Inflation and Growth: An Analysis of Recent Trends in Pakistan

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1/Introduction

Inflation in Pakistan has once again crossed the single-digit threshold during the Eighties. It declined continuously from 11.9 percent in 1980-81 to 4.8 percent in 1986-87; but it has been rising since 1987-88. The PIDE's Macro-econometric Model predicts an inflation rate of 10.7 percent for the year 1989-90. The focus of policy-making has, therefore, shifted to controlling the rate of inflation.

One may begin by asking: what has caused the recent upsurge in the price level? The large budgetary deficits, associated with an increase in money supply at a rate of 12.2 percent during 1987-88, have been cited as the main culprits. Such a belief seems to underlie the IMF policy package, which advocates that to fight inflation the budgetary deficit should be slashed from the all-time high level of 8.6 percent of the GDP reached in 1987-88 to 4.8 percent of the GDP by the year 1990-91; and that the growth rate of bank credit should be held down below the growth rate of the nominal GDP at the target inflation rate till the year 1990-91.

But this may be too narrow a view of the recurring winter of our economic discontent, as other factors may also have contributed to inflation. For instance, the import price index increased suddenly from 3.5 percent in 1986-87 to 24.3 percent in 1987-88; and the growth rate of the com-

modity-producing sectors has, of late, slowed down somewhat, especially due to the unusually bad performance of the large-scale manufacturing sector.[1] We must, therefore, determine the relative weights of the various contributory factors to determine the overall level of inflation, and to evolve an effective policy package to fight inflation. At the same time, we must be concerned about the possible (adverse) effects of anti-inflationary policies on the growth rate of the economy. The real challenge of policy-making is to ensure a moderate – i.e., single-digit – rate of inflation, while keeping a high rate of growth of the GDP.

In this study, we propose to determine, within the framework of the 83-equations PIDE Macro-econometric Model, referred to hereinafter as the PIDE Model (1989),[2] the proximate *causes* and *consequences* of inflation, and to present the (first best) forecasts of inflation in the coming year. With the help of an extensive simulation exercise performed on the PIDE Model (1989), we also propose to generate alternative inflation scenarios under three anti-inflationary regimes, including the one prescribed by the IMF, and relate these to certain key 'reference' variables, i.e., the growth rate of the GDP, the growth rate of money supply, the size of the budgetary gap, and the import-export gap.

The present essay builds on our report entitled *Recent Inflationary Upsurge in Pakistan: Causes and Cures,* which

[1]The value-added by the commodity-producing sector is defined as the sum of the value-added by the agricultural and the manufacturing sectors. The agricultural sector has grown at an average rate of 4 percent during the years 1986-87 to 1988-89. The large-scale manufacturing sector during this period has grown at an average rate of 6.3 percent, while manufacturing sector as a whole has grown at an average rate of 6.8 percent.

[2]The bare outlines of the PIDE Model (1989) are reproduced as Appendix E for ready reference. For details of the model, see Naqvi and Khan (1989).

was submitted to the Government of Pakistan in May 1989. The analysis presented here is the first of its kind ever done in Pakistan which demonstrates explicitly the interlinkages between economic growth and inflation. It provides a systematic analytical framework to evaluate alternative policy objectives; and also to evolve workable, and feasible, rules for guiding the monetary and fiscal policies of the Government. Towards the end of this study, we also propose a practical rule for monetary expansion, taking into account the trade-off between the inflation and the growth of (real) GDP, as well as the trade-off between the growth of (real) GDP and the growth of (nominal) money supply.

2/ The Causes of Inflation

A macro-econometric model permits the estimation of both the direct effects and the total effects of the explanatory variables, i.e., (the causatory factors) on the dependent variable – in the present case, the rate of inflation. The total effects may reinforce the direct effects; or they may weaken the latter, depending on the strength of the indirect effects. The indirect effects are transmitted, through the estimated (inflation) equation, to dependent variables from the many dynamic relations embedded in the system of equations of the macro-model. In the present chapter, we discuss both the direct and the total effects of various causatory factors on inflation.

The Direct Effects

To understand the *direct* effects of various causatory factors on inflation, consider the following equation, which is embedded in the PIDE Model (1989):

$$L_n P_{gn} = \underset{}{0.36} + \underset{(2.30)}{0.10} L_n M_s(-1) + \underset{(4.32)}{0.18} L_n P_m - \underset{(7.59)}{}$$

$$\underset{(1.77)}{0.19} L_n C_s + \underset{(12.24)}{0.56} L_n P_{gn}(-1) \qquad \ldots \quad (1)$$

$$\bar{R}^2 = 0.99; \quad DW = 2.02; \quad F = 4878.08$$

where P_{gn} = Implicit GNP Deflator;

P_m = Import Price Index;

$M_s(-1)$ = (Nominal) Money Supply lagged by one year; and

C_s = Ratio of value-added by commodity-producing sectors to value-added by services sectors.[3]

Equation (1), which is the first-best option we have at the moment, encapsulates the basic information about the chemistry of inflation in Pakistan. The values of elasticities, which are the coefficients of Equation (1), are the main transmitters of such information.[4] This information is summarized in Table 1.

The values of these elasticities tell us many important 'facts' about inflation.

First, inflation is determined by changes in money supply (lagged by one year), in import prices, in the ratio of value-added by the commodity-producing sectors to that of the services sectors, and in inflationary expectations.

Second, a 10 percent increase in money supply will increase the price level by 1.0 percent with a lag of one year; a 10 percent increase in the import price will increase the

[3] Formally, $C_s = \frac{y_A + y_m}{y_g - y_A - y_m}$

where y_g = Gross Domestic Product;

y_A = Value-added in Agriculture; and

y_m = Value-added in Manufacturing.

[4] As is well known, the coefficients of a regression equation, if expressed in logarithmic form, also measure the elasticities of the relevant explanatory variables with respect to the dependent variable.

has certainly contributed to the recent inflationary upsurge. One can, thus, reasonably hope that P_m will not stay there for ever. Indeed, it is not likely to do so. According to the latest available information, P_m, adjusted for the fluctuation in the (nominal) exchange rate, is expected to increase by no more than 10 percent in 1989-90.

Equation (1) tells us clearly that, given the current level of import prices and last year's inflation, a successful anti-inflationary effort will require remedial action both on the demand side and the supply side. On the demand side, appropriate fiscal and monetary policy actions are required to make an impact on $M_s(-1)$; while, on the supply side, it takes improving the performance of C_s to make a favourable impact on inflation.

The Total Effects

As should be obvious, the total effects of various factors contributing to inflation typically tend to exceed the direct effects, assuming that the dynamic interactions among the many variables included in a macro-model are not such as to swamp the direct effects. For the PIDE Model (1989), such an assumption appears to hold. It is interesting to note that the explanatory variables of Equation (1) are linked with the rest of the model in many ways. For instance, (C_s), which according to Equation (1) is the most important contributing factor, is, in turn, influenced by value-added in agriculture (y_A), manufacturing (y_m), and services sectors (y_s). And money supply is further influenced by budget deficits, bank credit, and foreign exchange reserves. As the last two variables are exogenously determined, budget deficits are in turn related to government revenues and expenditures. Some of these complex interrelations among the many variables included in the PIDE Model (1989) can be seen in Fig. 1.

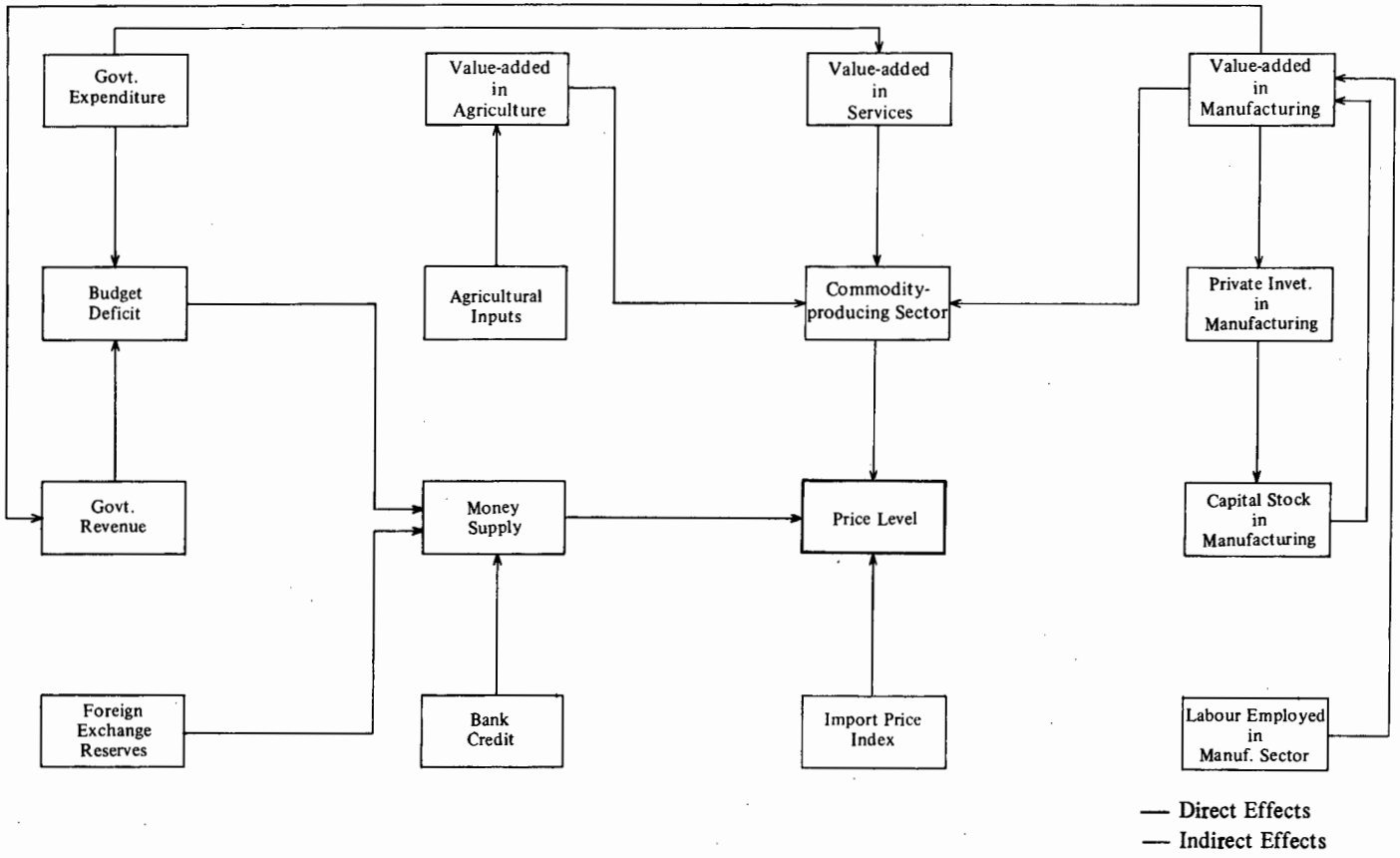


Fig. 1. Flow Chart Showing Direct, Indirect, and Total (Direct & Indirect) Effects of Explanatory Variables on Inflation.

The measurement of the total effects requires estimating the dynamic elasticities of each of the three contributing factors identified in Equation (1). The dynamic elasticities measure basically the total effects of various factors causing inflation, and are computed by simulating the PIDE Model (1989). These elasticities not only include the direct effects of each factor; but they also take into account, as Fig. 1 clearly shows, the effects of various sectors of the economy on inflation. The dynamic elasticities of each factor (variable) are reported in Table 2.

A comparison of Table 2 with Table 1 shows that the total effects of each factor are almost the same as the direct effects for the year 1989-90, but the total effects tend to exceed the direct effects during 1990-91. This simply reflects the fact that dynamic elasticities tend to exceed the direct ones as more time is allowed to pass. It is also clear by now that, in terms of the size of the elasticities, the variable C_s is the most important causatory factor influencing inflation, followed by P_m. The effect of $M_s(-1)$ on inflation is significantly much less; but it is by no means insignificant.[8]

[8]The dynamic elasticities cannot be estimated for inflationary expectations $[P_{gn}(-1)]$ because P_{gn} is a dependent variable.

Table 2

Dynamic Elasticities of Factors Contributing to Inflation in Pakistan

Various Causative Factors	Dynamic Elasticities (Total Effects)	
	1989-90	1990-91
Money Supply ($M_s(-1)$)	0.098	0.126
Import Price Index (P_m)	0.178	0.23
Ratio of Commodity-producing Sector to Services Sectors (C_s)	−0.187	−0.22

Note: The dynamic elasticities, obtained by simulating the PIDE Model (1989), are defined as:

$$\eta_t = \frac{L_n\ (y_t^s/y_t^c)}{L_n\ (X_t^s/X_t^c)}$$

where y_t^s and y_t^c are the "shocked" and "control" solutions of endogenous variables respectively; and X_t^s and X_t^c are the changed and original values of the relevant exogenous variable respectively. For a fuller explanation of dynamic elasticities and the corresponding formula for estimating it, see Tarkka and Willman (1985).

3/Searching for an Optimal Solution

Having analysed the nature of inflation in Pakistan, the next question to be answered is: how best can we control (reduce) it, and at what (opportunity) cost?[9] But giving a non-trivial answer to this question is a difficult matter. *First,* as explained in Chapter 2, it takes initiating remedial action both on the demand side and the supply side to bring down the inflation rate. *Second,* we should be concerned not only with reducing inflation to a single-digit level, but also about safeguarding the economy's growth rate, say in the 6-7 percent range. *Third,* we must be concerned about the anti-inflationary policies making a favourable impact on some key variables – e.g., the money supply, the budgetary deficit, and the import-export gap. *Fourth,* we should minimize the (opportunity) cost of 'structural' adjustment. *Fifth,* we must determine the relative strengths of the various elements of the anti-inflationary policy package – in particular, the fiscal and monetary policies – as a guide to an appropriate policy response. We shall attempt to answer these questions in this and the next chapter.

[9]To measure the opportunity cost of inflation in terms of lost output, we would also have needed in the PIDE Model (1989) the equations for wages and employment. This we have not been able to do so far. Opportunity cost, as measured in this essay, therefore, means the probable reduction in output which may be caused by the size of the structural adjustment needed to control inflation. However, as Table 3 shows, the negative effects of structural adjustment on output are at best minimal. But see Table 5 for a brief discussion of the trade-off between inflation and growth in limited range. For a further discussion of the beneficial effects of structural adjustment on economic growth, see Balassa (1989).

To do this job, we have carried out extensive simulation experiments on the PIDE Model (1989). Then, to put the whole exercise into proper focus, the proposed IMF policy package has been taken as a starting point.[10] In search of an optimal solution, the IMF policy package is compared with the alternative policy scenarios, which we call the PIDE Scenario-I and PIDE Scenario-II. The method of comparison is to relate the outcome (solution) of each of these policy alternatives with the 'control solution' – i.e., with the PIDE forecasts *if no remedial action is taken.* We also compare the simulated *solutions* of the three policy alternatives with one another to choose the optimal – in a sense, the 'best' – policy package.[11]

Alternative Policy Scenarios

To search for an optimal solution, alternative scenarios were generated by simulating (solving) the PIDE Model (1989). These are reproduced in Table 3 (see also Appendix Table B). Table 3 brings out clearly the nature of inflation in Pakistan, and provides information about the effectiveness of the alternative scenarios – i.e., those induced by policy actions – in reducing inflation. Furthermore, we can also read from this Table the nature of the trade-off between inflation and economic growth, and of the effectiveness of these alternative scenarios in keeping a balance between these two key variables. (See also Table 5, Chapter 5).

[10]The IMF policy package provides a time-frame for structural adjustment policies during the years 1988-89 to 1990-91. In addition to many reforms suggested for various sectors of the economy, the proposed policy package includes a recommendation to bring the rate of inflation down to 6 percent level by 1990-91. To achieve this objective, various policy measures regarding reducing the budget deficit and contracting the rate of monetary expansion have been suggested. (See also note to Table 3).

[11]Such a comparison also provides a way of determining the relative effectiveness of various anti-inflationary policies – especially of the fiscal and monetary policies – with reference to their (total) effects on inflation and the growth of the GDP. See Chapter 4 for such a discussion.

Table 3

The Control Solution and the Relative Performance of Three Anti-inflationary Policy Packages: 1989-90 to 1990-91

Reference Variables / Alternative Policy Packages	Inflation		Growth Rate of Gross Dom. Product		Growth Rate of Money Supply		Import-Export Gap as % of GDP		Revenue-Expd. Gap as % of GDP	
	1989-90	1990-91	1989-90	1990-91	1989-90	1990-91	1989-90	1990-91	1989-90	1990-91
PIDE Forecast (Control Solution)	10.69	9.96	6.26	6.25	17.11	17.09	6.05	6.52	7.73	7.22
Alternative Scenarios										
IMF Scenario	10.34	9.14	6.27	6.28	10.43	10.05	5.90	6.27	6.00	4.80
PIDE Scenario-I	7.85	6.67	6.56	6.77	8.72	9.53	5.85	6.21	6.40	5.80
PIDE Scenario-II	8.20	7.04	6.54	6.76	8.72	9.53	5.87	6.24	6.40	5.80

Source: Appendix Table B.

Notes: The forecasts given in row 1 and the alternative scenarios sketched in rows 2–4 have been generated by simulating the *PIDE Macro-econometric Model of Pakistan's Economy, 1989*. [See Naqvi and Khan (1989)]. The control solution is obtained by solving the model without changing the values of exogenous variables, while the alternative scenarios are generated under the different assumptions of the values of the relevant exogenous variables. For assumptions underlying the control solution, see footnote 12.

1. IMF Scenario consists of the following assumptions:
   (i) Bank credit increases by 11.8 percent in 1989-90 and by 11.0 percent in 1990-91. (The relevant IMF condition relates to the growth of money supply at a rate of 10.4 percent in 1989-90. To find this level, an appropriate level of bank credit expansion has to be chosen).
   (ii) Budget deficit is assumed to be 6.0 percent of the GDP in 1989-90 and 4.8 percent of the GDP in 1990-91.
2. PIDE Scenario-I consists of following policy measures:
   (a) Value-added in agriculture grows by 5.2 percent in 1989-90 and by 5.0 percent in 1990-91.
   (b) Value-added in manufacturing grows by 7.4 percent in 1989-90 and 1990-91.
   (c) Bank credit grows by 9.0 percent in 1989-90 and by 10.0 percent in 1990-91.
   (d) Budget deficit is Rs 56.8 billion or 6.4 percent of the GDP in 1989-90 and Rs 58.4 billion or 5.8 percent of the GDP in 1990-91.
   (e) Import price index increases by 8.0 percent in 1989-90 and by 7.0 percent in 1990-91.
3. PIDE Scenario-II consists of all the assumptions of PIDE Package-I with the exception of (e). In it the import price index is assumed to grow at the rate of 10.0 percent in 1989-90 and by 8 percent in 1990-91.

The top row of Table 3 gives the control solution – i.e., it says that, *if no anti-inflationary action is taken,* inflation will rise to 10.7 percent in 1989-90, but will gradually decline to 9.9 percent in 1990-91.[12] GDP will grow by 6.3 percent in 1989-90, and will show a slight deceleration in growth rate in the subsequent years. It may be noted that these are first-best (conditional) forecasts. This can be seen from Appendix Table B. The margin of error in *ex-post* forecasting – i.e., comparing PIDE's forecasts with actual inflation rates for the years 1984-85 to 1986-87 – is extremely small: on the average, it is 0.97 percent (see Appendix Table A; and segment B-C of Fig. 2 for details).[13]

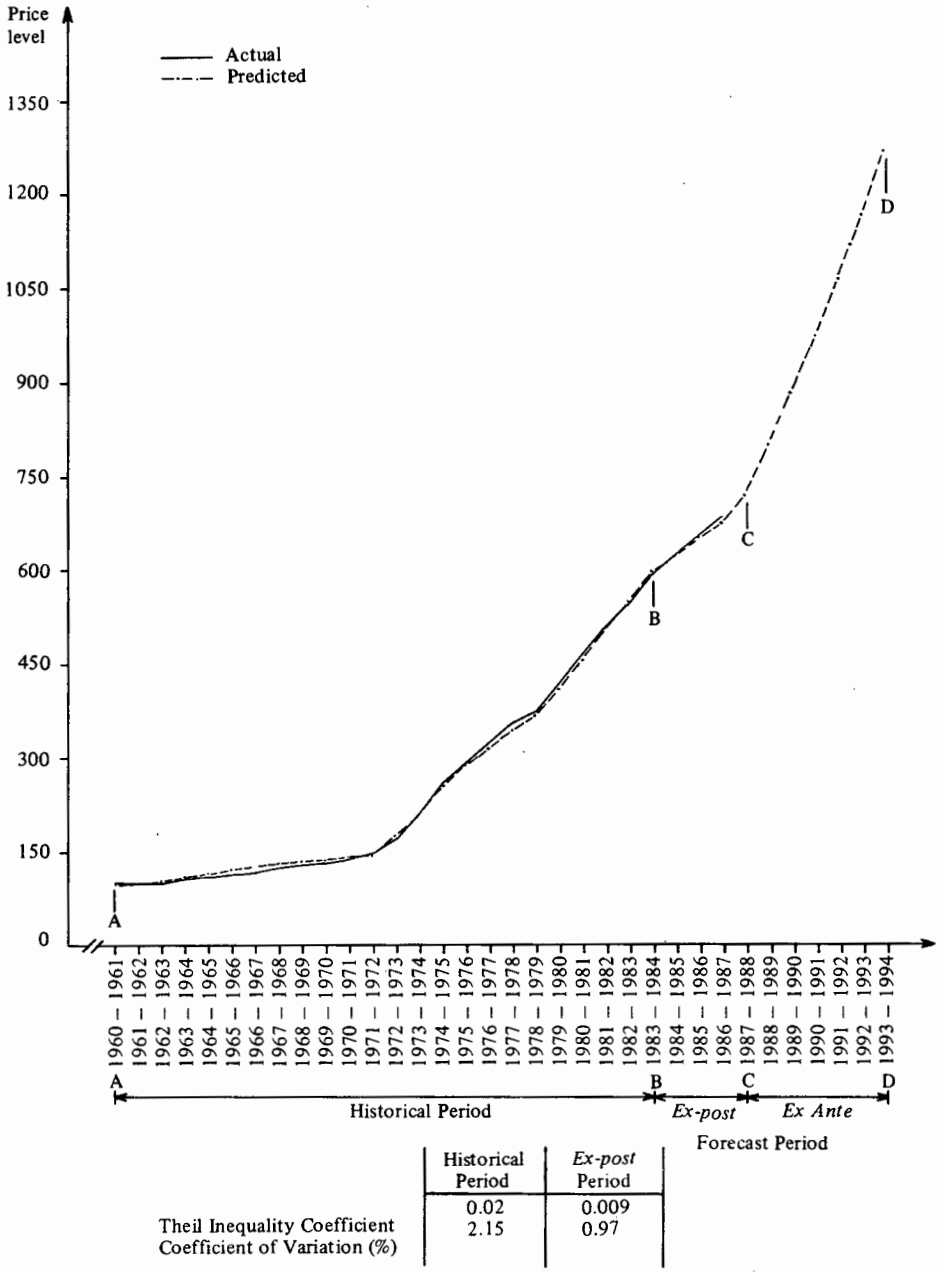
To change these forecasts, specific anti-inflationary policies, which also accelerate the growth rate of the GDP, must be adopted. In our search for an optimal solution, we now turn to an analysis of three alternative scenarios, beginning with the policy scenario recommended by the IMF.

The IMF Policy Scenario

The major objective of the IMF policy scenario is to bring down the rate of inflation to about 6 percent in 1989-90 – 1990-91. To achieve this objective, the anti-inflationary part of the IMF policy package consists of two major elements: (i) it constrains money supply to grow by no more than 10.4 percent in 1989-90, which within the framework of the PIDE Model (1989) implies a growth rate of 11.8 percent for bank credit in 1989-90 (To sustain this rate

[12] It may be pointed out that in the control solution the value-added in agriculture is expected to grow by 5.03 percent and 4.94 percent during 1989-90 and 1990-91, respectively, while the value-added in manufacturing is projected to grow by 7.0 percent during the next two years. Also, import prices are assumed to increase at a rate of 15.0 percent in 1989-90 and 12.0 percent in 1990-91. Bank credit is assumed to grow at the rates of 15.0 percent and 12.0 percent in 1989-90 and 1990-91, respectively.

[13] It may be noted that segment A-B of Fig. 2 shows the forecasting strength of the equation during the historical period.



	Historical Period	*Ex-post* Period
Theil Inequality Coefficient	0.02	0.009
Coefficient of Variation (%)	2.15	0.97

Fig. 2. Price Level.

of growth of money supply, the bank credit will have to grow by 11.0 percent in 1990-91); (ii) it reduces the budgetary deficit to 6.0 percent of the GDP in 1989-90 and to 4.8 percent of the GDP in 1990-91. The second row of Table 3 shows (see also Appendix Table B) that the IMF scenario, as compared with the control solution (row 1), lowers inflation slightly to 10.3 percent in 1989-90; and to 9.0 percent in 1990-91. Also, as a result of the proposed course of policy action, the growth rate of GDP does not change materially in 1989-90, but increases slightly in 1990-91. The rate of monetary expansion is duly reduced to 10.4 percent in 1989-90; and to 10.0 percent in 1990-91. The revenue-expenditure gap is consequently reduced to 6.0 percent of the GDP in 1989-90; and then to 4.8 percent of the GDP in 1990-91. The trade gap is also reduced to 5.9 percent and 6.3 percent of the GDP during 1989-90 and 1990-91, respectively.

It follows that, as compared with the control solution (row 1), *the IMF policy package does not achieve its stated objectives of reducing inflation to 6.0 percent by 1990-91.* Besides, the IMF policy package is unnecessarily restrictive in scope, particularly with respect to the proposed size of the budget deficit in 1990-91.[14] Reason: it does not pay due attention to the supply side factors to reduce inflation. This package is also unduly pessimistic as it ignores the key role of import prices (P_m) in restraining (increasing) inflation.

We should, therefore, look for an alternative policy package, which preserves the essential message of the IMF

[14] Although the IMF Package lists a few corrective measures to improve the performance of the commodity-producing sector, no growth targets have been set in quantitative terms. Such observations do not constitute the central thrust of the IMF package, which is predominantly fiscal and monetary in nature. However, it should be noted that within the framework of the PIDE Model (1989) it is assumed that the assumptions underlying the control solution, set out in footnote 12, will hold in the IMF Scenario as well.

policy package but achieves better results – e.g., a lower level of inflation and a higher GDP growth rate. Needless to state, it would be a decided advantage if we could pull the trick.

PIDE Scenario-I

The anti-inflationary part of the PIDE Scenario-I consists of the following policies: (i) value-added in agriculture grows by 5.2 percent in 1989-90 and by 5.0 percent in 1990-91; (ii) value-added in manufacturing grows by 7.4 percent in 1989-90 and by 1990-91;[15] (iii) bank credit is restricted to grow by 9.0 percent in 1989-90 and by 10.0 percent in 1990-91; (iv) budget deficit is assumed to be Rs 56.8 billion (or 6.4 percent of the GDP) in 1989-90 and Rs 58.4 billion (or 5.8 percent of the GDP) in 1990-91;[16] and, finally, (v) the import price index (P_m) is assumed to increase by 8.0 percent in 1989-90 and by 7.0 percent in 1990-91. In the light of Pakistan's recent experience, these appear to be reasonable assumptions.[17]

The results of the PIDE Scenario-I are given in row 3 of Table 3 (see also Appendix Table B). It can be seen that, as compared with the control solution (row 1), the PIDE Scenario-I significantly lowers the rate of inflation: to 7.85 percent in 1989-90, and to 6.67 percent in 1990-91. Furthermore, the PIDE Scenario-I achieves in 1989-90 almost the same growth in GDP as the control solution does. The growth rate of money supply is reduced considerably as compared

[15] As a result of the specified rates of growth of the agriculture and manufacturing sectors, the ratio of the commodity-producing sector to that of the services sectors (C_s) will be around 80 percent.

[16] Within the framework of the PIDE Model (1989) the budget deficit is determined endogenously. However, in the three scenarios reported in the text, we have fixed the size of the budget deficit to compare the *consequences* of fiscal policy.

[17] It may be noted that the assumptions regarding the growth of the above-mentioned variables for the year 1989-90 are those used by the Pakistan Government for the same year.

with the control solution. The PIDE Scenario-I provides a growth of 8.7 to 9.5 percent of money supply for the years 1989-90 and 1990-91. This is even lower than the target of 10.4 percent set by the Pakistan Government and the IMF. Some improvement in the import-export gap as a percentage of the GDP is also achieved under the PIDE Scenario-I for the years 1989-90 and 1990-91.

The PIDE Scenario-I thus makes a significant improvement on the control solution in terms of accelerating the growth rate of the GDP and restraining inflation. Money supply grows at a rate lower than that prescribed by the IMF. In the bargain, the government is allowed greater freedom with respect to the size of the budget deficit.

PIDE Scenario-II

The anti-inflationary part of the PIDE Scenario-II is essentially the same as that discussed in the PIDE Scenario-I. It differs from the latter only with respect to the assumptions regarding the growth of the import price index: instead of assuming that P_m grows by 8.0 percent in 1989-90, and by 7.0 percent in 1990-91, we now assume that this variable will grow by 10.0 percent in 1989-90 and by 8.0 percent in 1990-91. The underlying reason for assuming a higher rate of increase of P_m is to take into account a possible depreciation in the (nominal) exchange rate of the Pakistani currency *vis à vis* the U.S. dollar.[18] All other assumptions of the PIDE

[18] Strictly speaking, Pakistan's exchange rate is now adjusted – so far only downwards – not just against the U.S. Dollar, but against a 'basket' of currencies. The currencies included in the composite basket and their relative weights have been kept confidential, presumably to avoid the speculation against the Pakistani Rupee in the foreign exchange market. The U.S. Dollar, however, serves as the intervention currency, in terms of which the State Bank of Pakistan establishes the daily exchange rate. It may be pointed out that prior to 1981 a fixed exchange rate system was operative in Pakistan, and that the Pakistani Rupee was linked with the U.S. Dollar. In January 1982, Pakistan delinked the Rupee from the U.S. Dollar and adopted a system of managed floating exchange rates. Since then, the Rupee has depreciated by 52.7 percent against a 'basket' of currencies. See also footnote 7 in Chapter 2.

Scenario-I remain unchanged. Table 2 (row 4) shows (see also Appendix Table B) that allowing the import prices to rise at a higher rate slightly worsens the inflationary situation. The rate of inflation increases to 8.2 percent in 1989-90 as compared with the 7.8 percent under the PIDE Scenario-I. The inflation rate declines to 7.0 percent in 1990-91 under the PIDE Scenario-II.[19]

Obviously, depending on the assumption made about the import price index, the PIDE Scenarios (I as well as II) offer an optimal solution – optimal in the sense of doing a better job than the IMF package does – of keeping inflation in the 7-8 percent range, and keeping the growth rate also in the 6.5-7.0 percent range, while minimizing the cost of structural adjustment.

[19]To check on the importance of reducing budgetary deficit in containing inflation without compromising the growth rate of the GDP, we conducted the following simulation experiment. The budget deficit was allowed to be determined endogenously; instead, bank credit was used as a policy instrument. It turned out that by constraining the growth of bank credit to 11.2 percent in 1989-90 and to 11.0 percent in 1990-91, the budgetary deficit increased to 7.77 percent of the GDP in 1989-90 and to 7.34 percent of the GDP in 1990-91. As a result, the rate of inflation increases by 10.3 percent in 1989-90 and by 9.1 percent in 1990-91. And the growth rate of the real GDP increases by 6.27 percent in 1989-90 and by 6.28 percent in 1990-91. It follows that reducing budgetary deficits, along with the other policy instruments mentioned in the text, holds the key to the attainment of the pre-assigned policy objectives. Specifically, the policy of reducing bank credit is not a fruitful policy alternative to reducing budgetary deficits for reducing inflation and stimulating the growth of the real GDP. It is interesting to compare this counterfactual experiment with the three scenarios sketched in the text.

4/Evaluating Policy Instruments

A comparison of the policy packages as a whole, on the basis of the information provided in Table 3, allows us to determine the relative effectiveness of the policy instruments that make up the three policy packages (scenarios). In this chapter, we attempt to disaggregate the total change induced by the alternative scenarios presented in Table 3, and impute this change to each of the elements of the three scenarios.

Determining the Relative Strength of the Causative Factors of Inflation

Using the dynamic elasticities given in Table 2 in Chapter 2, we now turn to computing the relative contribution of each of the contributing factors to reducing inflation under the three alternative scenarios discussed in Chapter 3. The basic technique is to focus on the difference between the control solution and the three alternative scenarios identified in Table 3; and, then, with the help of the dynamic elasticities, to disaggregate the individual contributions of money supply ($M_s(-1)$), the import price index (P_m), and the ratio of the commodity-producing sectors to services sectors (C_s). The results of this exercise are reported in Table 4.

It can be seen from the table that under the PIDE Scenario-I, inflation is reduced by 2.84 percent in 1989-90

about the contribution of the fourth variable identified in Equation 1 – namely, the inflationary expectations. The table shows that inflationary expectation is by far the most important variable, as is evident by the size of its estimated coefficient. But, within the framework of the PIDE Model (1989), the only way to reduce it is to act on the other three explanatory variables – to reduce $M_s(-1)$ and P_m, and to increase C_s.

5/Conclusions

The analysis presented in the preceding four chapters highlights several interesting points about the chemistry of inflation in Pakistan. The analysis also tells us about an efficient anti-inflation policy package – defined in this essay as one that keeps inflation at a single-digit level and maintains a growth rate of the GDP in the 6.5 to 7 percent range, while keeping the cost of structural adjustment to a minimum. Finally, we learn about the relative contribution of each inflation-inducing factor, as identified in Chapter 2, in reducing inflation; and about the effectiveness of various anti-inflation policies. In this concluding chapter, we draw the threads of these arguments together and outline a course of action to fight inflation. We also present here a workable formula for monetary expansion.

A Recapitulation

This essay shows that, *first,* inflation in Pakistan has been caused by a rise in money supply ($M_{s(-1)}$), by a slower growth in the commodity-producing sectors as compared with the services sectors (C_s), by a rise in import price (P_m), and by an increase in last year's inflation – also called inflationary expectations ($P_{gn(-1)}$) (See Table 1, Chapter 2).

Second, the dynamic elasticities, reported in Table 2, estimate the *total* effects of the policy variables on inflation.

They provide an even deeper insight into the complexities of inflation than Equation (1) does – which reports only the direct effect of explanatory variables on inflation. This information tells us that, although monetary and fiscal factors are significant determinants of inflation, an increase in C_s is by far the most important factor; which underlies the need for taking a hard look at the performance of the real sector of the economy. Also, a reduction in import prices should be allowed for when it is clearly anticipated in determining the size of the structural adjustment.

Third, the dynamic simulations reported in Table 3 extend the analytical canvass in two directions: (i) The information so generated puts together the insights provided by dynamic elasticities in the form of a policy package. (ii) These dynamic simulations help us to consider the problems of inflation and growth simultaneously.

Fourth, in fighting inflation, and in minimizing its cost, both the demand-side and the supply-side factors should be taken into account. Also, being an open economy, the 'happenings' in the foreign-trade sector (i.e., changes in import prices) turn out to be a very important cause of inflation in Pakistan.

Fifth, monetary and fiscal policies are significant – but not all-important – anti-inflationary instruments.

Sixth, the size of structural adjustments, such as the one proposed by the IMF, can be substantially reduced by taking into consideration the supply-side factors as well, and by allowing for a reasonable reduction in import prices. A comparison of row 2 with rows 3 and 4 of Table 3 substantiates this point.

Seventh, Equation (1) shows that, given the inflationary expectations, 74 percent of inflation in the current year is explained (caused) by factors which are not manipulable by domestic policy action. It follows that while anti-inflationary policies are important, we should not always expect dramatic results. An adverse movement in the import prices may suddenly upset the apple-cart rather unceremoniously.

An Operational Rule for Monetary Expansion

We now turn to a brief consideration of an operational rule for determining the desired level of money supply to meet the demand generated by the growth process itself. The primary motivation of government policy is to keep these two variables in close proximity to each other so that the country's requirements for the desired rate of economic growth are met; which, in Pakistan's context, is 6-7 percent in the year 1990-91.

The standard rule for monetary expansion is $\dot{M}_s = \dot{Y}$.[20] In words, the rate of growth of money supply should, in a dynamic equilibrium, be equal to the growth rate of the nominal GNP. In the context of the PIDE Model (1989), the reference points for deriving the rule are the forecast values (control solution) of the GDP and the rate of inflation. Given these values, we can determine the corresponding rate of monetary expansion. These values are given in Appendix Table D.

Taking these values of the control solution as a starting-point, we "disturb" the solution by applying a series of shocks to generate alternative policy scenarios or packages. We have already identified three policy scenarios in Tables

[20]See Friedman (1969).

Table 5

The Relationship between Inflation, Growth of GDP and Money Supply (1989-90)

Inflation \ Growth Rate of Real GDP	6.31	6.31	6.30	6.30	6.29	6.29	6.29	6.28	6.27	6.26
					Zone of Indifference					
9.18	2.0									
9.39		4.0								
9.59			6.0							
9.80				8.0						
9.90					9.0					
9.95						9.5				
10.00							10.0			
10.20								12.0		
10.40									14.0	
10.57										16.0

Source: Appendix Table D.

Note: The alternative scenarios pertaining to the growth of money supply have been generated by solving the PIDE Model (1989) with the assumptions listed under the control solution (see note to Table 3), with the exception of bank credit. The off-diagonal entries, not reproduced here, pertain to sub-optimal combinations of the above-mentioned variables.

3 and 4 – namely, the IMF Policy Scenario and the PIDE Scenarios I and II. By simulating the model we determine the required (equilibrium) rate of monetary expansion, as shown in the diagonal of the matrix for each pair of the desired rate of inflation and the desired growth of the real GDP.[21]

A cursory look at Appendix Table D is sufficient to see that the standard rule of monetary expansion, i.e., $\dot{M}_s = \dot{Y}$, should be replaced by $\dot{M}_s \leq \dot{Y}$. In words, the modified rule says that the rate of monetary expansion can be *at the most* equal to the (nominal) growth rate of the GNP, instead of always being equal to it. The reason why this modification is needed is that if money supply is allowed to grow according to the standard rule, namely, by 17.1 percent in 1989-90 because the (nominal) GNP rises by 17.1 percent, then the inflation rate will cross the single-digit threshold. To make sure that inflation does not cross this threshold *and* economic growth is not affected adversely, the money supply can grow at about 9-10 percent, which is substantially less than the maximum rate of 17.1 percent, the growth rate of the (nominal) GNP allowed by the standard rule.

Incidentally, the table also makes clear that monetary policy alone will not bring down the rate of inflation to the 7-8 percent range. In fact, the rate of inflation will remain in the 9.18 – 10.57 percent range. To shift to the lower range, additional anti-inflationary steps, as discussed in the earlier chapters, must be taken.

[21]It should be noted that values corresponding to the rate of inflation, the growth rates of the GDP, and money supply, as reported in Table 5, differ with the corresponding values reported under alternative scenarios in Table 3. These differences simply reflect the different assumptions used regarding the growth of exogenous/policy variables while simulating the model. For example, the values reported in Table 5 are generated under the assumption that *only* money supply is controlled to reduce inflation (see also the note to Table 5), *and no other anti-inflationary measures are being taken.*

summarizes the message that, in general, a higher monetary growth will lead to a higher inflation, but a higher inflation will reduce the growth of the real GDP.

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Appendices

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Appendix Table A

Error Margin of Key Macroeconomic Variables

Variables	Historical Simulation		*Ex-post* Forecast	
	TIC	CV(%)	TIC	CV(%)
Price Level	0.02	2.15	0.009	0.97
Money Supply	0.08	11.90	0.04	4.46
Ratio of Commodity-producing Sector to Services Sector	0.04	3.68	0.009	0.93

Source : PIDE Model (1989).

Note: Historical period covers 1959-60 to 1983-84 and *Ex-post* forecast covers 1984-85 to 1986-87.

TIC = Theil Inequality Coefficient

CV = Coefficient of Variation defined as the Root Mean Square Error divided by the Mean Value of the Endogenous Variable.

Appendix Table B

Scenarios under Alternative Anti-inflationary Regimes

Years	PIDE Forecast (Control Solution)					Alternative Scenarios														
						IMF Scenario					PIDE Scenario - I					PIDE Scenario - II				
	Inflation	GDP (%)	Money Supply (%)	M-X Gap as % of GDP	R-E Gap as % of GDP	Inflation	GDP (%)	Money Supply (%)	M-X Gap as % of GDP	R-E Gap as % of GDP	Inflation	GDP (%)	Money Supply (%)	M-X Gap as % of GDP	R-E Gap as % of GDP	Inflation	GDP (%)	Money Supply (%)	M-X Gap as % of GDP	R-E Gap as % of GDP
1984-85	5.13 (5.36)*	10.54 (9.16)*	9.24 (12.64)*	10.54 (10.74)*	7.44 (7.70)*															
1985-86	4.64 (4.76)*	7.38 (6.95)*	2.40 (14.78)*	7.07 (7.55)*	7.60 (7.60)*															
1986-87	3.47 (4.77)	5.18 (5.72)*	19.44 (13.70)*	2.82 (4.78)*	8.94 (7.70)*															
1987-88	6.93 (6.25)*	5.85 (5.82)*	17.11 (12.22)	5.32 (4.80)*	8.65 (8.60)*															
1988-89	11.06	5.05	17.17	6.14	8.43															
1989-90	10.69	6.26	17.11	5.91	7.73	10.34	6.27	10.43	5.90	6.00	7.85	6.56	8.72	5.85	6.40	8.20	6.54	8.72	5.87	6.40
1990-91	9.96	6.25	17.09	6.30	7.22	9.14	6.28	10.05	6.27	4.80	6.67	6.77	9.53	6.21	5.80	7.04	6.76	9.53	6.24	5.80
1991-92	9.56	6.33	17.10	6.78	6.77	8.44	6.38	10.03	6.73	4.80	6.16	6.38	9.48	6.59	5.15	6.37	6.37	9.48	6.63	5.15
1992-93	9.33	6.51	17.10	7.22	6.36	8.04	6.57	10.17	7.14	4.80	5.68	6.69	9.48	6.93	4.56	5.98	6.67	9.48	6.98	4.56
1993-94	9.21	6.62	17.10	7.69	5.97	7.84	6.69	10.17	7.61	4.80	5.26	6.78	9.48	7.29	4.05	5.69	7.76	9.48	7.37	4.05

Notes: Figures in parentheses with (*) are the actual growth rates of the variable. M = Imports; X = Exports; R = Revenue; E = Expenditure.

For assumptions regarding the control solution, see footnote 12.

1. IMF Scenario consists of the following policy measures:
   (a) Bank credit grows by less than the growth of nominal GDP (which is approximately 11.8 percent in 1989-90 and 11.0 percent in 1990-91). See also note to Table 3.
   (b) Budget deficit is reduced to 6.0 percent of the GDP in 1989-90 and to 4.8 percent of the GDP in 1990-91 to 1993-94. See also footnote 12.
2. PIDE Scenario-I consists of the following policy measures:
   (a) Bank credit grows by 9 percent in 1989-90, by 10 percent in 1990-91 to 1993-94.
   (b) Budget dificit is reduced to 6.4 percent of the GDP in 1989-90, to 5.8 percent in 1990-91, to 5.15 percent in 1991-92, to 4.56 in 1992-93 and to 4.05 percent of the GDP in 1993-94.
   (c) Value-added in agriculture grows by 5.2 percent in 1989-90 and by 5 percent thereafter.
   (d) Value-added in manufacturing grows by 7.4 percent in 1989-90 and thereafter.
   (e) Import price index increases by 8 percent in 1989-90, 7 percent in 1990-91, and 6 percent thereafter.
3. PIDE Scenario-II includes PIDE Scenario-I with the exception that the rate of increase in the import price index remains restricted to 10 percent in 1989-90, to 8 percent in 1990-91, and to 7 percent in 1991-92 to 1993-94.

These forecasts have been generated by performing the simulation experiments with the *PIDE Macro-econometric Model of Pakistan's Economy, 1989*. See Naqvi and Khan (1989).

Appendix Table C

Growth of Money Supply, Import Price Index and Inflation during the 1980s
(In Percentage Terms)

Years	Money Supply	Import Price Index 1959-60 = 100.00	Inflation Rate
1980-81	13.20	21.61	11.95
1981-82	11.36	10.77	9.26
1982-83	25.33	7.77	7.26
1983-84	11.81	4.86	8.57
1984-85	11.64	6.24	5.59
1985-86	14.79	−0.60	4.76
1986-87	13.70	3.50	4.77
1987-88	12.22	24.30	6.25
High Inflation Period			
1980-81 to 1981-82	12.28	16.19	10.60
Moderate Inflation Period			
1982-83 to 1983-84	18.57	6.31	7.92
Low Inflation Period			
1984-85 to 1986−87	13.71	3.06	5.04

Source: Statistical Supplement, *Pakistan Economic Survey 1987-88.*

Appendix Table D

Impact of Monetary Policy on Growth and Inflation

Money Supply Increased during the Year 1988-89 to 1990-91 by (Percent)	Growth Rate of Nominal GDP		Growth Rate of Real GDP		Growth Rate of Nominal GNP		Growth Rate of Real GNP		Rate of Inflation	
	1989-90	1990-91	1989-90	1990-91	1989-90	1990-91	1989-90	1990-91	1989-90	1990-91
2	16.07	14.47	6.31	6.34	15.96	14.38	6.21	6.26	9.18	7.65
4	16.28	14.80	6.31	6.33	16.17	14.71	6.21	6.24	9.39	7.97
5	16.39	14.96	6.30	6.32	16.28	14.87	6.20	6.24	9.49	8.13
6	16.49	15.12	6.30	6.31	16.38	15.03	6.20	6.23	9.59	8.29
7	16.60	15.28	6.30	6.31	16.49	15.19	6.20	6.22	9.69	8.44
8	16.70	15.44	6.30	6.30	16.59	15.35	6.19	6.22	9.80	8.60
9	16.80	15.60	6.29	6.30	16.69	15.51	6.19	6.21	9.90	8.76
10	16.90	15.75	6.29	6.30	16.79	15.66	6.18	6.20	10.00	8.91
11	17.00	15.90	6.28	6.29	16.89	15.81	6.18	6.20	10.10	9.06

Continued –

Appendix Table D – (*Continued*)

12	17.09	16.05	6.28	6.29	16.99	15.96	6.17	6.19	10.20	9.15
13	17.19	16.20	6.28	6.28	17.09	16.11	6.17	6.19	10.30	9.30
14	17.29	16.25	6.27	6.27	17.19	16.26	6.17	6.19	10.40	9.45
15	17.39	16.40	6.27	6.26	17.28	16.41	6.17	6.18	10.49	9.60
16	17.50	16.66	6.26	6.25	17.39	16.57	6.17	6.17	10.57	9.80
Control Solution (17.11)	17.60	16.83	6.26	6.25	17.49	16.74	6.16	6.16	10.69	9.96

Notes: The control solution is obtained by simulating the *PIDE Macro-econometric Model of Pakistan's Economy 1989* under the following assumptions:

(a) The import price index, adjusted for depreciation in the exchange rate, will increase by 15 percent in 1989-90, and by 12 percent in 1990-91.

(b) Bank credit will increase by 15 percent in 1989-90, and by 12 percent in 1990-91.

The alternative scenarios pertaining to the growth of money supply have been generated by solving the model according to the assumptions listed under "Control Solution", with the exception of bank credit.

APPENDIX E

The P.I.D.E. Macro-econometric Model of Pakistan's Economy, 1989: An Outline

THE P.I.D.E. MACRO-ECONOMETRIC MODEL OF PAKISTAN'S ECONOMY, 1989*

A. PRODUCTION – EXPENDITURE MODEL

Production Block

Gross Domestic Product

$$y_g = y_a + y_b + y_q + y_{lm} + y_{sm} + y_c + y_r + y_{od} + y_p + y_{tc} + y_s \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Gross National Product

$$y = y_g + R \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Value-added in Agriculture

$$y_A = y_a + y_b \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Value-added in Manufacturing

$$y_m = y_{lm} + y_{sm} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

Non-agriculture Income

$$y_n = y - y_A \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

*The bare outlines of the Model are reproduced here for ready reference. For details of the Model, see Naqvi and Khan (1989).

Value-added in Agriculture (Crop Sector)

$$ln\,(y_a/L_a) = -0.59 + \underset{(6.05)}{0.18\,ln\,(T_r/L_a)} + \underset{(2.05)}{0.53\,ln\,(A_{tc}/L_a)}$$

$$\underset{(3.66)}{-0.15\,D_{8384}} \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$\bar{R}^2 = 0.56;\ DW = 1.67;\ F = 10.88;\ SER = 0.039$$

Input Demand in Agriculture (Crop Sector)

Labour : $L_a = 0.29\,(p_a \times y_a/W_a)$ ... ... (7)

Tractor: $T_r = 0.18\,(p_a \times y_a/P_r)$ ... ... (8)

Area : $A_{tc} = 0.53\,(p_a \times y_a/P_l)$ ... ... (9)

Value-added in Manufacturing (Large-scale)

$$ln\,(y_{lm}) = 2.03 + \underset{(1.32)}{0.26\,ln\,L_{lm}} + \underset{(4.49)}{0.42\,ln\,K_{lm}} +$$

$$\underset{(2.22)}{0.104\,D_{8284}} + \underset{(9.44)}{0.064t} \quad \ldots \quad \ldots (10)$$

$$\bar{R}^2 = 0.99;\ DW = 1.04;\ F = 786.92;\ SER = 0.043$$

Input Demand in Manufacturing (Large-scale)

Labour : $L_{lm} = 0.26\,(p_{lm} \times y_{lm}/W_{lm})$ ... (11)

Capital : $K_{lm} = 0.42\,(p_{lm} \times y_{lm}/r)$ ... ... (12)

Value-added in Construction

$$y_c = \underset{}{-538.63} + \underset{(8.94)}{0.04C} + \underset{(3.73)}{0.13I} + \underset{(2.26)}{273.72\, D_{8384}} \quad (13)$$

$\bar{R}^2 = 0.93$; $DW = 1.69$; $F = 660.00$; $SER = 105.08$

Value-added in Wholesale and Retail Trade

$$y_r = \underset{}{-147.35} + \underset{(47.94)}{0.14\, y} \quad \cdots \quad \cdots \quad \cdots \quad (14)$$

$\bar{R}^2 = 0.98$; $DW = 1.63$; $F = 2178.00$; $SER = 113.44$

Value-added in Public Administration and Defence

$$y_p = \underset{}{-228.5} + \underset{(3.66)}{0.42C_g} + \underset{(3.51)}{127.13t} - \underset{(1.79)}{346.89\, D_{7073}} \quad (15)$$

$\bar{R}^2 = 0.83$; $DW = 2.02$; $F = 37.78$; $SER = 235.37$

Value-added in Agriculture (Non-crop) Sector

$$y_b = \underset{}{2119.6} + \underset{(13.38)}{0.04C} + \underset{(2.42)}{0.04I} + \underset{(2.36)}{0.05\, X_T} \quad \cdots \quad (16)$$

$\bar{R}^2 = 0.99$; DW 1.22; $F = 1660.00$; $SER = 48.51$

Value-added in Mining and Quarrying

$$y_q = \underset{}{-6.83} + \underset{(8.19)}{0.04C} + \underset{(2.10)}{0.007I} \quad \cdots \quad \cdots \quad (17)$$

$\bar{R}^2 = 0.95$; $DW = 1.83$; $F = 252.00$; $SER = 8.08$

Value-added in Ownership of Dwellings

$$y_{od} = \underset{(14.44)}{545.45} + \underset{(1.06)}{0.02C + 0.01I} \quad \ldots \quad \ldots \quad (18)$$

$$\bar{R}^2 = 0.97;\ DW = 1.75;\ F = 339.50;\ SER = 18.13$$

Value-added in Transport and Communications

$$y_{tc} = \underset{(33.87)}{-118.36 + 0.07y} + \underset{(3.42)}{299.51\, D_{8384}} \quad \ldots \quad (19)$$

$$\bar{R}^2 = 0.98;\ DW = 1.88;\ F = 514.50;\ SER = 78.97$$

Value-added in Services

$$ln\, y_s = \underset{(12.35)}{7.27 + 0.07t} \quad \ldots \quad \ldots \quad \ldots \quad (20)$$

$$\bar{R}^2 = 0.98;\ DW = 1.93;\ F = 1078.00;\ SER = 0.03$$

Value-added in Manufacturing (Small-scale)

$$y_{sm} = \bar{y}_{sm} \quad \ldots \quad \ldots \quad \ldots \quad (21)$$

Expenditure Block

Resource Gap

$$G_r = C + I - y \quad \ldots \quad \ldots \quad \ldots \quad (22)$$

Total Consumption

$$C = C_p + C_g \quad \ldots \quad \ldots \quad \ldots \quad (23)$$

Private Consumption

$$C_p/y_d^n = \underset{(1.18)}{0.51 - 0.30\,(y_d^n/y_{d(-1)}^n)} + \underset{(5.51)}{0.78\,(C_p/y_{d(-1)}^n)} \quad \ldots \quad \ldots \quad (24)$$

$$\bar{R}^2 = 0.56;\ DW = 1.77;\ F = 15.75;\ SER = 0.03$$

$$C_p = C_p/y_d^n \times y_d^n \quad \ldots \quad \ldots \quad \ldots \quad (25)$$

Public Consumption

$$C_g = \underset{(19.64)}{126.38} + \underset{(0.75)}{0.72Z} + 0.04F_B + \underset{(2.99)}{1039.7\,D_{6566}} + \underset{(1.53)}{529.24\,D_{7172}} \quad \ldots \quad \ldots \quad \ldots \quad (26)$$

$$\bar{R}^2 = 0.97;\ DW = 1.39;\ F = 232.75;\ SER = 336.47$$

Disposable Income

$$y_d = y - Z_i \quad \ldots \quad \ldots \quad \ldots \quad (27)$$

Disposable Income Adjusted for Remittances

$$y_d^n = y_d - R_m \quad \ldots \quad \ldots \quad \ldots \quad (28)$$

Total Investment

$$I = I_p + I_g + S_t \quad \ldots \quad \ldots \quad \ldots \quad (29)$$

Gross Fixed Capital Formation

$$I_{pg} = I_p + I_g \quad \ldots \quad \ldots \quad \ldots \quad (30)$$

Total Private Investment

$$I_p = I_{pm} + I_{pa} + I_{po} \quad \ldots \quad \ldots \quad \ldots \quad (31)$$

Private Investment in Manufacturing

$$I_{pm} = I_{plm} + I_{psm} \quad \ldots \quad \ldots \quad \ldots \quad (32)$$

Private Investment in Manufacturing (Large-scale)

$$\ln I_{plm} = \underset{}{7.07} + \underset{(4.55)}{0.61} \ln Y_{lm(-1)} - \underset{(3.41)}{0.62} \ln K_{lm(-1)} -$$

$$\underset{(3.81)}{1.63} \ln (P_k/W_{lm}) - \underset{(5.54)}{0.71} D_{7284} \quad \ldots \quad \ldots \quad (33)$$

$$\bar{R}^2 = 0.90; \; DW = 1.89; \; F = 42.75; \; SER = 0.14$$

Private Investment in Manufacturing (Small-scale)

$$I_{psm} = \bar{I}_{psm} \quad \ldots \quad \ldots \quad \ldots \quad (34)$$

Private Investment in Agriculture

$$I_{pa} = \underset{}{65.33} + \underset{(2.58)}{0.03} y_a + \underset{(1.55)}{0.02} R_m + \underset{(1.33)}{84.87} D_{6364} +$$

$$\underset{(7.31)}{368.34} D_{7584} \quad \ldots \quad \ldots \quad \ldots \quad (35)$$

$$\bar{R}^2 = 0.95; \; DW = 1.09; \; F = 114.00; \; SER = 60.38$$

Private Investment in 'Other Sectors'

$$I_{po} = \underset{}{358.67} + \underset{(2.58)}{0.05\, C_r} - \underset{(1.55)}{32.74\, r_{cm}} + \underset{(1.33)}{417.48\, D_{6364}} + \underset{(7.31)}{0.64\, I_{po(-1)}} \quad \ldots \quad \ldots \quad \ldots \quad (36)$$

$$\bar{R}^2 = 0.83;\ DW = 1.63;\ F = 29.18;\ SER = 122.30$$

Total Public Investment

$$I_g = I_{go} + I_{gm} \quad \ldots \quad \ldots \quad \ldots \quad (37)$$

Public Investment in Manufacturing

$$\bar{I}_{gm} = \bar{I}_{glm} + \bar{I}_{gsm} \quad \ldots \quad \ldots \quad \ldots \quad (38)$$

Total Investment in Manufacturing (Large-scale)

$$I_{lm} = I_{plm} + I_{glm} \quad \ldots \quad \ldots \quad \ldots \quad (39)$$

Public Investment in 'Other Sectors'

$$I_{go} = \underset{}{238.96} + \underset{(3.77)}{0.17\, Z} + \underset{(3.60)}{0.14\, F_B} + \underset{(3.34)}{836.01\, D_{6263}} + \underset{(2.95)}{628.26\, D_{8184}} + \underset{(2.47)}{0.34\, I_{go(-1)}} \quad \ldots \quad \ldots \quad (40)$$

$$\bar{R}^2 = 0.94;\ DW = 2.04;\ F = 91.20;\ SER = 234.85$$

Changes in Stocks

$$S_t = y_g - C - I - X_T + M_T + S_u \quad \ldots \quad \ldots \quad (41)$$

Subsidies

$$S_u = \bar{S}_u \quad \cdots \quad \cdots \quad \cdots \quad (42)$$

B. FOREIGN TRADE SUB-MODEL

Import Block

Imports of Goods and Services

$$M_T = M_g + M_{sr} \quad \cdots \quad \cdots \quad \cdots \quad (43)$$

Imports of Goods

$$M_g = M_{01} + M_{24} + M_3 + M_{5\,t9} \quad \cdots \quad \cdots \quad (44)$$

Imports of Food and Beverages (SITC 0, 1)

$$\ln M_{01} = \underset{}{6.46} - \underset{(0.54)}{0.07 \ln y_A} + \underset{(3.03)}{0.60 D_{6465}} + \underset{(2.31)}{0.46 D_{6667}} - \underset{(7.76)}{0.92 D_{6871}} + \underset{(2.82)}{0.55 D_{7273}} + \underset{(3.08)}{0.61 D_{7879}} \quad (45)$$

$$\bar{R}^2 = 0.81;\ DW = 1.51;\ F = 17.64;\ SER = 0.19$$

Imports of Crude Materials (SITC 2, 4)

$$M_{24} = -17.62 + \underset{(8.06)}{0.0066 y_g} + \underset{(4.93)}{0.044 F_{er}} + \underset{(5.33)}{183.45 D_{7879}} \quad \cdots \quad \cdots \quad \cdots \quad (46)$$

$$\bar{R}^2 = 0.96;\ DW = 1.61;\ F = 183.01;\ SER = 33.23$$

Imports of Fuel and Mineral Oils (SITC 3)

$$M_3 = \underset{(4.61)}{-401.86} + \underset{(5.85)}{0.015\, y_g} + 0.21\, F_{er(-1)} -$$

$$\underset{(0.81)}{0.41\, p^m_3/p_{gn}} + \underset{(3.59)}{368.55\, D_{8081}} \quad \ldots \qquad \ldots \quad (47)$$

$$\bar{R}^2 = 0.95;\ DW = 1.13;\ F = 103.22;\ SER = 94.42$$

Imports of Manufactured Goods (SITC 5 to 9)

$$M_{5t9} = \underset{(5.71)}{749.85} + \underset{(0.14)}{0.049\, y_g} + 0.0097\, F_{er(-1)} -$$

$$\underset{(4.87)}{27.70\, E_{m5t9}} + \underset{(2.29)}{448.21\, D_{6465}} - \underset{(4.72)}{942.41\, D_{7172}} +$$

$$\underset{(2.21)}{431.42\, D_{7980}} \qquad \ldots \qquad \ldots \qquad \ldots \quad (48)$$

$$\bar{R}^2 = 0.79;\ DW = 1.54;\ F = 11.33;\ SER = 188.53$$

Imports of Services

$$M_{sr} = M^A_{sr} + I_{PD} \qquad \ldots \qquad \ldots \qquad \ldots \quad (49)$$

Imports of Services Adjusted for Interest Payment on Foreign Debt

$$M^A_{sr} = \underset{(2.69)}{-821.18} + \underset{(3.39)}{0.29\,(X_g + M_g)} + 86.43\, t -$$

$$\underset{(3.68)}{1104.7\, D_{7273}} \qquad \ldots \qquad \ldots \qquad \ldots \quad (50)$$

$$\bar{R}^2 = 0.94;\ DW = 0.89;\ F = 104.44;\ SER = 293.74$$

Interest Payments on Foreign Debt

$$I_{PFD} = \underset{}{64.64} + \underset{(18.85)}{0.026F_{DT}} + \underset{(9.28)}{1714.6\,D_{8284}} \quad \ldots \quad (51)$$

$$\bar{R}^2 = 0.98;\ DW = 1.33;\ F = 514.50;\ SER = 191.95$$

$$I_{PD} = I_{PFD}/P_m \times 100 \quad \ldots \quad \ldots \quad \ldots \quad (52)$$

Export Block

Exports of Goods and Services

$$X_T = X_g + X_{sr} \quad \ldots \quad \ldots \quad \ldots \quad (53)$$

Exports of Goods

$$X_g = X_{01} + X_{24} + X_{3,5t9} \quad \ldots \quad \ldots \quad \ldots \quad (54)$$

Exports of Food, Beverages and Tobacco (SITC 0, 1)

$$X_{01} = \underset{}{-450.27} + \underset{(17.15)}{4.95W_{gd}} - \underset{(4.63)}{17.56r_F} + \underset{(2.11)}{115.87\,D_{6263}}$$

$$+ \underset{(3.94)}{223.69\,D_{8081}} + \underset{(3.94)}{86.19\,D_{8384}} \quad \ldots \quad \ldots \quad (55)$$

$$\bar{R}^2 = 0.96;\ DW = 1.96;\ F = 116.40;\ SER = 51.21$$

Exports of Crude Materials (SITC 2, 4)

$$X_{24} = \bar{X}_{24} \quad \ldots \quad \ldots \quad \ldots \quad (56)$$

Exports of Manufactured Goods (SITC 3, 5 to 9)

$$X_{3,5t9} = \underset{(11.52)}{-1312.76 + 14.10W_{gd}} \underset{(1.18)}{- 1.28RP_{x3,5t9}} + \underset{(5.32)}{445.41\,D_{7273}} + \underset{(5.63)}{567.69\,D_{8284}} \quad \ldots \quad (57)$$

$$\bar{R}^2 = 0.94;\ DW = 1.67;\ F = 90.25;\ SER = 94.05$$

Exports of Services

$$X_{sr} = \bar{X}_{sr} \quad \ldots \quad \ldots \quad \ldots \quad (58)$$

Trade Balance

$$M_g^c = M_g \times P_m \quad \ldots \quad \ldots \quad \ldots \quad (59)$$

$$X_g^c = X_g \times P_x \quad \ldots \quad \ldots \quad \ldots \quad (60)$$

$$G_t = X_g^c - M_g^c \quad \ldots \quad \ldots \quad \ldots \quad (61)$$

Current Account Balance

$$B = G_t + R \quad \ldots \quad \ldots \quad \ldots \quad (62)$$

C. FISCAL AND MONETARY SUB-MODEL

Fiscal Block

Total Government Revenue

$$Z = Z_i + Z_c + Z_e + Z_s + Z_n + Z_o \quad \ldots \quad \ldots \quad (63)$$

Income and Corporation Taxes

$$Z_i = \underset{(12.90)}{179.02} + \underset{}{0.022\, y_n^c} - \underset{(1.26)}{472.04\, D_{7071}} + \underset{(5.35)}{2061.4\, D_{7984}} \quad \cdots \quad \cdots \quad (64)$$

$$\bar{R}^2 = 0.98;\ DW = 1.51;\ F = 1562.64;\ SER = 578.05$$

Custom Duties

$$Z_c = \underset{(48.43)}{-352.24} + \underset{}{0.52\, M_{5\,t9}^c} + \underset{(5.32)}{3448.2\, D_{8283}} \quad \cdots \quad (65)$$

$$\bar{R}^2 = 0.99;\ DW = 1.51;\ F = 1562.64;\ SER = 578.05$$

Excise Taxes

$$Z_e = \underset{(37.78)}{15.22} + \underset{}{0.23\, y_m^c} + \underset{(6.40)}{1259.4\, D_{7980}} \quad \cdots \quad (66)$$

$$\bar{R}^2 = 0.98;\ DW = 1.69;\ F = 514.50;\ SER = 241.18$$

Sales Taxes

$$Z_s = \underset{(2.09)}{218.80} + \underset{}{0.027\, y_m^c} + \underset{(2.62)}{0.026\, M_g^c} - \underset{(4.90)}{349.53\, D_{7071}} + \underset{(4.25)}{562.10\, D_{8384}} \quad \cdots \quad \cdots \quad \cdots \quad (67)$$

$$\bar{R}^2 = 0.97;\ DW = 1.45;\ F = 232.75;\ SER = 86.66$$

Non-tax Revenue

$$Z_n = \bar{Z}_n \quad \ldots \quad \ldots \quad \ldots \quad (68)$$

Other Tax Revenue

$$Z_o = \bar{Z}_o \quad \ldots \quad \ldots \quad \ldots \quad (69)$$

$$M_{01}^c = M_{01} \times P_{01}^m \quad \ldots \quad \ldots \quad \ldots \quad (70)$$

$$M_{24}^c = M_{24} \times P_{24}^m \quad \ldots \quad \ldots \quad \ldots \quad (71)$$

$$M_3^c = M_3 \times p_3^m \quad \ldots \quad \ldots \quad \ldots \quad (72)$$

$$M_{5t9}^c = M_{5t9} \times P_{5t9}^m \quad \ldots \quad \ldots \quad \ldots \quad (73)$$

$$Y_m^c = y_m \times P_{mf} \quad \ldots \quad \ldots \quad \ldots \quad (74)$$

$$y_n^c = y_n \times P_{gn} \quad \ldots \quad \ldots \quad \ldots \quad (75)$$

$$y^c = y \times P_{gn} \quad \ldots \quad \ldots \quad \ldots \quad (76)$$

Budget Deficit

$$D_f = p_{gn} [C_g + I_g + S_u] - Z \quad \ldots \quad \ldots \quad (77)$$

Monetary Block

Money Supply

$$\ln M_s = \underset{}{1.85} + \underset{(11.53)}{0.69} \ln C_r + \underset{(0.26)}{0.016} \ln D_f +$$

$$+ \underset{(3.76)}{0.22} \ln F_{er} \quad \ldots \quad \ldots \quad \ldots \quad (78)$$

$$\bar{R}^2 = 0.98; \; DW = 1.10; \; F = 3421.52; \; SER = 0.14$$

Money Demand

$$\ln m_d = \underset{(4.32)}{-1.377} + 0.67 \ln y - \underset{(1.10)}{0.67} \ln r_{cm} +$$

$$\underset{(3.01)}{0.42} \ln m_{d(-1)} + \underset{(4.57)}{0.23} D_{7172} \quad \ldots \quad (79)$$

$$\bar{R}^2 = 0.98; \quad DW = 2.01; \quad F = 232.75; \quad SER = 0.05$$

$$M_d = m_d \times p_{gn} \quad \ldots \quad \ldots \quad \ldots \quad (80)$$

Equilibrium Condition

$$M_d = M_s \quad \ldots \quad \ldots \quad \ldots \quad (81)$$

Price Level

$$\ln P_{gn} = \underset{(4.32)}{0.36} + \underset{(7.59)}{0.10} \ln M_{s(-1)} + 0.18 \ln P_m -$$

$$\underset{(1.77)}{0.19} \ln C_s + \underset{(12.24)}{0.56} \ln P_{gn(-1)} \quad (82)$$

$$\bar{R}^2 = 0.99; \quad DW = 2.02; \quad F = 4878.08; \quad SER = 0.02$$

Commodity Share

$$C_s = y_A + y_m/(y_g - y_A - y_m) \quad \ldots \quad \ldots \quad (83)$$

List of Variables

A

A_{tc} = Total irrigated area in thousand hectares

B

B = Current account balance in million rupees

C

C = Total consumption in million rupees

C_p = Private consumption in million rupees

C_g = Public consumption in million rupees

C_r = Total bank credit in million rupees

C_s = Ratio of value-added by commodity-producing sectors to value-added by services sectors

D

D_{6263} = 1962-63 = 1 and zero otherwise

D_{6364} = 1963-64 = 1 and zero otherwise

D_{6465} = 1964-65 = 1 and zero otherwise

D_{6566} = 1965-66 = 1 and zero otherwise

D_{6667} = 1966-67 = 1 and zero otherwise

D_{6871} = 1968-69 to 1970-71 = 1 and zero otherwise

D_{7071} = 1970-71 = 1 and zero otherwise

D_{7073} = 1970-71 to 1972-73 = 1 and zero otherwise

D_{7172} = 1971-72 = 1 and zero otherwise

D_{7273} = 1972-73 = 1 and zero otherwise

D_{7284} = 1971-72 to 1983-84 = 1 and zero otherwise

D_{7584} = 1974-75 to 1983-84 = 1 and zero otherwise

D_{7879} = 1978-79 = 1 and zero otherwise

D_{7980} = 1979-80 = 1 and zero otherwise

D_{7984} = 1978-79 to 1983-84 = 1 and zero otherwise

D_{8081} = 1980-81 = 1 and zero otherwise

D_{8184} = 1980-81 to 1983-84 = 1 and zero otherwise

D_{8283} = 1982-83 = 1 and zero otherwise

D_{8284} = 1981-82 to 1983-84 = 1 and zero otherwise

D_f = Budget deficit in million rupees

E

E_{m5t9} = Effective exchange rate of imports of manufactured goods (SITC 5 to 9)

F

F_{er} = Foreign exchange reserves in million rupees

F_B = Foreign borrowing in million rupees

F_{DT} = Outstanding foreign debt in million rupees

G

G_t = Balance of trade in million rupees

I

I = Total investment in million rupees

I_P = Total private investment in million rupees

I_g = Total public investment in million rupees

I_{go} = Public investment in 'other' sector in million rupees

I_{gm} = Public investment in manufacturing sector in million rupees

I_{glm} = Public investment in large-scale manufacturing sector in million rupees

I_{gsm} = Public investment in small-scale manufacturing sector in million rupees

I_{lm} = Total investment in large-scale manufacturing sector in million rupees

I_{pm} = Private investment in manufacturing sector in million rupees

I_{plm} = Private investment in large-scale manufacturing sector in million rupees

I_{psm} = Private investment in small-scale manufacturing sector in million rupees

I_{pg} = Gross fixed capital formation in million rupees

I_{pa} = Private investment in agriculture sector in million rupees

I_{po} = Private investment in 'other' sector in million rupees

I_{PFD} = Interest payment on foreign debt in million rupees at current prices

I_{PD} = Interest payment on foreign debt in million rupees at constant prices (1959-60 = 100.0)

K

K_{lm} = Capital stock in large-scale manufacturing sector in million rupees

L

L_a = Labour force in agriculture sector in thousand

L_{lm} = Labour force in large-scale manufacturing sector in thousand

M

M_T = Imports of goods and services in million rupees

M_g = Imports of goods in million rupees

M_{sr} = Imports of services in million rupees

M_{01} = Imports of food and beverages (SITC 0, 1) in million rupees

M_{24} = Imports of crude materials (SITC 2, 4) in million rupees

M_3 = Imports of fuel and mineral oils (SITC 3) in million rupees

$M_{5\,t9}$ = Imports of manufacturing goods (SITC 5 to 9) in million rupees

M^A_{sr} = Imports of services adjusted for interest payment on foreign debt in million rupees

M^c_g = Imports of goods in million rupees at current prices

M^c_{01} = Imports of food and beverages in million rupees at current prices

M_{24}^{c} = Imports of crude materials in million rupees at current prices

M_{3}^{c} = Imports of fuel and mineral oils in million rupees at current prices

M_{5t9}^{c} = Imports of manufactured goods in million rupees at current prices

M_{s} = Money supply (M_2 definition) in million rupees at current prices

M_{d} = Demand for money in million rupees at current prices

m_{d} = Real demand for money in million rupees

P

P_{a} = Price index of agricultural output

P_{r} = Price index of tractor

P_{l} = Price index of land

P_{lm} = Price index of large-scale manufacturing goods

P_{k} = Price index of capital

P_{m} = Import price index

P_{x} = Export price index

P_{01}^{m} = Import price index of food and beverages

P^m_{24} = Import price index of crude materials

P^m_3 = Import price index of fuel and mineral oils

P^m_{5t9} = Import price index of manufactured goods

P_{mf} = Price index of manufactured goods

P_{gn} = Implicit GNP deflator

R

R = Net factor income from abroad in million rupees

R_m = Remittances in million rupees

r = Rate of interest on time deposits

r_{cm} = Inter-bank call money rate

r_F = Real international interest rate defined as Euro-dollar rate adjusted for Pakistan's export price of food and beverages (SITC 0, 1)

$RP_{x3,5t9}$ = Relative price of exports of fuel and manufactured good (SITC 3, 5 to 9)

S

S_t = Changes in stock in million rupees

S_u = Subsidies in million rupees

T

T_r = Number of tractors

t = Time trend

W

W_a = Index of wages in agriculture

W_{lm} = Index of wages in large-scale manufacturing sectors

W_{gd} = Index of world GDP

X

X_T = Exports of goods and services in million rupees

X_g = Exports of goods in million rupees

X_{sr} = Exports of services in million rupees

X_{01} = Exports of food, beverages and tobacco in million rupees

X_{24} = Exports of crude materials in million rupees

$X_{3,5 t 9}$ = Exports of manufactured goods in million rupees

X_g^c = Exports of goods in million rupees at current prices

Y

y = Gross national product in million rupees

y_g = Gross domestic product in million rupees

y_a = Value-added in agriculture (crop sector) in million rupees

y_b = Value-added in agriculture (non-crop sector) in million rupees

y_{lm} = Value-added in manufacturing (large-scale) in million rupees

y_{sm} = Value-added in manufacturing (small-scale) in million rupees

y_q = Value-added in mining and quarrying in million rupees

y_c = Value-added in construction in million rupees

y_r = Value-added in wholesale and retail trade in million rupees

y_{od} = Value-added in ownership of dwellings in million rupees

y_p = Value-added in public administration and defence in million rupees

y_{tc} = Value-added in transport and communications in million rupees

y_s = Value-added in services in million rupees

y_A = Value-added in agriculture in million rupees

y_m = Value-added in manufacturing in million rupees

y_n = Non-agriculture income in million rupees

y_d = Disposable income in million rupees

y_d^n = Disposable income adjusted for remittances in million rupees

y_n^c = Disposable income in million rupees at current prices

y_m^c = Value-added in manufacturing in million rupees at current prices

y^c = Gross national product in million rupees at current prices

Z

Z = Total government revenue in million rupees at current prices

Z_i = Income and corporation taxes in million rupees at current prices

Z_c = Custom duties in million rupees at current prices

Z_e = Excise tax in million rupees at current prices

Z_s = Sales tax in million rupees at current prices

Z_n = Non-tax revenue in million rupees at current prices

Z_o = Other tax revenue in million rupees at current prices

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