			(0.61)****	
FB				0.266
				(2.53)**
IG_{t-1}				0.784
				(9.55)*
GQ				332.49
				(1.57)****
R^2	0.99	0.98	0.73	0.96
Adj R^2	0.99	0.98	0.67	0.95
D.W.	1.8	1.61	1.53	2.05
F-Stat.	2574.2	220.15	13.43	133.32

Notes : Figures in parentheses below the coefficients refer to t - statistics.

* The coefficients are statistically significant at 1-percent level.
** The coefficients are statistically significant at 5-percent level.
*** The coefficients are statistically significant at 10-percent level.
**** The coefficients are statistically significant at 15-percent level.

Table 4
2SLS Estimates of Investment , Saving and Output Growth.
(1971-72 - 1994-95; N = 24)

Dependent variables	Q_t	IP_t	$(SD/P)_t$	IG_t
Intercept	-15435.58	-8110.9	-2.15	1818.60
	(-2.78)	(-4.59)	(-0.88)	(0.94)
Q_{t-1}	0.543	0.046		
	(3.94)*	(-2.61)**		
IP_{t-1}	1.98	0.472		
	(3.38)*	(3.73)*		
$(U/W)_t$	48867.8			
	(1.63)***			
TKS_t	0.287	0.073		
	(3.20)*	(4.53)*		
(U/W_{t-1})		-14566.1		
		(-2.65)**		
IG_t		0.310		
		(2.36)**		
RIR_t			0.118	
			(1.65)***	
$(SD/P)_{t-1}$			1.15	
			(5.71)*	
GQ			0.247	332.49
			(1.08)****	(1.57)***
FB				0.265
				(2.53)**
IG_{t-1}				0.784
				(9.55)*
R^2	0.99	0.99	0.68	0.96
Adj R^2	0.99	0.99	0.62	0.95
D.W.	1.8	2.06	1.50	2.05
F-Stat.	2575.2	381.52	10.93	133.32

Notes : Figures in parentheses below the coefficients refer to t - statistics.

* The coefficients are statistically significant at 1-percent level.
** The coefficients are statistically significant at 5-percent level.
*** The coefficients are statistically significant at 15-percent level.

Table 5
2SLS Estimates of Investment , Saving and Output Growth.
(1971-72 - 1994-95; N = 24)

Dependent variables	IP_t	Q_t	S_t	IG_t
Intercept	-1488.19	-31507.2	11.28	5794.29
	(-0.77)	(-3.65)	(2.46)	(3.55)
Q_{t-1}	-0.113	0.410		
	(-2.69)**	(3.12)*		
$(U/W)_t$	-190433.6			
	(-1.54)****			
TKS_t	0.111	0.280		
	(3.62)*	(3.25)*		
(S-IG)/PI	0.105			
	(3.77)*			
IP_{t-1}	0.378	2.61		
	(2.25)**	(4.16)*		
IG_t		1.37		
		(2.05)***		
GQ			0.738	
			(2.05)***	
RIR_1			0.541	
			(4.04)*	
SF			-1.32	
			(-3.67)*	
S_{t-1}			0.615	
			(3.73)*	
FB				0.112
				(1.20)****
IG_{t-1}				0.503
				(3.57)*
Q_t				0.028
				(2.63)**
R^2	0.98	0.99	0.76	0.96
Adj R^2	0.98	0.99	0.69	0.96
D.W.	1.6	1.8	2.0	1.95
F-Stat.	228.02	2779.3	11.41	166.2

Notes : Figures in parentheses below the coefficients refer to t - statistics.
* The coefficients are statistically significant at 1-percent level.
** The coefficients are statistically significant at 5-percent level.
*** The coefficients are statistically significant at 10-percent level.
**** The coefficients are statistically significant at 15-percent level .

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