IS PUBLIC SECTOR INVESTMENT PRODUCTIVE? SOME EVIDENCE FROM PAKISTAN

BY

Hafiz A Pasha*, M Aynul Hasan

A.F. Aisha Ghaus, M. Ajaz Rahseed

September 1995

* This paper has been prepared for presentation at the Fall Meeting of the Project Link, September 25-29, 1995 University of Pretoria, South Africa. The authors wish to thank Peter Pauly and Ashfaque Khan for valuable comments on an earlier version of the paper. Excellent research support was provided by Nadeem Ahmed and Nazia Bano.

INTRODUCTION

Pakistan has traditionally given a relatively low priority to the social sectors as reflected in poor human development indicators of the country. However, Pakistan has recorded a respectable economic growth rate of 6 percent per annum during the decade of the Eighties. Apparently, low levels of literacy and poor health standards had not acted as a constraint to growth in the past. In fact, the view has sometimes been put forward that because Pakistan placed higher priority on public investment in economic and physical infrastructure as opposed to larger development outlays in the social sectors (see Table 1) it was able to accelerate its growth rate. Lately, it has been argued that while this was a successful development strategy in the short run it was bound to fail eventually because of lack of human capital to sustain the process of future economic growth, especially in a changed international environment with greater competition for export among developing countries.

Undoubtedly, it is essential to develop a deeper understanding of the operation of the economy of a developing country like Pakistan and to analyse in a long-term macroeconomic setting the consequences of public investments in different sectors. In recent years, Pakistan has launched a major initiative with international donor agency support called the Social Action Program (SAP). The SAP represents a big push forward in the social sectors with some diversion of resources from traditional areas of priority. It is crucial to project the implications of this program not only on the process of social development but also on the overall rate of economic growth in a long-run perspective.

In the aftermath of the launching of the SAP, concerns have been voiced by the provincial governments in Pakistan, who are primarily responsible for the delivery of basic social services like education, health, water supply and sanitation, etc., about the financial sustainability of this program. These governments have rapidly realised that while accelerated development funding could potentially become available through SAP there is no obvious source of revenue for financing the downstream operations and maintenance expenditures of the facilities created, especially since some of the social sectors like education and health are highly recurring expenditure intensive. The lack of recurrent funding could, therefore, adversely affect the fiscal position of provincial governments and require either larger inter-govemmental revenue transfers or higher resource mobilisation. Therefore, it is necessary to develop a medium-to-long-term perspective on the financing needs of social sectors of Pakistan.

There has also been growing emphasis placed in the development literature [see Lloyd-Ellis (1993)] on the social progress of a nation as a necessary condition for sustained economic growth. It is now increasingly evident that investment in social sectors like primary education, basic health and housing along with changes in the land tenure system, social security and in the pattern of social relations are as, if not, more important than investment in commodity producing sectors or related infrastructure.

The issue of the impact directly on production in economic sectors of public expenditure has also been investigated recently in a more rigorous manner. Sturm and Haan [1995] review the empirical evidence for the USA on the impact of public capital stock on productivity. Their work represents an econometric refinement of the earlier work by Auschauer [1989], Munnell [1990] and Evans and Karras [1994]. The results are mixed in character. However, no work has been done in the context of developing countries on the productivity enhancing role of public investments.

TABLE 1

RANKING OF COUNTRIES IN INDICATORS OF DEVELOPMENT OF SOCIAL AND ECONOMIC INFRASTRUCTURE

Country	SOCIAL INFRASTRUCTURE								ECONOMIC INFRASTRUCTURE						Per Capita Income Ranking
	Primary Enrollment	Secondary Enrollment	Hospital Beds	Doctors	Nurses	Drinking Water	Sanitation	Overall Ranking	Electricity Generation	Roads	Telephones	Railway	Irrigation	Overall Ranking	
Nepal	10	10	10	9	5	8	10	10	10	8	7	10	5	9	10
Bangladesh	6	9	8	6	10	2	8	8	8	10	8	4	2	7	8
India	5	4	4	2	6	4	7	3	2	1	5	2	3	1	6
Nigeria	7	7	7	10	7	7	4	9	6	3	6	7	9	6	5
Pakistan	9	6	5	3	9	6	5	6	3	5	2	3	1	2	4
Sri Lanka	2	2	1	4	4	5	2	2	4	2	3	1	4	3	3
Egypt	4	1	2	1	1	1	1	1	1	4	1	6	7	4	2
Indonesia	1	3	6	5	8	9	3	4	5	7	4	8	6	5	1
Myanmar	3	8	9	7	3	3	6	5	7	6	9	5	8	8	7
Sudan	8	5	3	8	2	10	9	7	9	9	10	9	10	10	9

SOURCE: World Development Report, 1994, World Bank.

The need has been felt in Pakistan for developing a macro economic model incorporating explicitly the impacts of public expenditure, which is in excess of 30 percent of the GDP. Given the resource constraints being faced by all levels of government and the growing pressures to achieve greater macro-economic stability by cutting down the national budget deficit, it has become necessary to evaluate the inter-sectoral priorities of public investment from the viewpoint of the maximum impact on the long-term growth potential of the country. The basic issues are: **Should Pakistan reduce significantly the size of its public sector? Should there be a shift in development allocations away from economic to social infrastructure? Will the development allocations in the social sector alone be sufficient to produce a sustainable growth in the human capital and so on.**

Currently, the only major macroeconomic modelling initiative undertaken in Pakistan is that by the *Pakistan Institute of Development Economics* (PIDE). The first attempt was made in 1979 and a completed document was produced in 1982. The model was relatively small initially with 53 equations. In the latest vintage of the model [see Naqvi, et. al. [1992]] the size has increased to 97 equations. The model now includes detailed modules for sectors related to production, expenditure, labour market, international trade, etc. However, the model does not have a developed public finance module and does not get into the issue of public expenditure allocations to different sectors, including the social sectors. A relatively small 33 equations model has also been developed by the *AppliedEconomics Research Centre* [1993]. Although this model is rich on the public finance side, including fiscal linkages between federal and provincial governments, there is only a limited treatment of the macro economy.

In view of the emerging social development issues and need for changing public expenditure priorities this paper describes a large 196 equations integrated planning macroeconometric model for Pakistan's economy that has been developed by the *Social Policy and Development Centre* (SPDC). The model clearly establishes linkages between the macro economy, public finances and the social sectors. It addresses a number of major policy issues including the relative impact of public investments on economic and social infrastructure respectively on economic growth, the financial sustainability of the SAP, implications of privatization of the public ventures and decentralisation of the process of delivery of services, etc.

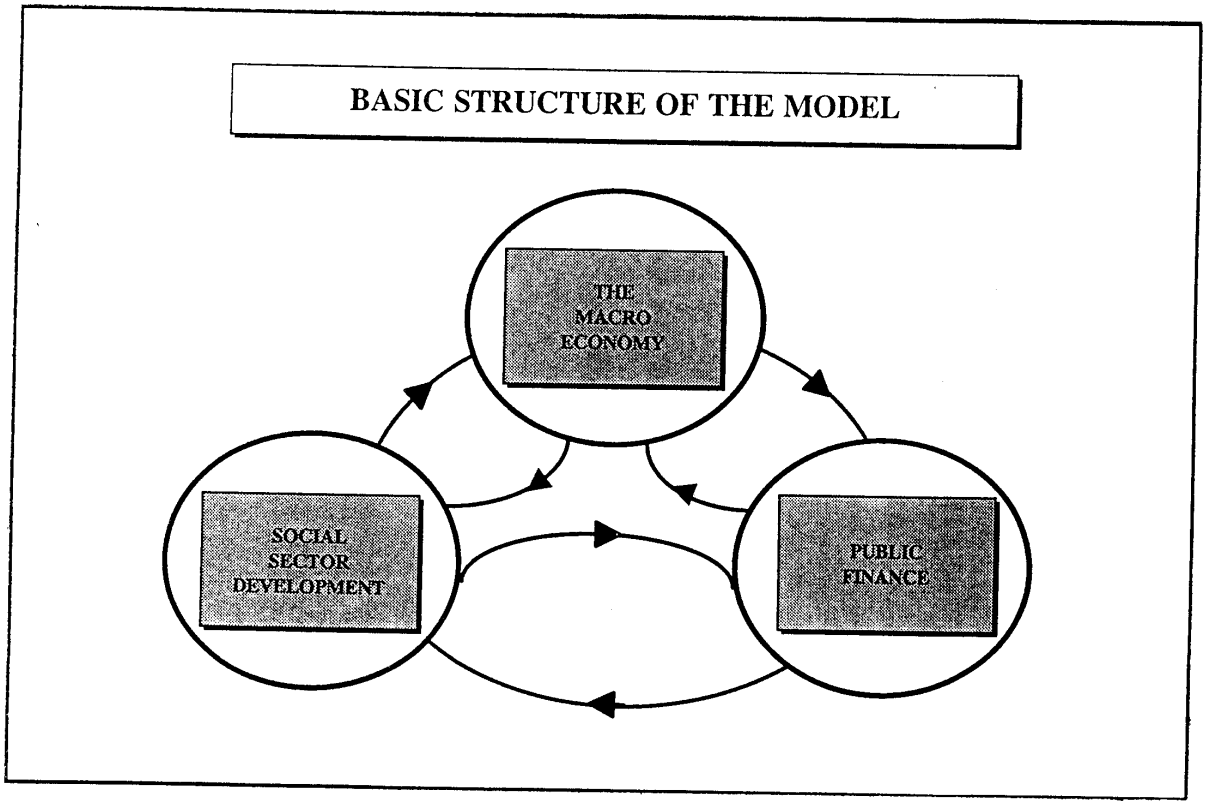
The paper is organised as follows: Section 2 gives the overall structure of the model and delineates the linkages of various modules, blocks and equations. It also describes the special features of the model including mechanisms for financing of social sectors and endogenisation of factor productivity by development of a human capital index which enters explicitly into production functions of the economic sectors. Section 3 gives the results of estimation and validation of the model. Section 4 presents the findings from some major policy simulations. Finally, in Section 5 are given the conclusions.

2. STRUCTURE AND LINKAGES OF THE MODEL

The model used in this study consists of 196 equations and covers several aspects of the economy. One of the unique features of the model is that, for the first tool wherein the social, public finance

and macroeconomic dimensions of the economy have been integrated under one system. The model is dynamic, rich in specification and based on a pragmatic approach. Due to its highly disaggregated character, covering all three levels of government (federal, provincial and local), the model is capable of predicting variables in greater detail even at the level of provision of individual social services. It should be noted that such a disaggregation of the model at the provincial level, in terms of revenue and expenditures on social services (e.g., schools, hospitals, doctors, teachers, enrollment, etc.) is, in fact, necessary particularly in order to analyse the impact *of SAP* on the macroeconomy. The broad links of the model can be traced as follows (see Flow Chart I):

FLOW CHART 1



Macroeconomy -> Public Finance:

The key link here is that developments in the macroeconomy influence the growth of tax bases of taxes (including divisible pool taxes) and thereby affect the fiscal status of different governments. Also, the overall rate of inflation in the economy affects the growth of public expenditure.

Public Finance -» Social Sector Development: The availability of resources, both external and internal, determines the level of development and recurring outlays to social sectors by different levels of government, especially the provincial and local governments.

Social Sector Development -> Macroeconomy: Higher output of educated workers and their entry into the labour force raises the human capital stock and could contribute to improvements in productivity and higher growth rate of output in the economy. Similarly, an improvement in public health standards may also have a favourable impact on production.

Public Finance -> Macroeconomy:

The level of government expenditure could exert a demand side effect on national income while the size of the overall budget deficit of the federal and provincial governments combined influences the rate of monetary expansion and consequently the rate of inflation in the economy.

Social Sector Development ->Public Finance: A vital link in the model is between the rate of social sector development and the state of public finances, especially of provincial governments, in terms of implications on the level of debt servicing and recurring expenditures.

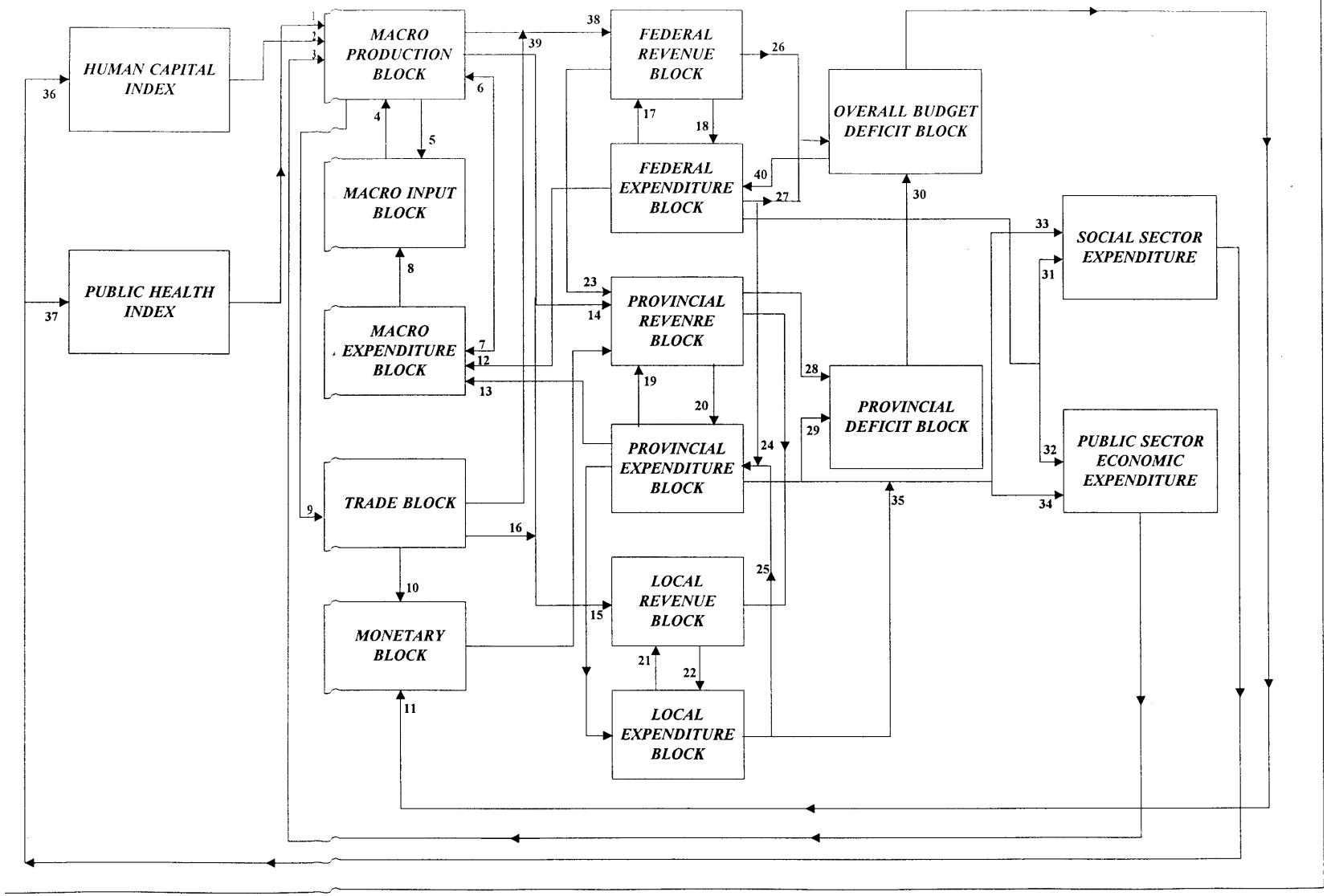
Macroeconomy -> Social Sector Development: Demographic and other socio-economic changes impact on the demand for social sector facilities like schools, hospitals, etc., and thereby influence the level of social sector outputs.

2.1 Intra-Module Linkages

Apart from these broad linkages among different modules, links exist between different blocks within each module too. Flow Chart 2 indicates the schematic diagram of the model along with intra-block linkages. In all, there are 39 major linkages in the model. Seven of these linkages are within the macro module, fifteen within the fiscal module and two within the social sector module. Major linkages within the macro module consist of, for example, the two-way linkage to and from the macro production block and macro input blocks (links 4 and 5). This link is due to the dependence of sectoral value added on the factors of production and input demand functions on the value of production. Similarly, two-way linkages between the macro production and macro expenditure blocks (link 6 and 7) arise due to the partial dependence of value added in the services sectors on public expenditure and the causality between income and private consumption. Link between macro production block and trade block (link 9) is due to the fact that value of imports and exports depend on the level of economic production activity. The trade gap affects the level of money supply captured by link 10.

Important linkages in the fiscal module consist of the simultaneous dependence of revenues of various levels of government and their expenditures. Non-tax receipts of governments have been made a function of the recurring expenditure on particular services via cost recovery ratios. Similarly, the level of government expenditure if affected by that government's level of resource generation. Important vertical links between levels of government include the fiscal transfers in the form of divisible pool transfers, non-development grants and ADP loans from federal to provincial governments (link 23) and development grant requirements (in line with the feasible level of decentralisation) from provincial to local governments (link 25). Link between the federal and provincial governments' budget deficits (link 30) and their revenues and expenditures is obvious.

FLOW CHART 2
SCHEMATIC DIAGRAM OF LINKAGES IN THE MODEL



2.2 **Financing of Social Sector Investments** The process of financing and execution of social services is quite complex in Pakistan with involvement of all three tiers of government. The principal responsibility of execution and maintenance of social sector projects rests with the provincial (state) and local governments. The role of the federal government is limited to the provision of social services in federally administered areas. Consequently, over 80 percent of the total expenditure on social sectors is incurred by the provincial and local governments, the share of the former being about 65 percent. However, the bulk of the financing is by transfers from higher levels of government.

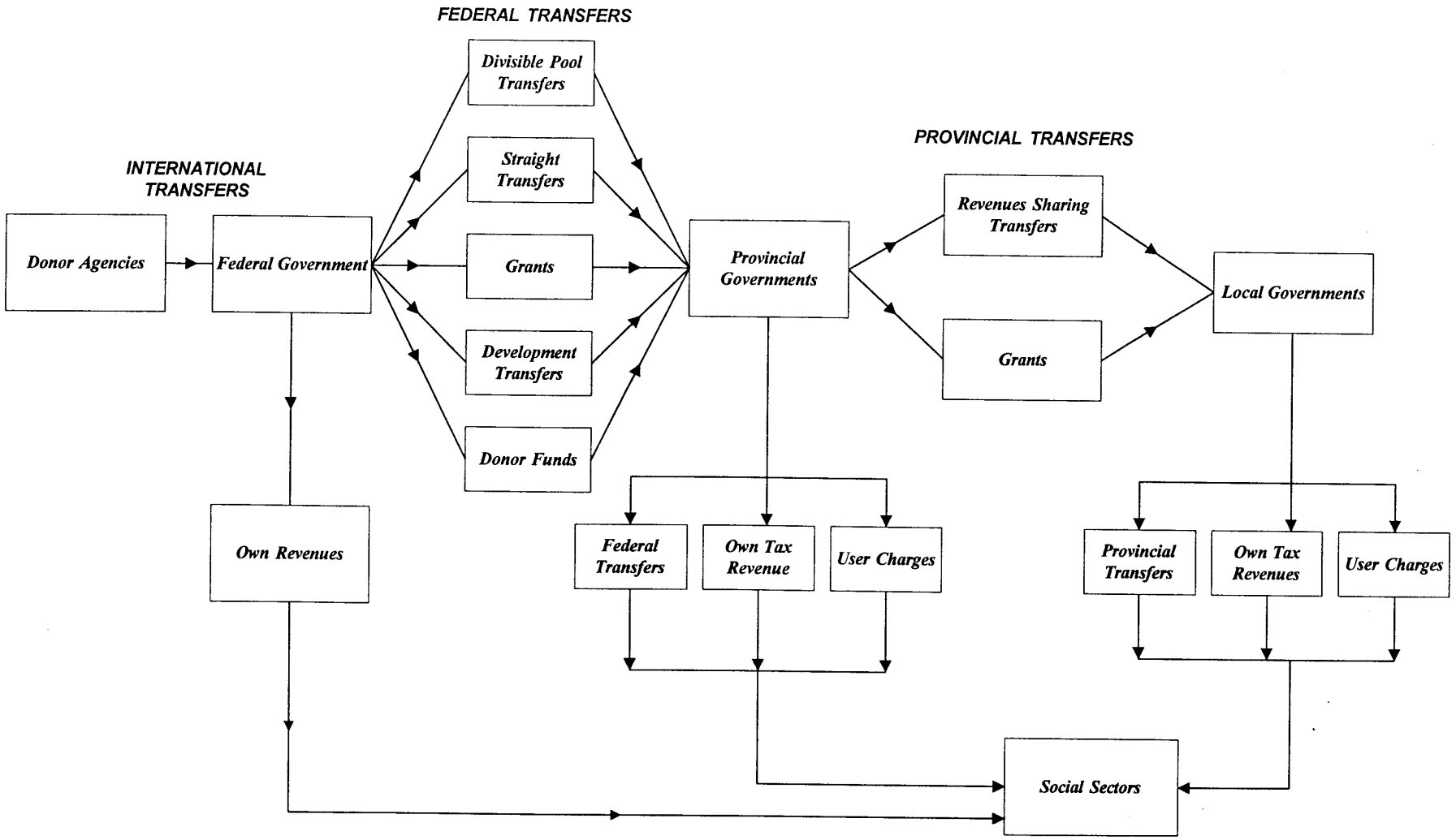
This is a consequence of the structural imbalance between the allocation of functional responsibilities and fiscal powers to different tiers of government which has necessitated the establishment of elaborate inter-govemmental revenue-sharing arrangements particularly between the federal and the four provincial governments. As shown in Flow Chart 3, provinces finance their expenditures from various tax and non-tax sources constitutionally under their fiscal powers, federal revenue sharing transfers (which includes divisible pool and straight transfers), grants and development transfers (including donor funds) received from the federal government. In 1994-95, for example, 15 percent of the provincial recurring expenditures was financed by own sources (8 percent taxes and 7 percent user charges), 75 percent from revenue sharing transfers, 11 percent from grants from federal government while almost all of the provincial development outlays were financed from federal development transfers, largely consisting of loans, and donor mnds. Clearly, the bulk of provincial income comes from the federal government and is outside the direct control of the provincial governments. As such, modelling of inter-governmental fiscal transfers is a crucial feature of the model.

The heavy provincial reliance on federal transfers is not a recent development but has been a feature of public finances since the independence of the country. The reliance, however, has been increasing over time. Currently, revenue-sharing transfers are equivalent to over 6 percent of the GDP. Renewed by the National Finance Commission (NFC) in 1990, divisible pool transfers to provinces include 80 percent of the proceeds of federal income and corporation tax, sales tax, export duty on cotton and excise duty on tobacco and sugar. Besides, 100 percent of the proceeds (net of collection costs) of surcharge on gas, royalty on gas and crude oil and excise duty on natural gas are transferred to the provinces as straight transfers. On the development side, transfers essentially consist of loans given on near market rate of interest.

The primary sources of provincial revenues consist of taxes on physical and financial assets like stamp duty, property tax, betterment tax, motor vehicle tax, land revenue etc. User charges partially finance the provision of economic and social services but the extent of cost recovery is low, particularly, in the case of the social services.

Unlike the provincial governments, local governments are largely self-financing entities in Pakistan. They largely rely on own tax and non-tax revenues to finance their on-going operation and maintenance costs and the development of new schemes. Almost 55 percent of the total (recurring + development) expenditure of local government is financed by own tax collection, 18 percent by user charges, 6 percent by revenue sharing transfers from the provincial governments and 8 percent by grants.

FLOW CHART 3
FINANCING OF SOCIAL SECTORS IN PAKISTAN



Octroi is the single largest source of revenue to urban local councils in the country. It is levied on goods imported into the municipality for sale, consumption or use. Export tax is the rural counterpart of octroi. It is levied on goods exported from the district. Revenue-sharing transfers in the case of local governments is limited to 85 percent of the proceeds of property tax. The local governments, however, have no autonomy on the administration of the tax.

2.3 Endogeniety and Factor Productivity of Public Investment One of the key features of this model is the inclusion of public sector investments in the form of social (human capital and public health indices) and economic infrastructure in the value added production function. It has been argued that along with private factor inputs (labour and capital) public sector investments may also contribute to the output of the economy. Unlike the private inputs, which directly influence the production, the role of public investments is in the form of creating positive externalities and enabling environment (e.g., educated and healthy workers, roads, electricity, etc.). The model has the ability estimate the direct and relative factor productivities of public social *vis-a-vis* economic infrastructure investments on the output of the economy.

The two types of public capital (social and economic) included in the model are endogenized under separate modules for human capital, public sector health and economic infrastructure. Within the human capital and public sector health modules, there exists a link between the level of social sector expenditures and the human capital and public health indices (links 35 and 36 in Chart 3) which, in turn, is expected to influence the productivity of the economy through the output production function (links 1 and 2). On the other hand, acting as a base for the public revenues, the output of the economy may also indirectly impact on the social variables through social sector expenditures.

3. ESTIMATION AND VALIDATION OF THE MODEL

Policy simulation exercises require the knowledge of the magnitude of parameters (e.g., marginal propensity to consume, marginal product of inputs, tax rates, etc.) and exogenous variables in the system. While the exogenous variables can be generated based on their historical trend values, estimation of the parameters reflecting the reality is more complex and needs consistent statistical regression techniques.

One of the problems in estimating the econometric model relates to the simultaneous character of equations where the endogenous variable in one equation feeds back into variables in other equations. Consequently, the error term for a given equation becomes correlated with the right hand side endogenous variables. This "errors in variables" problem arising due to simultaneity of equations may make the simple single equation ordinary least squares (OLS) estimates both biased and inconsistent.

Another important consideration in this context pertains to the stationarity of time series variables. Intuitively, stationarity is simply the proclivity of a variable moving towards its long-

run trend value after encountering a shock. In the absence of stationarity, the direct functional relationship between two or more non-stationary time series could be due to "spurious correlation".1 Consequently, the traditional properties of test-statistics (e.g., t-test and F-test) which are predicated on the assumption of stationarity of the time series may break- down.

In view of the above, ideally, the estimation technique(s) adopted should take into account the econometric problems of simultaneity and non-stationarity. Estimation methods, namely, two-stage least squares (2SLS), Zeilner's seemingly unrelated (SURE), three-stage least squares (3SLS) and full information maximum likelihood (FIML), may reduce the simultaneity bias while the non-stationarity problem may be avoided if the variables are Cointegrated or by using "Error Correction Model (ECM)".

On theoretical grounds, obviously, the systems of equations methods should be preferred to OLS, however, in terms of practical implementation, the usefulness of system based techniques is not clear [e.g., see Hasan (1987)] particularly for large models. This is due to the fact that the system methods, although they are asymptotically efficient, have two critical problems associated with them. First, any misspecification in the structure of the model will be propagated throughout the system, viz., specification error in one equation can affect the parameter estimates in all other equations in the model. Second, the finite samples variation (or error) of the estimated covariance matrix can be transmitted throughout the system. Consequently, the theoretical advantage of the system based methods in finite sample may be more modest than the asymptotic efficiency results. In the same way, the *ECM &nd Cointegration* techniques will be meaningful if the sample size is large. The estimated coefficients and accompanying test-statistics from these methods will be legitimate only when the length of time series is sufficiently large.

In the case of a developing country like Pakistan, in addition to the shortness of time series2, the quality of data is also soft . This is due to the fact that not enough consideration is given to collect and consolidate macroeconomic variables and at times the definition/coverage is changed on an *adhoc* basis.3 Furthermore, the period of estimation considered (1973-93) entails several shocks (or disturbances), some of which are external (e.g., oil prices changes, commodity prices, wars in neighbouring countries) while others are internal [e.g., political instability, rapid shift from one policy regime to another like exchange rate policy change, interest rate policy change and weather conditions (floods and droughts, etc)].

Therefore, in light of the above econometric and data considerations, we have opted to use the simple OLS (ordinary least square) technique to estimate the parameters of behavioural equations.

1 A plethora of literature is now available on this topic and readers may refer to the original articles by Engle and Granger (1987). An excellent intuitive exposition on stationarity and cointegration is also available in Moosa (1992).

2 Due to the break-up of Pakistan in 1971, a consistent data at the national level is available only after this period. This amounts to only 21 (1973-93) or at best 22 (1973-94) years of observations.

3 For instance, in 1987 the methodology to compute major macroeconomic series were changed and new data sets for these variables were reconstructed by the Bureau of Statistics (BOS) from 1980-81 onwards. Consequently, the series prior to 1981 had to be generated by the researchers based on regression methods, which may be different from the ones used by BOS.

This method is easy to implement and will restrict errors (both specification and data) to the equations affected. It should also be noted that, at the estimation stage, the specifications of some of the equations were revised in view of data limitations. Thus, based on a pragmatic approach and the knowledge of the economy, we included some other variables (as proxies) or, at times, dropped statistically insignificant variables from a given equation. In addition, dummy variables are also included in some equations to capture a one time or a permanent structural change (due to change in political regime, floods, etc.,) in the behaviour of a given time series. A list of dummy variables used in different equations and their possible explanations are given in *Appendix B.*

The estimation period of the model is from 1972-73 to 1992-93 with annual data. The model consist of three main modules i.e., macro, fiscal and social sector modules and these are again divided into 18 sub-modules. There are 81 behavioural equations and 115 identities, with 81 endogenous variables, 56 exogenous variables and 82 lagged endogenous variables. The estimated OLS regression results and other summary statistics for all the behavioural equations are given in *Appendix C.*

Summary Test Statistics

Along with traditional *t-stcitistics* and *R-square,* we have also conducted several other formal and informal statistical tests on each estimated equation to detect serial correlation, heteroscedasticity, and instability of the parameters and equations. A brief description of these tests are given below:

a) ***Serial Correlation LM Test:*** In the presence of lagged endogenous variable and no intercept term, the conventional *Durbin-Watson statistic* is considered only a partial test for serial correlation. Using *Breusch-Godfrey* test for autocorrelated disturbances, the serial correlation *LM test* correctly identifies the presence of both AR(p) and MA(p) process where *p* can be specified for any positive order.

b) ***ARCHLM Test:*** Since the size of the residual of some of the macroeconomic time series may be correlated with the magnitude of recent residuals, it is, therefore, possible that these disturbances will be heteroskedastic in nature. Like autocorrelation, the presence of heteroskedasticity in the residual of a time series variable may increase the standard error of the regression and thus make parameter estimates less efficient. The *ARCH LM* test simply detects the heteroskedasticity for a given equation.

c) ***White's Heteroskedasticity Test:*** In this test, the squared of the residual is regressed on all the right hand side variables with different polynomials. White (1980) argued that this is a general statistical test for testing the correct specification of the model.

In all the above three statistical tests, the underlying hypotheses are that there is no serial correlation, no heteroskedasticity and that the equation is correctly specified. Acceptance of these hypotheses based on F-statistics will reassure that the estimated parameters are efficient and that the equation is appropriately specified.

In addition to these three formal test-statistics, we have also used two other informal tests to

detect the presence of instability in the parameters of the equation. These informal tests are:

d) *Recursive Residuals* and e) *CVSVMTest.*

Both these informal tests produce residuals about the zero-line as well as a two standard deviation confidence band (plus and minus) along that zero line. A significant deviation of the estimated residual plots *(Recursive Residuals* and *CUSUM)* from the confidence bands may suggest instability of the parameter estimates.

Table 2 provides a summary of the number of parameters having significant t-values less than 5% and 10% levels, respectively, in each block of the model. Also reported in the table are the number of behavioural equations in each block having adjusted R-square greater than 95%, F-statistic values greater than 10% (based on the three formal tests) and residuals being within two standard deviation bands (based on the two informal tests). The summary results reported in the table are organized in terms of sub-modules and major blocks.

In general, based on t-values, it appears that over eighty-two percent (316 out of 385) of the estimated parameters in the model are statistically significant at least at or below the 10% levels. It is also interesting to note that about sixty-one percent (50 out of 81) of the behavioural equations have high explanatory power (represented by adjusted R2). Furthermore, based on the *LMtest*, over 85 percent of the total 81 behavioural equations have no serial correlation problem. In the remaining 15 percent of the equations, most of them are either borderline cases (implying very close or no serial correlation) while some may be in the indecisive region.

As for the presence ofheteroskedastic residuals measured by *ARCH LM test*. Table 2 indicates that 87 percent (71 out of 81) of the total number of equations are free from this problem. Based on *White's* test, over 60 percent (50 out of 81) of the equations seem to pass this formal specification test. On the other hand, based on *Recursive Residual* and *CUSUM* tests, over 72% and 92% of the equations in the model have parameters which are considered to be stable.

Given the shortness and softness of the time series data, the performance of the estimated parameters based on formal and informal statistical tests appears to be quite reasonable.

Validation of the Model

A good estimated individual equation does not necessarily guarantee good simulation results of the model. This is due to the fact that in a simultaneous equation framework when individual estimated equations (behavioural equations) are linked with other accounting identities and the endogenous variable in one equation feeds back into variables in another equation, there is no guarantee that the model, as a whole, when simulated, will produce the historical data reasonably well, despite the fact that the individual equations may produce good estimates. In order to conduct meaningful policy simulations in the presence of both identities as well as behavioural equations, it is, therefore, important that the model be tested and validated so that it may be able to replicate the historical data reasonably well.

We have used standard summary statistics, namely, root mean square percentage error (RMPSE) and Theil inequality coefficient (TIC)4 to measure how closely individual variables track their corresponding data series. *RMPSE* simply measures the combined bias and variance of the estimated *vis-a-vis* actual values of a time series in percentage form. Obviously, a smaller percentage value of *RMPSE* will be more desirable than larger ones.

Unlike *RMPSE*, *TIC*, on the other hand, consists of three components. These components are *bias*, *variance* and *covariance*. The *'bias'* component of the inequality coefficient is an indication of systematic error, since it estimates the average value of the simulated and actual series deviating from each other. These *TIC* values of a series will always lie between 0 and 1. As the value is close to 0, it becomes a more better fit, while if the value is close to 1, the model is considered to be badly fitted as compared to the given series. Table 3 reports cumulative frequency distribution tables and graphs on *RMPSE* and *TIC* for all variables in the model while Table 4 contains the actual values of these two summary measures for key variables.

Inspection of Table 3 reveals that about seventy percent (135 out of 196) of the endogenous variables in the model have *RMPSE* values below 10 percent. When *RMPSE* values are examined for key selected variables in Table 4, it appears that only 2 out of 24 variables exceed the 10 percent mark. In fact, the two variables which have large *RMPSE* (greater than 10%) are arrived at from accounting identities (domestic debt and overall budget deficit).

Measuring the performance of historical simulations based on *TIC*, it is evident from Table 3 that over ninety-four percent of the total number of variables in the model have values less than 0.1 and only 10 out of 196 variables have crossed the value of *TIC* greater than 0.1. As for key selected variables, *TIC* value has never exceeded 0.04.5

Thus, based on summary statistics *(RMPSE* and *TIC)* and comparing the graphs of actual and simulated series in the historical period, it appears that the estimated model has the power to replicate fairly well the historical data for endogenous variables.

---

4 Exact formula for these summary measures are available in Pindyck and Rubinfeld (p. 3 38-41, 1991).

5 Another important criterion to validate the performance of simulation series is how well the model replicates the turning points in its historical path. With the exception of two human capital index variables all other variables (22 of them) simulated by the model are not only very close to each other but more importantly the forecasted series (of these variables) have also captured most of the turning points in actual variables. Graphs of actual and simulated series for selected key variables of the model are reported in Pasha, Hasan, Ghaus et. al. (1995)

TABLE 2

SUMMARY OF REGRESSION RESULTS AND STATISTICAL TESTS

Block		Total Number of Behavioural Equations in the Blocks	Total No. of Parameters in the Blocks	t - Statistics Significant at		No. of Equations Having					
						Adjusted R-Square	Serial Correlation LM Test	Hetcroske-Dasticity ARCH LM Test	Specification Test White's Test (No Cross Terms)	Stability Test Recursive Residual	Stability Test CUSUM Test
				=< 5 %	>5% to 10%	> 95 Percent	Pr. (F) > 10 %	Pr. (F) > 10 %	Pr. (F) > 10 %	Within Band	Within Band
MACRO ECONOMIC BLOCK											
A	Macro Economic Production Block	3	15	14	1	3	3	2	1	2	3
B	Macro Input Demand Block	4	22	18	1	4	4	4	3	3	4
C	Macro Economic Expenditure Block	4	22	15	1	3	4	3	3	4	4
L	Trade Block	3	16	11	2	2	3	3	3	3	2
M	Monetary Block	1	7	2	2	1	1	1	1	1	1
N	Price Block	6	27	23	-	6	6	5	3	4	5
	TOTAL	*21*	*109*	*83*	*7*	*19*	*21*	*18*	*14*	*17*	*19*
FISCAL BLOCK											
D	Federal Revenue Block	5	25	17	1	5	3	5	3	2	5
E	Federal Expenditure Block	5	22	18	2	5	4	5	4	5	5
G	Provincial Revenue Block	4	13	12	-	4	2	4	2	2	2
H	Provincial Expenditure Block	10	50	41	2	10	10	10	8	9	9
J	Local Revenue Block	3	6	6	-	3	2	2	1	1	3
K	Local Expenditure Block	8	37	24	1	8	6	5	4	3	7
	TOTAL	*35*	*153*	*118*	*6*	*35*	*27*	*31*	*22*	*22*	*31*
SOCIAL SECTOR BLOCK											
O	Human Capital Index Block	15	74	55	4	15	12	12	6	10	15
P	Public Health Index Block	10	49	38	5	10	9	10	8	10	10
	TOTAL	*25*	*123*	*93*	*9*	*25*	*21*	*22*	*14*	*20*	*25*
	GROSS TOTAL	*81*	*385*	*294*	*22*	*79*	*69*	*71*	*50*	*59*	*75*

1. Serial Correlation measured by LM F-Statistics at 2 lags.
2. Heteroskedasticity as measured by LM ARCH at 1 lag.
3. White's Test with no cross terms.
4. For Recursive and CUSUM Tests a two Standard Deviation Band has Considered
5. Intercept, Dummy Variables are also included in the Calculation of t-values.

4.2 SAP Development Expenditures Having examined the impact of social investments on the macroeconomy, it is now important to investigate whether *the SAP* type plan with only development expenditures will be able to produce long term sustainable results for the social sectors. This is critical as many of the special development programmes such as *SAP* were initially designed with no specific provisions for recurring expenditure liabilities. In other words, schools or basic health centres were constructed without giving due consideration to the ongoing needs for teachers, books, doctors, nurses, medications, etc. As before, we first explain the transmission mechanism using a flow chart through which the above policy will permeate the macroeconomy and subsequently analyse the impact of such a policy in terms of numerical figures. For pedagogical reasons and to get a deeper insight, we assume a three-year *SAP* with one billion rupees additional investment every year of which fifty percent is borrowed from donors and the rest generated domestically by the federal government.

Flow Chart 5 shows the schematic linkages of the above type *of SAP* in the form of a special *annual development program (ADP)* which, of course, comes from both external and internal borrowing. These two types of borrowing each year will add to the overall deficit of the economy. Since the implementation of *SAP* is the responsibility of the provincial governments, the federation will transmit *SAP* development funds *via* special provincial development transfers. These funds, subsequently, based on some guidelines, will be divided into three specific social programmes, namely primary schools, *basic health units (BHUs)* and *rural health centres (RHCs)* and other social services (e.g., clean water, sanitation and population planning). Construction of these physical social infrastructure is expected to have an impact on both human capital and public health endowments of the society (through educated and healthy labour force) and, thus, in due course, is expected to have an impact on the economy's broad macroeconomic aggregate such as *GDP*. Higher *GDP* will subsequently enhance the tax bases, thus increasing the revenues of the provincial governments. With improved revenue position of the provincial governments it may also improve the revenue surplus/deficit of these governments. On the other hand, the development transfers to the provinces will also have immediate implications on provincial debt servicing liabilities placing a negative effect on the revenue surplus/deficit of these governments. Thus, the net effect on the revenue surplus/deficit of the provincial governments will be ambiguous. However, the overall deficit of the economy will unambiguously rise at least in the period when the federation is engaged in borrowing to finance *SAP*.

The numerical values of the impact of the above policy on key variables are reported in Table 6. For convenience, we have provided simulation results for the short-run (1994-95), medium-run (1997-98) and long-run (2002-03). As expected, the social infrastructure variables, namely, schools, hospital beds and *RHCs* have improved and this is reflected in higher student participation rates, human capital and public health indices. It is, however, important to note that the above type *of SAP*, having no provision for recurring expenditures (e.g., teachers, doctors, etc.), will eventually end up providing facilities with lower qualities. This is manifested in the decline of ratios of teachers to school, doctor to beds and *RHCs* as shown in Table 6.

As for the fiscal variables, provincial debt servicing liabilities will increase up to rupees one-half billion and about Rs. 200 million in use of provincial cash balances by the year 2002-03. Recurring liabilities have also increased but not commensurate with the initial development expenditures. This is due to the fact that no funds have been earmarked for recurring expenditure. It is also interesting to note that, due to improved provision human capital, *GDP* has increased

FLOW CHART 5
A SCHEMATIC FLOW DIAGRAM OF THE IMPACT OF SAP (DEVELOPMENT) ON THE MACRO ECONOMY

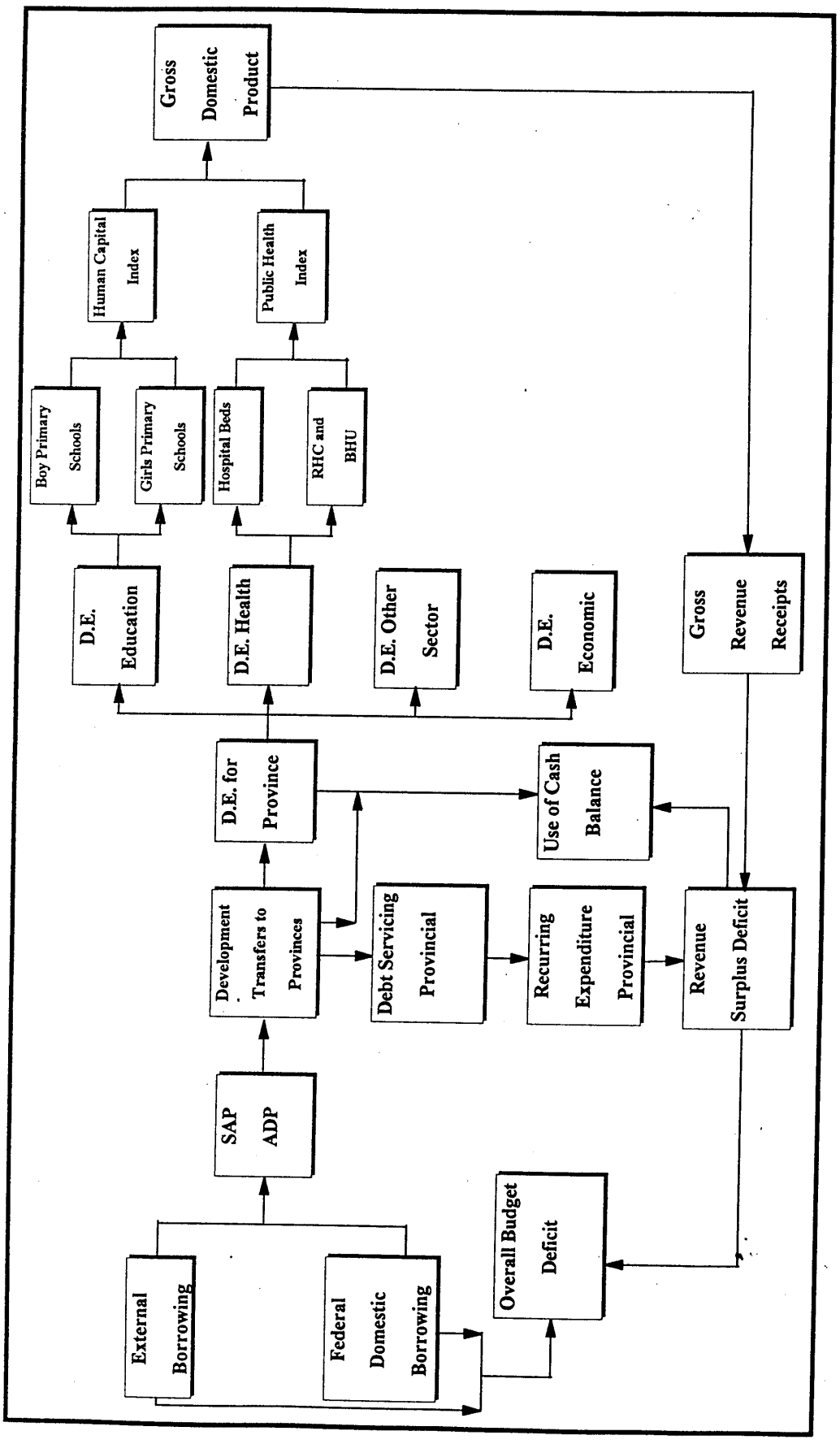


TABLE - 6

IMPACT OF SAP DEVELOPMENT EXPENDITURE ON MACRO ECONOMY

A. Social Sector Magnitudes	Short Run 1994-95	Medium Run 1997.98	Long Run 2002-03
Teacher to School Ratio Male	0.000	0.000	0.002
Female	-0.318	-0.390	-0.308
Hospital Beds	0	0	187
Rural Health Center (RHC)	0	136	136
Doctor to Bed Ratio	0.000	0.000	-0.001
Doctor to RHC's Ratio	0.000	-0.424	-0.242
Human Capital Index	0.02	0.14	0.70
Public Health Index	0.34	5.53	5.83
B. Fiscal magnitudes			
Federal Net Revenue Receipts	208	421	1,087
Federal Expenditure	383	1,539	4,537
Federal Budget Deficit	1,102	1,082	3,549
Provincial Revenue Receipts	6	69	587
Total Provincial Expenditure	1,221	496	1,042
Expenditure on Social Sectors (Dev.)	1,009	62	144
Expenditure on Social Sectors (Rec.)	205	376	663
Provincial Revenue Deficit	(205)	(364)	(292)
C. Macro magnitudes			
Overall Budget Deficit	1,307	1,446	3,841
Value Added in Agriculture	12	93	508
Value Added in Manufacturing	3	29	340
Value Added in Other Sectors	12	96	651
Gross Domestic Product	28	228	1,638

Note: Numbers in section B & C represents change from baseline simulation due to Rs. 1 Billion increase for three consecutive years

by over one and a half billion and this has also resulted in improved gross revenue receipts by over half a billion by the year 2002-03. The overall deficit position of the economy has deteriorated by about four billion rupees.

In summary then a *SAP* policy, with only development expenditures, is expected to elevate the provision of social physical infrastructure (schools, beds, RHCs) without having a corresponding increase in other recurring type inputs, namely, teachers, books, doctors, nurses, medications, etc. Thus, as a result, initially the performance of the social sector may improve, however, as soon as the development programme ends after three years, the quality of provision of social services will decline due to lack of necessary recurring inputs. The long-term consequences of such a programme may result in additional schools without enough teachers and hospitals with inadequate supply of medication, doctors and *nurses. Hence, though this type of SAP programme* ... "^y *not* ^Part a greater burden on the overall deficit of the economy, such a programme will certainly not achieve the stipulated long-run objective of improving the social conditions of the masses.

4.3 Increase in Private Investment

Increase in private investment registers its impact via the macro-expenditure block and the macro-input block (through an increase in capital stock). There is an increase in production and thereby in *gross* domestic product. Enhancement in economic activity expands federal/provincial/local tax bases and, therefore, revenues which leads to an increase in expenditures and an improvement in fiscal status of the governmental units. There is also an increase in expenditures on social services which via the social sector module leads to an improvement in social sector indices and further accentuates growth in economic activity. Flow Chart 6 traces through these linkages.

Table 7 shows that a 50 percent increase in private investment in 1993-94 improves the fiscal status of all levels of government through a reduction in the budget deficit. The overall national budget deficit is lower by about Rs 8'/2 billion by the turn of the decade. This improvement is, in part, achieved through an increase in revenues and a reduction in expenditures at the federal level. There is an increase in revenues of over Rs 3 billion in 2002-03. Also, in the long run, federal recurring expenditure declines due to a reduction in debt servicing liability. This is lower by Rs 3.8 billion by the year 2002-03. In the case of provincial and local governments, the improvement in fiscal status is primarily because of an increase in the resources.

Higher subnational resources are, in part, translated into higher expenditures. Expenditures on social sectors by the provincial governments are likely to be higher by over a billion rupees by the turn of the decade. Consequently, the human capital index, particularly of the manufacturing sector, and the public health index improve, stimulating the economy and increasing GDP by over Rs 7½ billion in the long run.

In short, higher private investment impacts upon the fiscal position of different tiers of government and thereby affects the social sectors also. Positive impact is registered both on the public finances and the economy in the short run and, through dynamic effects, is likely to be accentuated in the long run.

FLOW CHART 6
MACRO POLICY SIMULATIONS
[Dynamic Impact of Higher Private Investment]

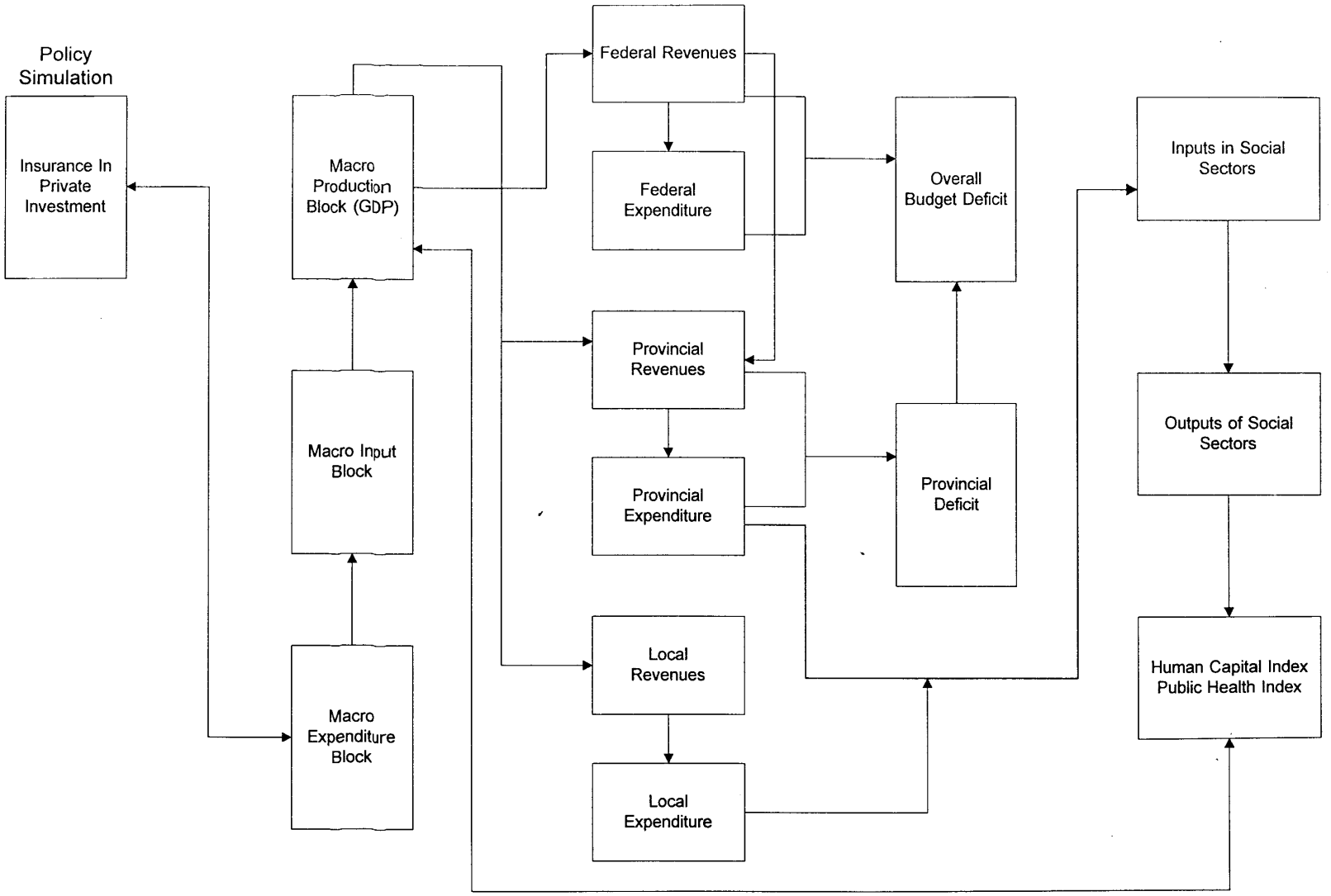


TABLE - 7

IMPACT OF CHANGE IN PRIVATE INVESTMENT ON MACRO ECONOMY

A. Social Sector Magnitudes	Short Run 1994-95	Medium Run 1997-98	Long Run 2002-03
Teacher to School Ratio Male	0.001	0.004	0.018
Female	0.002	0.009	0.027
Hospital Beds	0	0	6
Rural Health Center (RHC)	0	0	5
Doctor to Bed Ratio	0.000	0.001	0.004
Doctor to RHC's Ratio	0.002	0.014	0.036
Human Capital Index	0.06	0.19	0.40
Public Health Index	0.04	0.26	1.23
B. Fiscal magnitudes			
Federal Net Revenue Receipts	143	781	3,149
Federal Expenditure	18	(171)	(3,772)
Federal Budget Deficit	(113)	(883)	(6,526)
Provincial Revenue Receipts	167	943	3,893
Total Provincial Expenditure	62	429	2,217
Expenditure on Social Sectors (Dev.)	9	46	233
Expenditure on Social Sectors (Rec.)	28	195	958
Provincial Revenue Deficit	117	584	2,072
C. Macro magnitudes			
Overall Budget Deficit	(230)	(1,467)	(8,598)
Value Added in Agriculture	1	13	108
Value Added in Manufacturing	474	1,971	5,734
Value Added in Other Sectors	4	46	312
Gross Domestic Product	568	2,449	7,514

CONCLUDING REMARKS

This paper represents a first attempt at developing a relatively large (196 equations) planning macroeconometric model for Pakistan that integrates the social, public finance and macroeconomic dimensions of the economy. The model is dynamic, behaviourally rich in specification, based on a pragmatic approach and incorporates a large number of inter-module and inter-block linkages. Special features of the model include the detailed modelling of the process of financing of social sectors with special emphasis on inter-govemmental transfers and explicit incorporation of the impact of economic and social infrastructure on the productive sectors, with the latter being captured by changes in factor productivity measured by human capital and public health indices, especially developed as part of the model.

Despite the shortness of the time series and softness of some of the data the application of a number of formal and informal econometric tests to check for goodness-of-fit, serial correlation, heteroskedasticity and specification reveal that the model performs fairly well. The use of a number of dummy variables is justified on the grounds of random shocks and structural shifts. The validation exercise also highlights the high ex post forecasting power of the model.

A number of important policy simulations have been undertaken of the model which lead to some key insights. For example, a change in public investment priority from economic towards social infrastructure depresses the GDP in the short run but pays dividends in terms of a higher national income after a lag of about eight years. Similarly, launching of accelerated development programs in the social sectors like the SAP have significant GDP impacts but could exacerbate the problem of the national budget deficit. Altogether, the model has considerable flexibility and can be used to answer a number of important policy questions.

$NENSE_M$	Number of Male Enrollment at Secondary Level
NFI^r	Net Factor Income from Abroad in Real Terms
NHBED	New Hospital Beds
NLR_F	Total Female Literate
NLR_M	Total Male Literate
NPS_F	New Female Primary School
NPS_M	New Male Primary School
NRCH	New RHCs
NRR_F	Federal Net Revenue Receipts
NSS_F	New Female Secondary School
NSS_M	New Male Secondary School
$NWPR_F$	Number of Female Workers with Primary Education
$NWPR_M$	Number of Male Workers with Primary Education
$NWSE_F$	Number of Female Workers with Secondary Education
$NWSE_M$	Number of Male Workers with Secondary Education
	O
OCT_L	Local Octroi
OIT_P	Other Indirect Taxes Provincial
ORE_F	Other Federal Recurring Expenditure
OT_L	Local Taxes Others
$OUTPR_F$	Output of Female from Primary Level
$OUTPR_M$	Output of Male from Primary Level
$OUTSE_F$	Output of Female from Secondary Level
$OUTSE_M$	Output of Male from Secondary Level
	P
PHI	Public Health Index
PI	Price Index (Implicit GDP Deflator)
PI_{GC}	Price Index for Government Consumption
PI_{GI}	Price Index for Government Investment
PI_M	Price Index of Manufacturing Goods
PI_{WG}	Price Index Wholesale General
$PRENR_F$	Female Primary Enrollment
$PRENR_M$	Male Primary Enrollment
PT	Property Tax
PTHOS	Patient Treated Production Function for Hospitals
PTRHC	Patient Treated Production Function for RHCs
	R
REDOH	Recurring Expenditure on Doctors in Hospital
REDOR	Recurring Expenditure on Doctors in RHCs
RED_P	Provincial Revenue from Education
REED	Total Recurring Expenditure on Education
REEDHE	Recurring Expenditure on Higher Education
$REED_L$	Local Recurring Expenditure on Education
$REED_P$	Provincial Recurring Expenditure on Education
$REEDPR_F$	Recurring Expenditure on Education Female Primary
$REEDPR_M$	Recurring Expenditure on Education Male Primary
$REEDSE_F$	Recurring Expenditure on Education Female Secondary
$REEDSE_M$	Recurring Expenditure on Education Male Secondary
RE_F	Total Recurring Expenditure Federal
REH	Total Recurring Expenditure on Health
REH_L	Local Recurring Expenditure on Health
REHOT	Recurring Expenditure on Other facilities (MCH, TBC, SHC)
REH_P	Provincial Recurring Expenditure on Health
RE_L	Total Local Recurring Expenditure
RENUH	Recurring Expenditure on Nurses in Hospital
$REOT_L$	Local Recurring Expenditure on Other Services
$REOT_P$	Provincial Recurring Expenditure on Other Sectors
$REOTS_L$	Local Recurring Expenditure on Other Social Sectors
$REOTS_P$	Provincial Recurring Expenditure on Other Social Sectors
RE_P	Total Provincial Recurring Expenditure
REPAH	Recurring Expenditure on Paramedics in Hospital
REPAR	Recurring Expenditure on Paramedics in RHCs
REP_F	Repayment of External Debt
RG^r	Resource Gap in Real Term
RH_P	Provincial Revenue from Health
ROT_P	Provincial Revenue from Other **Non-Taxes**
RSD_L	Local Revenue Surplus or Deficit
RSD_P	Provincial Revenue Surplus or Deficit
	S
SD_P	Stamp Duties
$SEENR_M$	Male Secondary Enrollment Ratio
$SEENR_F$	Female Secondary Enrollment Ratio
$SPIE_F$	Stock of Physical Economic Infra-Structure Federal
$SPIE_P$	Stock of Physical Economic Infra-Structure Provincial
SPS_F	Total Female Primary School
SPS_M	Total Male Primary School
SSS_F	Total Female in Secondary School
SSS_M	Total Male in Secondary School
$STOK^r$	Stock in Real Terms
STR_F	Federal Revenues from Sales Tax
SUB^r	Subsidies in Real Terms
	T
TDOH	Total Doctors in Hospitals
TDOR	Total Doctors in RHCs
$TEPS_F$	Teacher Female Primary School
$TEPS_M$	Teacher Male Primary School
$TESS_F$	Teacher Female Secondary School
$TESS_M$	Teacher Male Secondary School
THBED	Total Stock of Beds in Hospital
TNT_L	Total Local Non-Taxes
TNT_P	Total Provincial Non-Taxes
TNUH	Total Nurses in Hospitals
TPAH	Total Paramedics in Hospitals
TPAR	Total Paramedics in RHCs
TRHC	Total Stock of RHCs
TT_L	Total Local Taxes
TT_P	Total Provincial Taxes
	U
U	Unemployment Rate
UCB_P	Provincial Use of Cash Balances
	X
X^r	Total Export in Real Terms
X^r_g	Total Export of Goods in Real Terms
	Y
Y^r	Gross Domestic Product in Real Terms
Y^r_A	Value-added in Agriculture Sector in Real Terms
Y^r_M	Value-added in Manufacturing Sector in Real Terms
Y^r_N	Gross National Product in Real Term
Y^r_{OT}	Value-added in Other Sectors in Real Terms

δ_1	Depreciation in Capital Stock in Manufacturing Sector (= 10%)
δ_2	Depreciation in Capital Stock in Agriculture Sector (= 7.5%)
δ_3	Depreciation in Capital Stock in Other Sector (= .05%)
δ_4	Male Death Rate over Ten Years
δ_5	Adult Literacy Rate in Male
δ_5	Female Death Rate over Ten Years
δ_7	Adult Literacy Rate in Female
δ_8	Death Rate of Workers with Primary Education
δ_9	Death Rate of Workers with Secondary Education
δ_{10}	Depreciation in Public Infra-structure (Economic
**	All the variables are expressed in constant 1980-81 million rupees unless otherwise states

APPENDIX C

EQUATION NUMBER	$\overline{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]
A. MACRO ECONOMIC PRODUCTION BLOCK					
A-1 Gross Domestic Product					
$Y^r = Y^r_A + Y^r_M + Y^r_{OT} + IT^r - SUB^r$					
A-2 Value Added in Agriculture Sector					
$\ln Y^r_A = \underset{(34.0)^*}{+ 4.640} + \underset{(19.8)^*}{0.649 \ln \overline{A}} + \underset{(7.62)^*}{0.350 \ln \left[SPIE_P + SPIE_F\right]} + 0.003\ HCI_A$					
$\underset{(-3.55)^*}{- 0.083\ DA2_{84}} \underset{(-4.63)^*}{- 0.072\ DA2_{85-87}} \underset{(4.85)^*}{+ 0.083\ DA2_{74,92}}$	0.99	2.54	0.21	0.0096	0.079
A-3 Value Added in Manufacturing Sector					
$\ln Y^r_M = \underset{(4.13)^*}{+ 1.276} + \underset{(9.13)^*}{0.309 \ln L_M} + 0.686 \ln \left[K^r_M + SPIE_F\right]$					
$\underset{(2.84)^*}{+ 0.004\ HCI_M} \underset{(-8.66)^*}{- 0.201\ DA3_{76-81}} \underset{(1.83)^{***}}{+ 0.079\ DA3_{81}}$	0.99	1.44	0.63	0.35	0.43
A-4 Value Added in Other Sectors					
$\ln Y^r_{OT} \underset{(3.15)^*}{+ 1.642} + \underset{(13.9)^*}{0.750 \ln \left[K^r_{OT} + SPIE_F\right]} + \underset{(2.64)^*}{0.001\ HCI_{OT}}$					
$+ 0.249 \ln L_{OT} \underset{(6.09)^*}{+ 0.131\ DA4_{73-76}}$	0.99	1.90	0.89	0.84	0.007
A-5 Indirect Taxes					
$IT^r = \left[\frac{IT_F + IT_P + IT_L}{PI_{WG} / 100}\right]$					
A-6 Subsidies					
$SUB^r \equiv \left[\frac{\overline{SUB}}{PI_{WG} / 100}\right]$					
A-7 Gross National Product					
$Y^r_N \equiv Y^r + NFI^r$					
A-8 Net Factor Income					
$NFI^r \equiv \overline{RM}^r - \left[\frac{INTED_F}{\overline{PI}_{IMP} / 100}\right]$					
B. MACRO INPUT DEMAND BLOCK					
B-1 Capital Stock in Agriculture Sector					
$K^r_A = (1 - \delta_1) K^r_{A-1} + I^r_{PA}$					
B-2 Capital Stock in Manufacturing Sector					
$K^r_M = (1 - \delta_2) K^r_{M-1} + I^r_{PM}$					
B-3 Capital Stock in Other Sectors					
$K^r_{OT} = (1 - \delta_3) K^r_{OT-1} + I^r_{POT}$					
B-4 Labour Input Demand in Agriculture Sector					
$\ln L_A = \underset{(-2.40)^*}{- 1.669} + \underset{(2.17)^{**}}{0.187 \ln Y^r_A} + \underset{(2.07)^{**}}{0.485 \ln L_{A-1}} \underset{(-0.32)}{- 0.024 \ln K^r_A}$					
$\underset{(0.70)}{+ 0.091 \ln \left[SPIE_F + SPIE_P\right]} \underset{(-7.19)^*}{- 0.117\ DB4_{93}} \underset{(2.10)^{***}}{+ 0.029\ DB4_{86}}$	0.99	1.40	0.25	0.34	0.06
B-5 Labour Input Demand in Manufacturing Sector					
$\ln L_M = \underset{(-3.62)^*}{- 1.228} + \underset{(12.2)^*}{0.484 \ln Y^r_M} \underset{(-4.56)^*}{- 0.254 \ln K^r_M} \underset{(5.95)^*}{+ 0.012 \ln K^r_M * DB5_{75-79}}$					
$\underset{(4.02)^*}{+ 0.099\ DB5_{80-81}} \underset{(2.45)^{**}}{+ 0.068\ DB5_{91-92}}$	0.96	1.67	0.77	0.57	0.55
B-6 Labour Input Demand in Other Sectors					
$\ln L_{OT} = \underset{(-34.1)^*}{- 4.628} + \underset{(6.44)^*}{0.358 \ln Y^r_{OT}} + \underset{(4.42)^*}{0.201 \ln \left[SPIE_F + SPIE_P\right]}$					
$\underset{(-7.95)^*}{- 0.123\ DB6_{86}} \underset{(1.48)}{+ 0.024\ DB6_{79}}$	0.99	1.50	0.47	0.18	0.10
B-7 Total Labour Input Demand					
$LABIND \equiv L_A + L_M + L_{OT}$					

EQUATION NUMBER	$\bar{R}^2$	D.W.	S.C.I.M[1]	ARCH[2]	W.H. NCT[3]
B-8 Total Labour Force					
$\ln LABFO = \underset{(9.47)^*}{+\ 0.660 \ln \overline{POP10}_M} \underset{(4.02)^*}{+\ 0.291 \ln \overline{POP10}_F} \underset{(8.31)^*}{+\ 0.035\ DB8_{77-84}} \underset{(-4.57)^*}{-\ 0.032\ DB8_{91-93}}$	0.99	2.72	0.31	0.48	0.35
B-9 Unemployment Rate					
$U = \left[1 - \frac{LABIND}{LABFO}\right] * 100$					
C. MACRO ECONOMIC EXPENDITURE BLOCK					
C-1 Total Consumption Expenditure					
$C^r = C_p^r + C_g^r$					
C-2 Private Consumption Expenditure					
$C_p^r = \underset{(6.93)^*}{+\ 57298} + \underset{(37.9)^*}{0.568}\left[Y^r - \frac{ITR_F}{PI_{WG}/100}\right] \underset{(1.66)}{+\ 0.379\ \overline{RM}^r} \underset{(2.77)^*}{+\ 15918\ DC2_{88-89}}$	0.99	2.06	0.37	0.81	0.075
C-3 Public Consumption Expenditure					
$C_g^r = \left[\frac{RE_F + RE_P + RE_L - INTDD_F - INTED_F - REP_F - DS_P - \overline{GP}_F}{PI_{GC}/100}\right]$					
C-4 Total Investment					
$I^r = I_p^r + I_g^r$					
C-5 Total Private Investment					
$I_p^r = I_{PA}^r + I_{PM}^r + I_{POT}^r$					
C-6 Private Investment in Agriculture Sector					
$I_{PA}^r = \underset{(-1.67)}{-\ 870.1} + \underset{(3.24)^*}{0.059\ \overline{RM}^r} + \underset{(2.32)^*}{0.005}\left[SPIE_F + SPIE_P\right] + \underset{(3.42)^*}{0.567\ I_{PA-1}^r} + \underset{(4.27)^*}{2133\ DC6_{76}}$	0.94	1.81	0.14	0.49	0.37
C-7 Private Investment in Manufacturing Sector					
$I_{PM}^r = \underset{(0.72)}{+\ 2228} + \underset{(0.53)}{0.023}\left[X_g^r - X_{g-1}^r\right] \underset{(-1.73)}{-\ 583.8\ \overline{INT}_A} + \underset{(3.12)^*}{0.207\ DEEI^r} + \underset{(11.3)^*}{0.861\ I_{PM-1}^r} + \underset{(2.96)^*}{3096\ DC7_{92}}$	0.98	1.98	0.40	0.08	0.10
C-8 Private Investment in Other Sectors					
$I_{POT}^r = \underset{(4.38)^*}{+\ 2972} + \underset{(1.23)}{0.162\ I_{POT-1}^r} + \underset{(1.80)^{***}}{0.095}\left[Y_{OT}^r - Y_{OT-1}^r\right] + \underset{(6.72)^*}{0.026\ SPIE_F} + \underset{(3.61)^*}{1716\ DC8_{81}} + \underset{(4.19)^*}{2153\ DC8_{75}} \underset{(-3.07)^*}{-\ 1511\ DC8_{88}}$	0.99	2.04	0.34	0.42	0.51
C-9 Real Public Investment					
$I_g^r = \left[\frac{DE_F + DE_P + DE_L + \overline{DEAUB}}{PI_{GI}/100}\right]$					
C-10 Domestic Resource Gap					
$RG^r = C^r + I^r - Y^r$					
C-11 Change in Stock					
$STOK^r = X^r - IMP^r + RG^r$					
D. FEDERAL REVENUE BLOCK					
D-1 Net Revenue Receipt					
$NRR_F = GTR_F + DS_P + \overline{RNT}_F - DPT_F$					
D-2 Gross Federal Tax Revenues					
$GTR_F = IT_F + ITR_F + \overline{HYDRO} + \overline{SG}_F$					
D-3 Indirect Taxes					
$IT_F = ETR_F + STR_F + MTR_F + \overline{SUR}_F$					

EQUATION NUMBER	$\overline{R}^2$	D.W.	S.C.I.M[1]	ARCH[2]	W.H. NCT[3]
D-4 Excise Tax Revenue					
$ETR_F = + 5157 + 0.052 \left[\frac{Y^r_M * PI_M}{100} + \frac{Y^r_{OT} * PI}{100} \right] * IFE_{F-1} * DD4_{80-84}$ (6.70)* (3.02)*					
$+ 0.139\ \overline{DESCET}_F + 0.069 \left[\frac{Y^r_M * PI_M}{100} \right] - 2973\ DD4_{73-76}$ (0.75) (1.85)*** (-4.09)*	0.99	1.50	0.31	0.63	0.36
$+ 0.064 \left[\frac{Y^r_M * PI_M}{100} + \frac{Y^r_{OT} * PI}{100} \right] * IFE_{F-1}$ (1.59)					
D-5 Sales Tax Revenue					
$STR_F = - 76.65 + 0.012 \left[\frac{Y^r_M * PI_M}{100} + \frac{IMP^r_g * \overline{PI}_{IMP}}{100} + MTR_F \right] * IFS_{F-1} + 0.044\ \overline{DESCST}_F$ (-0.13) (3.80)* (0.09)					
$+ 0.0003 \left[\frac{IMP^r_g * \overline{PI}_{IMP}}{100} + MTR_F + \frac{Y^r_M * PI_M}{100} \right] + 225.5\ DD5_{88-90} * TIME$ (4.64)* (5.10)*	0.98	1.67	0.006	0.43	0.07
D-6 Import Duties					
$MTR_F = + 688.1 + 0.082 \left[\frac{IMP^r_g * \overline{PI}_{IMP}}{100} \right] * IFM_{F-1} + 0.285\ \overline{DESCMT}_F$ (0.42) (0.51) (0.76)					
$+ 0.244 \left[\frac{IMP^r_g * \overline{PI}_{IMP}}{100} \right] + 5726\ DD6_{85-90}$ (4.86)* (4.17)*	0.98	1.72	0.09	0.99	0.25
D-7 Income Tax Revenue					
$ITR_F = + 648.9 + 1.851 \left[(Y^r - Y^r_A) * \frac{PI}{100} \right] * IFI_{F-1}$ (2.87)* (16.1)*					
$+ 1.145\ \overline{DESCIT}_F + 0.006 \left[(Y^r - Y^r_A) * \frac{PI}{100} \right] + 2586\ DD7_{80}$ (7.26)* (4.11)* (8.66)*	0.99	1.70	0.23	0.50	0.55
$+ 2739\ DD7_{83-86} - 1320\ DD7_{90-91}$ (8.29)* (-3.22)*					
D-8 Revenue Transfer to Provincial Government					
$DPT_F = DPTX_F + \bar{\beta} * \overline{SUR}_F + \overline{HYDRO} + \overline{SG}_F$					
D-9 Divisible Pool Transfers					
$DPTX_F = + 0.80 * ITR_F + 0.80 * STR_F$					
$+ 0.303\ DD9_{92-93} * ETR_F + 2944\ DD9_{89-91}$ (15.9)* (5.75)*	0.99	0.45	0.84	0.31	0.000005
E. FEDERAL EXPENDITURE BLOCK					
E-1 Total Recurring Expenditure					
$RE_F = \overline{DEF}_F + INTDD_F + INTED_F + \overline{GP}_F + ORE_F + REP_F$					
E-2 Interest on Domestic Debt					
$INTDD_F = + 0.163\ DDEBT_{F-1} + 0.005\ \overline{INT}_A * DDEBT_{F-1}$ (4.93)* (2.06)***					
$- 565.7\ DE2_{80-83} * TIME + 6484\ DE2_{90}$ (-7.97)* (4.94)*	0.99	1.62	0.90	0.74	0.23
E-3 Interest on External Debt					
$INTED_F = - 448.2 + 0.025\ EDEBT_{F-1} + 0.509\ INTED_{F-1}$ (-1.8)*** (4.49)* (4.51)*					
$- 841.8\ DE3_{79-83} + 3189\ DE3_{90} + 1611.5\ DE3_{91-92}$ (-3.78)* (7.62)* (4.17)*	0.99	2.81	0.08	0.63	0.55
E-4 Repayment of External Debt					
$REP_F = - 3461.6 + 0.094\ EDEBT_F - 5497\ DE4_{90-93}$ (-7.13)* (22.1)* (-5.99)*	0.98	1.80	0.57	0.51	0.80
E-5 Other Recurring Expenditure					
$ORE_F = + 175.8 + 0.089\ NRR_F + 25794\ DE5_{91-93}$ (0.22) (7.43)* (14.9)*	0.97	2.07	0.97	0.56	0.045

EQUATION NUMBER	$\bar{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]
N-4 **Price Index for Government Consumption**					
$\ln PI_{GC} = \underset{(3.93)^*}{0.45} + \underset{(1.27)}{0.248} \ln PI + \underset{(3.45)^*}{0.667} \ln PI_{GC-1}$ $+ \underset{(4.74)^*}{0.202}\, DN4_{88} + \underset{(2.45)^{**}}{0.077}\, DN4_{91-93}$	0.99	1.60	0.64	0.00001	0.0002
N-5 **Price Index for Government Investment**					
$\ln PI_{GI} = \underset{(5.45)^*}{0.489} + \underset{(5.15)^*}{0.186} \ln \overline{PI}_{IME} + \underset{(14.02)^*}{0.708} \ln PI_{GI-1} + \underset{(5.83)^*}{0.182}\, DN5_{75,80}$	0.99	2.44	0.59	0.55	0.41
N-6 **Real Exchange Rate**					
$= \underset{(2.17)^{**}}{3.414} + \underset{(2.34)^{**}}{0.008} \left[CAG - \overline{GFB}_F + REP_F\right] + \underset{(16.3)^*}{0.988}\, e^r_{-1}$ $- \underset{(-2.42)^{**}}{0.0001} \left[CAG - \overline{GFB}_F + REP_F\right] * DN6_{92} + \underset{(7.06)^*}{12.51}\, DN6_{73}$ $- \underset{(-2.98)^*}{3.021}\, DN6_{82}$	0.98	2.00	0.65	0.55	0.03
N-7 **Nominal Exchange Rate**					
$e = \left[\frac{\overline{PI}_W}{PI}\right]$					

O. HUMAN CAPITAL INDEX BLOCK

O-1 **Total Development Expenditure on Education**

$DEED = DEED_P + DEED_L$

O-2 **Development Expenditure on Male Primary Education**

$DEEDPR_M = \underset{(-1.15)}{-21.78} + \underset{(7.75)^*}{0.141}\, DEED + \underset{(3.35)^*}{0.322}\, DEEDPR_{M-1}$ $+ \underset{(5.37)^*}{333.14}\, DO2_{93} + \underset{(4.37)^*}{238.42}\, DO2_{90}$	0.97	2.04	0.88	0.68	0.02

O-3 **Development Expenditure on Male Secondary Education**

$DEEDSE_M = \underset{(-0.86)}{-5.13} + \underset{(8.35)^*}{0.070}\, DEED + \underset{(9.63)^*}{0.514}\, DEEDSE_{M-1}$ $+ \underset{(7.35)^*}{149.2}\, DO3_{92} + \underset{(5.76)^*}{73.35}\, DO3_{88-89}$	0.99	2.10	0.85	0.32	0.71

O-4 **Development Expenditure on Female Primary Education**

$DEEDPR_F = \underset{(1.23)}{+6.781} + \underset{(6.27)^*}{0.034}\, DEED + \underset{(5.69)^*}{0.411}\, DEEDPR_{F-1}$ $+ \underset{(7.65)^*}{98.56}\, DO4_{90,92} + \underset{(9.49)^*}{175.3}\, DO4_{93}$	0.98	1.65	0.56	0.54	0.05

O-5 **Development Expenditure on Female Secondary Education**

$DEEDSE_F = \underset{(-2.26)^{**}}{-4.195} + \underset{(12.6)^*}{0.032}\, DEED + \underset{(19.6)^*}{0.594}\, DEEDSE_{F-1}$ $+ \underset{(13.4)^*}{83.72}\, DO5_{92} + \underset{(8.83)^*}{34.86}\, DO5_{88-89} - \underset{(-3.87)^*}{14.72}\, DO5_{82,87}$	0.99	1.81	0.97	0.74	0.77

O-6 **Development Expenditure on Higher Education**

$DEEDHE = DEED - DEEDPR_M - DEEDSE_M - DEEDPR_F - DEEDSE_F$

O-7 **Total Recurring Expenditure on Education**

$REED = REED_P + REED_L$

O-8 **Recurring Expenditure on Male Primary Education**

$REEDPR_M = \underset{(-0.83)}{-52.09} + \underset{(2.03)^{**}}{0.060}\, REED + \underset{(5.46)^*}{0.886}\, REEDPR_{M-1}$	0.98	2.16	0.12	0.01	0.00004

O-9 **Recurring Expenditure on Male Secondary Education**

$REEDSE_M = \underset{(-0.12)}{-5.67} + \underset{(2.23)^{**}}{0.063}\, REED + \underset{(6.11)^*}{0.866}\, REEDSE_{M-1}$	0.99	1.85	0.01	0.002	0.0010

O-10 **Recurring Expenditure on Female Primary Education**

$REEDPR_F = \underset{(-2.28)^{**}}{-36.34} + \underset{(8.74)^*}{0.080}\, REED + \underset{(6.03)^*}{0.465}\, REEDPR_{F-1}$ $+ \underset{(8.21)^*}{316.06}\, DO10_{89-90}$	0.99	1.58	0.78	0.66	0.004

EQUATION NUMBER	$\bar{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]
O-11 Recurring Expenditure on Female Secondary Education					
$REEDSE_F = -6.97 + 0.038\ REED + 0.742\ REEDSE_{F-1}$ $(-0.55)\quad (5.62)^{*}\quad (10.5)^{*}$ $+ 236.13\ DO11_{89-90}$ $(7.94)^{*}$	0.99	1.36	0.39	0.33	0.01
O-12 Recurring Expenditure on Higher Education					
$REEDHE = REED - REEDPR_M - REEDSE_M - REEDPR_F - REEDSE_F$					
O-13 New Male Primary School					
$NPS_M = DEEDPR_M / \overline{UCPS}_M$					
O-14 New Female Primary School					
$NPS_F = DEEDPR_F / \overline{UCPS}_F$					
O-15 New Male Secondary School					
$NSS_M = DEEDSE_M / \overline{UCSS}_M$					
O-16 New Female Secondary School					
$NSS_F = DEEDSE_F / \overline{UCSS}_F$					
O-17 Total Male Primary School					
$SPS_M = SPS_{M-1} + NPS_M$					
O-18 Total Female Primary School					
$SPS_F = SPS_{F-1} + NPS_F$					
O-19 Total Male Secondary School					
$SSS_M = SSS_{M-1} + NSS_M$					
O-20 Total Female Secondary School					
$SSS_F = SSS_{F-1} + NSS_F$					
O-21 Total Male Primary Teacher					
$TEPS_M = REEDPR_M / \overline{WPS}_M$					
O-22 Total Female Primary Teacher					
$TEPS_F = REEDPR_F / \overline{WPS}_F$					
O-23 Total Male Secondary Teacher					
$TESS_M = REEDSE_M / \overline{WSS}_M$					
O-24 Total Female Secondary Teacher					
$TESS_F = REEDSE_F / \overline{WSS}_F$					
O-25 Enrollment Ratio for Males at Primary Level					
$\ln PRENR_M = -1.35 + 0.213 \ln\left[\frac{SPS_M}{\overline{SGAPR}_M}\right] + 0.115 \ln\left[\frac{TEPS_M}{SPS_M}\right]$ $(-2.34)^{**}\quad (2.05)^{**}\quad (1.62)$ $+ 0.84 \ln PRENR_{M-1} + 0.0005\ \frac{Y^r}{\overline{POP10}_M + \overline{POP10}_F}$ $(7.36)^{*}\quad (0.41)$	0.98	2.01	0.18	0.86	0.51
O-26 Enrollment Ratio for Females at Primary Level					
$\ln PRENR_F = -2.074 + 0.106 \ln\left[\frac{TEPS_F}{SPS_F}\right] + 0.850 \ln PRENR_{F-1}$ $(-1.83)^{***}\quad (1.56)\quad (6.31)^{*}$ $+ 0.301 \ln\left[\frac{SPS_F}{\overline{SGAPR}_F}\right] + 0.0034\ LR_F$ $(1.71)\quad (0.35)$	0.99	2.1	0.09	0.07	0.005
O-27 Enrollment Ratio for Males at Secondary Level					
$\ln SEENR_M = -1.329 + 0.326 \ln\left[\frac{SSS_M}{\overline{SGASE}_M}\right] + 0.045 \ln\left[\frac{TESS_M}{SSS_M}\right] - 0.030\ DO27_{79-80}$ $(-3.45)^{*}\quad (2.64)^{**}\quad (0.60)\quad (3.19)^{*}$ $+ 0.0005\left[\frac{Y^r}{\overline{POP}_{10F} + \overline{POP}_{10M}}\right] + 0.686 \ln SEENR_{M-1} + 0.023\ DO27_{73-76}$ $(0.50)\quad (5.75)^{*}\quad (2.71)^{**}$	0.99	2.60	0.21	0.66	0.79

EQUATION NUMBER	$\overline{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]

O-28 *Enrollment Ratio for Females at Secondary Level*

$$\ln SEENR_F = -1.475 + 0.282 \ln\left[\frac{SSS_F}{\overline{SGASE}_F}\right] + 0.07 \ln\left[\frac{TESS_F}{SSS_F}\right]$$
$$(-1.76)^{***} \quad (1.95)^{***} \quad (0.44)$$
$$+ 0.657 \ln SEENR_{F-1} + 0.028\, LR_F + 0.074\, DO28_{75}$$
$$(3.08)^{*} \quad (2.18)^{**} \quad (2.51)^{**}$$

0.99 | 1.49 | 0.46 | 0.56 | 0.21

O-29 **Number of Male Enrollment at Primary Level**

$NENPR_M = PRENR_M * \overline{SGAPR}_M$

O-30 **Number of Female Enrollment at Primary Level**

$NENPR_F = PRENR_F * \overline{SGAPR}_F$

O-31 **Number of Male Enrollment at Secondary Level**

$NENSE_M = SEENR_M * \overline{SGASE}_M$

O-32 **Number of Female Enrollment at Secondary Level**

$NENSE_F = SEENR_F * \overline{SGASE}_F$

O-33 **Output of Male From Primary Level**

$OUTPR_M = \overline{SHPR}_M * NENPR_M$

O-34 **Output of Female From Primary Level**

$OUTPR_F = \overline{SHPR}_F * NENPR_F$

O-35 **Output of Male From Secondary Level**

$OUTSE_M = \overline{SHSE}_M * NENSE_M$

O-36 **Output of Female From Secondary Level**

$OUTSE_F = \overline{SHSE}_F * NENSE_F$

O-37 **Male Literate**

$$NLR_M = NLR_{M-1}(1 - \delta_4) + OUTPR_M(1 + \delta_5)$$

O-38 **Male Literacy Ratio**

$$LR_M = \frac{NLR_M}{\overline{POP10}_M}$$

O-39 **Female Literate**

$$NLR_F = NLR_{F-1}(1 - \delta_6) + OUTPR_F(1 + \delta_7)$$

O-40 **Female Literacy Ratio**

$$LR_F = \frac{NLR_F}{\overline{POP10}_F}$$

O-41 **Male Labor Force Entrants with Primary Education or In-complete Secondary Education**

$LFEPR_M = \overline{LFPR}_M * OUTPR_M$

O-42 **Female Labor Force Entrants with Primary Education or In-complete Secondary Education**

$LFEPR_F = \overline{LFPR}_F * OUTPR_F$

O-43 **Male Labor Force Entrants with Secondary Education**

$LFESE_M = \overline{LFSE}_M * OUTSE_M$

O-44 **Female Labor Force Entrants with Secondary Education**

$LFESE_F = \overline{LFSE}_F * OUTSE_F$

O-45 **Number of Male Workers with Primary Education**

$NWPR_M = NWPR_{M-1}(1 - \delta_8) + LFEPR_M$

O-46 **Number of Female Workers with Primary Education**

$NWPR_F = NWPR_{F-1}(1 - \delta_8) + LFEPR_F$

O-47 **Number of Female Workers with Secondary Education**

$NWSE_F = NWSE_{F-1}(1 - \delta_9) + LFESE_F$

O-48 **Number of Male Workers with Secondary Education**

$NWSE_M = NWSE_{M-1}(1 - \delta_9) + LFESE_M$

EQUATION NUMBER	$\bar{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]
O-49 Human Capital Index in Agriculture Sector					
$HCI_A = \left[\frac{HCIL_A}{L_A}\right]$					
O-50 Human Capital Index in Manufacturing Sector					
$HCI_M = \left[\frac{HCIL_M}{L_M}\right]$					
O-51 Human Capital Index in Other Sectors					
$HCI_{OT} = \left[\frac{HCIL_{OT}}{L_{OT}}\right]$					
O-52 Labor Force Adjusted for Human Capital in Agriculture Sector					
$HCIL_A = -1099 + 483.5\left[NWPR_M + NWPR_F\right] + 116.6\left[NWSE_F + NWSE_M\right]$ (-5.51)* (8.82)* (8.67)* $+ 251.2\ DO52_{85,86} + 202.9\ DO52_{90}$ (3.43)* (1.95)***	0.96	1.45	0.00005	0.12	0.002
O-53 Labor Force Adjustment for Human Capital in Manufacturing Sector					
$HCIL_M = 203.6 + 4.236\left[NWPR_M + NWPR_F\right] + 33.19\left[NWSE_F + NWSE_M\right]$ (12.0)* (0.97) (27.2)* $+ 43.34 DO53_{92} + 17.81\ DO53_{90-91} + 17.05\ DO53_{75-78}$ (5.05)* (2.81)* (3.41)*	0.99	1.80	0.91	0.90	0.48
O-54 Labor Force Adjustment for Human Capital in Other Sectors					
$HCIL_{OT} = -485.7 + 228.8\left[NWPR_M + NWPR_F\right] + 138.4\left[NWSE_M + NWSE_F\right]$ (-4.55)* (7.96)* (17.2)* $+ 167.2\ DO54_{92-93} - 172.8\ DO54_{86}$ (3.46)* (-3.22)*	0.98	1.34	0.59	0.21	0.02
P. PUBLIC SECTOR HEALTH INDEX BLOCK					
P-1 Total Development Expenditure on Health					
$DEH = DEH_P + DEH_L$					
P-2 Development Expenditure on Hospital Beds					
$DEBED = -105.4 + 0.611\ DEH_{-6} + 0.031\ PTHOS_{-4}$ (-2.02)*** (10.65)* (2.72)** $+ 132.6\ DP2_{86} + 108.5\ DP2_{81}$ (3.32)* (2.60)**	0.99	1.98	0.52	0.56	0.54
P-3 Development Expenditure on Rural Health Centre (including BHUs)					
$DERHC = +58.15 + 0.241\ DEH_{-2} + 0.362\ DERHC_{-1} - 244.7\ DP3_{92-93}$ (3.70)* (4.35)* (3.13)* (-5.75)* $+ 384.3\ DP3_{87-88} - 82.3\ DP3_{81}$ (11.5)* (-1.99)***	0.98	2.04	0.98	0.93	0.71
P-4 Development Expenditure on Other Facilities (MCH, TBC, SHC)					
$DEHOT = DEH - DEBED - DERHC$					
P-5 Total Recurring Expenditure on Health					
$REH = REH_P + REH_L$					
P-6 Recurring Expenditure on Doctors in Hospital					
$REDOH = +5.037 + 0.097\ REH + 0.539\ REDOH_{-1}$ (0.83) (6.59)* (6.83)* $+ 6.325\ DP6_{88-92} * TIME + 95.31\ DP6_{84-85}$ (8.81)* (7.04)*	0.99	1.95	0.86	0.80	0.07
P-7 Recurring Expenditure on Nurses in Hospital					
$RENUH = +0.527 + 0.023\ REH + 0.511\ RENUH_{-1}$ (0.20) (2.67)** (2.25)** $+ 13.90\ DP7_{92-93}$ (2.05)***	0.99	1.87	0.34	0.27	0.003

EQUATION NUMBER	$\bar{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]
P-8 Recurring Expenditure on Paramedics in Hospital					
$REPAH = 12.17 + 0.053\ REH + 0.378\ REPAH_{-1}$ (1.99)*** (5.84)* (2.82)* $+ 91.13\ DP8_{92-93} - 87.85\ DP8_{89}$ (4.69)* (-4.63)*	0.99	1.94	0.89	0.72	0.95
P-9 Recurring Expenditure on Doctors in RHCs					
$REDOR = -8.474 + 0.034\ REH + 0.645\ REDOR_{-1}$ (-2.57)** (7.96)* (12.2)* $+ 55.15\ DP9_{87-88} + 82.96\ DP9_{90}$ (8.54)* (9.05)*	0.99	1.89	0.53	0.64	0.25
P-10 Recurring Expenditure on Paramedics in RHCs					
$REPAR = -6.651 + 0.026\ REH + 0.743\ REPAR_{-1}$ (-0.88) (2.27)** (3.68)* $- 14.47\ DP10_{92-93}$ (-0.72)	0.98	1.91	0.06	0.93	0.28
P-11 Recurring Expenditure on Other Facilities (MCH, TBC, SHC)					
REHOT = REH - REDOH - RENUH - REPAH - REDOR - REPAR					
P-12 New Hospital Bed					
NHBED = DEBED / $\overline{UCBED}$					
P-13 Total Beds in Hospital					
THBED = $THBED_{-1}$ + NHBED					
P-14 New RHCs					
NRHC = DERHC / $\overline{UCRHC}$					
P-15 Additional RHCs					
TRHC = $TRHC_{-1}$ + NRHC					
P-16 Total Doctors in Hospitals					
TDOH = REDOH / $\overline{UCDOH}$					
P-17 Total Nurses in Hospitals					
TNUH = RENUH / $\overline{UCNUH}$					
P-18 Total Paramedics in Hospitals					
TPAH = REPAH / $\overline{UCPAH}$					
P-19 Total Doctors in RHCs					
TDOR = REDOR / $\overline{UCDOR}$					
P-20 Total Paramedics in RHCs					
TPAR = REPAR / $\overline{UCPAR}$					
P-21 Patients Treated Production Function for Hospitals					
$\ln PTHOS = -0.753 + 0.123 \ln TDOH + 0.285 \ln TNUH$ (-8.06)* (1.12) (2.42)** $+ 0.484 \ln THBED + 0.105 \ln TPAH$ (1.33) $+ 0.143\ DP21_{76-77} + 0.300 DP21_{73-75}$ (3.63)* (4.68)*	0.99	2.32	0.37	0.52	0.59
P-22 Patients Treated Production Function for RHCs					
$\ln PTRHC = 2.587 + 0.1213 \ln TDOR + 0.1022 \ln TPAR$ (9.71)* (2.40)** (0.85) $+ 0.776 \ln TRHC + 0.2024\ DP22_{92-93} + 0.2669\ DP22_{81}$ (3.33)* (3.36)* $+ 0.182\ DP22_{75}$ (2.06)**	0.99	1.90	0.82	0.36	0.98
P-23 Public Sector Health Index					
$PHI = 68.48 + 0.005\ PTHOS + 0.001\ PTRHC$ (15.9)* (3.13)* (4.82)* $+ 0.002 \left[\frac{DEOTS_P + DEOTS_L + DEHOT}{PI_{GI} * 100}\right]$ (1.99)*** $+ 0.002 \left[\frac{REOTS_L + REHOT + REOTS_P}{PI_{GC} * 100}\right]$ (1.06)	0.99	1.47	0.83	0.80	0.89

EQUATION NUMBER	$\overline{R}^2$	D.W.	S.C.LM[1]	ARCH[2]	W.H. NCT[3]

Q. INDEX OF ECONOMIC INFRASTRUCTURE BLOCK

Q-1 Total Public Investment in Economic Infrastructure

$$DEEI_F = \overline{DEAUB} + DE_F + DEOT_L$$

Q-2 Total Provincial Investment in Economic Infrastructure

$$DEEI_P = DEOT_P$$

Q-3 Real Public Investment in Economic Infrastructure

$$DEEI_F^r = \frac{DEEI_F}{PI_{GI}}$$

Q-4 Real Provincial Investment in Economic Infrastructure

$$DEEI_P^r = \frac{DEEI_P}{PI_{GI}}$$

Q-5 Total Real Investment in Economic Infrastructure

$$DEEI^r = DEEI_F^r + DEEI_P^r$$

Q-6 Stock of Public Infrastructure (Economic)

$$SPIE_F = SPIE_{F,1}(1 - \delta_{10}) + DEEI_F^r$$

Q-7 Stock of Provincial Infrastructure (Economic)

$$SPIE_P = SPIE_{P,1}(1 - \delta_{10}) + DEEI_P^r$$

R. INDEX OF FISCAL EFFORT BLOCK

R-1 Index of Fiscal Effort in Direct Taxes

$$IFI_F = IFI_{F,1} + \left[\frac{\overline{DESCIT}_F}{Y^r * PI/100}\right]$$

R-2 Index of Fiscal Effort in Excise Duty

$$IFE_F = IFE_{F,1} + \left[\frac{\overline{DESCET}_F}{Y_M^r * PI_M/100}\right]$$

R-3 Index of Fiscal Effort in Sales Taxes

$$IFS_F = IFS_{F,1} + \left[\frac{\overline{DESCST}_F}{IMP_g^r * \overline{PI}_{IMP}/100 + MTR_F + Y_M^r * PI_M/100}\right]$$

R-4 Index of Fiscal Effort in Import Duties

$$IFM_F = IFM_{F,1} + \left[\frac{\overline{DESCMT}_F}{IMP_g^r * \overline{PI}_{IMI}/100}\right]$$

1 Serial Correlation as measured by LM F-Statistics at 2 lags.
2 Heteroskedasticity as measured by LM ARCH at 1 lag.
3 White's Test with No Cross Terms (NCT).