CHAPTER FOUR
THE MODEL

In this chapter, we have described the model used for carrying out our simulation experiments to study the responses of employment and prices to changes in government investment in the Indian economy.

The structure of the model is based on integration of input-output and behaviouristic models. Briefly, the model incorporates the effects of both intermediate and final demand using a Static-Input - Output Model of Leontief type (hereafter referred to as SIOM). Attempt has been made to close the SIOM, to some extent, with the help of behaviouristic equations. Care has been taken to keep intact, the realism of the model, though, it also includes equations at current prices, wherever economic reasoning calls for. Some degree of dynamism is also present in the model, which is transmitted to the economy through Private Real Sectoral Gross Domestic Capital Formation. The problem of changing input-output and other coefficients related to SIOM has been solved by exogenously estimating a series of scalars, vectors and matrices of relevant coefficients which are mutually consistent. The Model, however, is not an ideal one and has been constructed according to availability of data. Attempt to keep the model within manageable limits has also prevented us from further improvements.
The model consists of two blocks. First block describes the SICM framework of the model, and the second contains linear and non-linear behavioural equations. Identities have been used in both the blocks accordingly.

4.1 The Input-Output Block

As mentioned earlier, this block is based on SICM of Leontief type. It consists of 120 deterministic equations.53

A vector having components of Real Final Demand at market prices is constructed in this block with the help of some definitional identities. To construct this vector, we use data on exogenous variables, endogenous variables estimated within the block and endogenous variables estimated in the Behaviouristic Block. The vector is then converted into a vector of Real Sectoral Final Demand at factor cost using a conversion matrix. The vector of Real Sectoral Final Demand determines, in turn, the vectors of Real Sectoral Gross Output and Direct and Indirect Employment with the help of Leontief's Inverse. The vector of Real Sectoral Gross Value Added, determines Oil Imports and Imports other than Oil.

53 All of these deterministic equations have not been used while solving our model for endogenous variables but pertain to some intermediate computations. The model is based on standard assumptions of Input-Output analysis, except that our coefficients do not remain fixed but change from year to year.
On the price front, a vector containing deflators for Sectoral Gross Output is estimated from data generated in the Behaviouristic Block and those given exogenously. Transpose of Leontief's Inverse is used to construct this vector with a set of mutually consistent Implicit Price Deflators for Sectoral Gross Output. This vector of deflators gives, in turn, the Implicit Price Deflators for components of Final Demand, using transpose of Final Demand conversion matrix.

Now we describe this block in detail. First of all we define a vector $D_t$ containing components of Real Final Demand at market prices. It is an $18 \times 1$ column vector with the following elements:

$$D_t = (BPCEM_{t}, BGCEM_{t}, BDKFT.AG_{t}, BDKFT.PI_{t}, BDKFT.PS_{t},$$
$$BDKFT.MQ_{t}, BDKFT.MF_{t}, BDKFT.CH_{t}, BDKFT.EM_{t},$$
$$BDKFT.RL_{t}, BDKFT.CT_{t}, BDKFT.CH_{t}, BDKFT.TR_{t},$$
$$BDKFT.BI_{t}, BDKFT.RE_{t}, BDKFT.SR_{t}, BCHSTK_{t},$$
$$BEXPQR_{t})$$

The first two elements of this vector, viz., $BPCEM_{t}$ and $BGCEM_{t}$, are Real Private and Real Government Consumption at market prices, respectively. The third through sixteenth elements are Real Total (Private+Government) Sectoral Gross Domestic Capital Formation at market prices. The last two elements are Changes in Stocks, and Exports.

54 Subscript "t" refers to period t throughout the text. For explanation of notations, see Appendix to this Chapter.
Let us now describe the Final Demand Conversion matrix $F_t$. Each column of this matrix corresponds to the elements of $D_t$ and contains proportions of Sectoral Gross Output at factor cost in one rupee worth of component of Final Demand at market prices. The column corresponding to, say, Real Private Consumption has proportions of Sectoral Gross Outputs at factor cost, purchased for one rupee worth of Private Consumption at market prices. Thus, the matrix, when added column-wise, give us the total purchases from all sectors at factor cost per rupee worth of component of Final Demand at market prices. The complement of this total is nothing but sum of proportions of indirect taxes and imports. This matrix when post-multiplied by the vector $D_t$ gives us estimates of Real Sectoral Final Demand. Thus, if we denote a vector of Real Sectoral Final Demand by $FD_t$ of the order $14 \times 1$, then, in matrix notation, we may write

$$FD_t = F_t \cdot D_t \quad \ldots (I)$$

### 4.1.1 Real Sectoral Gross Output

Using Leontif's Inverse for period $t+1$ we may obtain the vector $X_t$ of the order $14 \times 1$ having Real Sectoral Gross Output. Algebraically,

55 This compliment also includes proportion of changes in stocks in the sector of use in case of Gross Domestic Capital Formation.
\[ X_t = (I - A_t)^{-1} \cdot \mathbf{F} \mathbf{D}_t \]  \hspace{1cm} \text{(II)}

where \( A_t \) is a 14 x 14 input-output coefficient matrix for period 't', and I is an identity matrix of the order 14 x 14.

4.1.2 Real Sectoral Gross Value Added

A vector \( y_t \) of the order 14 x 1 can be computed from \( X_t \) with the help of a diagonal matrix \( B_t \) of the order 14 x 14 which contains proportion of Gross Value Added in each sector for one rupee worth of Gross Output in that sector. We, thus have,

\[ y_t = B_t \cdot X_t \]  \hspace{1cm} \text{(III)}

4.1.3 Import Requirements

In order to estimate the total import requirements in the economy, we estimate the oil and non-oil imports, separately.

4.1.3.1 Oil Imports

\[ \overline{M_O}_t = M_O \cdot X_t + CMO_t \cdot BCO\text{EMP}_t + GMO_t \cdot BGCE\text{MP}_t \]  \hspace{1cm} \text{(IV)}

where \( \overline{M_O}_t \) is the total oil import requirement and \( M_O \cdot X_t \) is total oil input requirement.
4.1.3.2 Imports other than Oil

\[ \overline{MG_t} = MG_t X_t + CMG_t BPCEMP_t + GMG_t BGCEMP_t + KM_t \cdot \overline{I_t} \]  \hfill \ldots (V)

where \( \overline{MG_t} \) and \( MG_t X_t \) are respectively the total non-oil import requirements and non-oil requirements of the production sectors.

\( \overline{I_t} \) is a 14 x 1 vector containing Real Total Sectoral Gross Domestic Capital Formation (which is the same as elements three through sixteen of \( D_t \)), and \( KM_t \) is a vector of coefficients indicating import requirement other than oil per rupee of Real Total Gross Domestic Capital Formation at market prices.

4.1.4 Changes in Stocks

Changes in stocks are defined as weighted sum of the Real Sectoral Gross Domestic Capital Formation - weights being the proportion of Changes in Stocks in one rupee worth of Real Sectoral Gross Domestic Capital Formation. Mathematically,

\[ \overline{Q_t} = \overline{S_t} = Q_t \cdot \overline{I_t} \]  \hfill \ldots (VI)

where \( Q_t \) is a 1 x 14 vector containing proportions of Changes in Stocks in each sector in one rupee worth of Real Sectoral Total Gross Domestic Capital Formation and \( \overline{Q_t} \) are total changes in stocks in the economy.
4.1.5 **Implicit Price Deflators for Sectoral Gross Output**

A set of Implicit Price Deflators for sectoral gross output (consistent with each other) is computed by using the information from the Behaviouristic Block regarding Implicit Price Deflators for Sectoral Gross Values Added and Implicit Price Deflator for Indirect Taxes less Subsidies. Exogenous data for c.i.f. Unit Value Indices for Oil Imports and non-Oil Imports, and transpose of Leontief's Inverse are also used in arriving at these Implicit Price Deflators.

It should be clear that these Deflators are different from Sectoral Gross Value Added Deflators. The latter may be appropriate to deflate sectoral incomes (Sectoral Net Output), but not for deflating the Sectoral Gross Output as these deflators may not reflect the rise in price of Sectoral Gross Output due to rise in prices of material inputs. These deflators are likely to represent only the rise in prices of primary inputs, whereas the economy is expected to be influenced by the price of finished output and not only by that of primary inputs. The two deflators may be considered as substitutes or proxy for each other, only under the assumption that the prices of primary inputs are pro-rata adjusted to changes in prices of finished output. We have however not made this assumption and maintain the distinction between the Gross Output and Gross Value Added Deflators.
Denoting Implicit price Deflators for Sectoral Gross Output by a vector $\mathbf{P}_c$ of the order $14 \times 1$, we define it as weighted sum of various prices of inputs going into production of the gross output-- weights being the input coefficients. Since our analysis is being carried out in real terms, i.e. at 1970-71 prices, and the column sum of all input coefficients is unity, we may say that for some unknown quantity of Gross Output being produced in a particular sector the price is Re. 1. Now if prices of inputs change, then the same quantity of Gross Output will be produced with change in its value according to input coefficients. For example, suppose 500 grams of steel worth Re. 1 (at 1970-71 prices) is produced with 600 grams of iron ore costing 90 paise. If the price of iron ore increases by 50 paise per kilogram then the same amount of iron ore will cost Rs. 1.20, and if prices of other inputs remain unaltered, 500 grams of steel will now be worth Rs. 1.30, which was earlier worth Re. 1. Thus, a 33.33% increase in the price of iron ore, would lead to 30% increase in the price of steel, if the input coefficient for iron ore in steel sector is .90 at 1970-71 prices and remains fixed. This may be termed as first-round-effect of increase in steel price due to increase in the price of iron ore. Since the production activity in the economy is interdependent, increase in steel price would be transmitted to rest of the economy directly and indirectly through sectors using steel as input. This interdependence is also expected to force a further increase in the prices
of iron ore which in turn would set a fresh hike in prices. We may, therefore, postulate that any change in price of Gross Output of even a single sector is capable of setting in a process for increase in prices of Gross Output of all the sectors.

SICM provides us a framework which helps us in handling complex problems arising due to interdependence in the economy. Using this technique we would find out our unknown vector $\mathbf{FX}_t$ of Implicit Price Deflators for Sectoral Gross Output, which are being considered as proxy for sectoral prices.

It can be observed clearly that $(A^t \mathbf{FX}_t)$ gives us the material input component of $\mathbf{FX}_t$. To this, if we add (i) $(B^t \mathbf{PV}_t)$; the Gross Value Added component; (ii) $(T^t \mathbf{DINTAX}_t)$; the Indirect Taxes less Subsidies component; (iii) $(M^t \mathbf{DIMOIL}_t)$; the Oil Import component and (iv) $(M^t \mathbf{DIMOQO}_t)$; the Imports other than Oil component, we have total $\mathbf{FX}_t$. We may define $\mathbf{FX}_t$ in matrix notation as

$$\mathbf{FX}_t = A^t \mathbf{FX}_t + (T^t \mathbf{DINTAX}_t + B^t \mathbf{PV}_t + M^t \mathbf{DIMOIL}_t + M^t \mathbf{DIMOQO}_t)$$

It may be verified from the above expression that for 1970-71 prices equal to unity, the unknown vector $\mathbf{FX}_t$ also becomes a unit vector.

The vectors $T^t$, $M^t\mathbf{DIMOIL}_t$ and $M^t\mathbf{DIMOQO}_t$, and matrices $A_t$ and $B_t$ are exogenously estimated for each year. Scalars $\mathbf{DIMOIL}_t$ and $\mathbf{DIMOQO}_t$ are given exogenously. The vector
PV_t and Scalar DINTAX_t are estimated in the Behaviouristic Block of the model. We may thus solve the above system of simultaneous equations for unknown vector PX_t as,

\[ PX_t = (I - A_t)^{-1} (T_t DINTAX_t + B_t PV_t + MQ_t DIMOIL_t + MG_t DIMOTO_t) \] (VII)

where I is an identity matrix of order 14 x 14.

4.1.6 Implicit Price Deflators for Components of Final Demand

Implicit Price Deflators for components of Final Demand are defined as weighted sum of Implicit Price Deflators for Gross Outputs, for Indirect Taxes less Subsidies, for Oil Imports and for Import other than Oil, weights being proportions of Gross Outputs, Indirect Taxes less Subsidies, Oil and non-Oil Imports and Changes in Stocks, in the elements of Final Demand at market prices.

4.1.6.1 Implicit Price Deflator for Private Consumption

\[ DPCEMP_t = C'_t PX_t + TC_t DINTAX_t + CMQ_t DIMOIL_t + CMG_t DIMOTO_t \ldots \] (VIII).

Vector C'_t and scalars TC_t, CMQ_t and CMG_t are estimated exogenously; DIMOIL_t and DIMOTO_t are exogenously given. Vector PX_t is estimated within the Input-Output Block of the model and DINTAX_t is obtained from the Behaviouristic Block. We can, therefore, find DPCEMP_t.
4.1.6.2 Implicit Price Deflator for Government Consumption

Implicit Price Deflator for Government Consumption is similarly defined as that of Implicit Price Deflator for Private Consumption. Thus, we have,

\[ DGCEMP_t = G'_t P_X + T_G P_{INTAX} + GMO_t P_{MIL} + GMG_t P_{MOTO} \ldots (IX) \]

Here also, vector \( G'_t \) and scalars \( T_G, GMO_t \) and \( GMG_t \) are estimated exogenously. Remaining notations of the expression are the same as that for Implicit Price Deflator for Private Consumption.

4.1.6.3 Implicit Price Deflators for Sectoral Total Gross Domestic Capital Formation

Ideally, separate sets of deflators for Sectoral Private and Government Capital Formation would have been defined. But for paucity of data, it could not be done. However, a separate set of Implicit Price Deflators for Government Gross Domestic Capital Formation is estimated in the Behaviouristic Block of the model.

Denoting Price Deflators for Sectoral Total Gross Domestic Capital Formation by a vector \( P_t \) of order 14 x 1, we define them as:

\[ P_t = K'_t P_X + TK'_t P_{INTAX} + KM'_t P_{MIL} + Q'_t P_{MOTO} + Q'_t P_{DCHSTK} \ldots (X) \]
The matrix $K_t$ and vectors $TK_t$, $KM_t$ and $Q_t$ are estimated exogenously; vector $PX_t$ and scalar $DCHSTK_t$ are estimated within Input-Output Block of the model. Scalar $DIMOTO_t$ is exogenously given and $DINTAX_t$ is estimated in the Behaviouristic Block.\textsuperscript{56}

4.1.6.4 Implicit Price Deflator for Changes in Stocks

Implicit Price Deflator for Changes in Stocks is defined in a manner similar to other deflators for components of Final Demand.

$$DCHSTK_t = S_t' PX_t \quad \ldots (XI)$$

This expression has only one term as the various transaction and coefficient tables available for India do not show direct imports and Indirect Taxes less Subsidies for Changes in Stocks. (See Technical Note for the Sixth Plan).

Vector $S_t'$ is estimated exogenously and $PX_t$ is determined within this block.

\textsuperscript{56} It should be noted that the 3rd and 13th elements of vector $PI_t$ actually pertain to Implicit Price Deflators for Private Gross Domestic Capital Formation in these sectors because there is no Government Gross Domestic Capital Formation in these sectors as per the NAS. Similarly, the 10th element has no Private Gross Domestic Capital Formation.
4.1.7 Real Government Consumption

Real Government Consumption is estimated by dividing exogenously given Nominal Government Consumption by its Implicit Price Deflator. Thus, we have

\[ \text{BGCEMP}_t = \frac{\text{AGCEMP}_t}{\text{DGCEMP}_t} \]  \hspace{1cm} \text{(XII)}

where \( \text{DGCEMP}_t \) is estimated within the Input-Output Block.

4.1.8 Sectoral Employment

Sectoral Employment is estimated in the form of vectors \( \text{ED}_t, \text{EI}_t, \) and \( \text{BII}_t \) representing Sectoral Direct Employment and Sectoral Indirect Employment I and Sectoral Indirect Employment II respectively. The employment is determined in terms of million standard person years and indicates generation of employment and not actual employment. Moreover, persons employed may be more than what is indicated by employment in terms of million standard person years due to part time employment.

4.1.8.1 Sectoral Direct Employment

Sectoral Direct Employment is defined as the employment generated in a sector due to its production activity for direct output.

Denoting a diagonal matrix of order 14 x 14, having employment in Standard Person Years per million rupees worth of gross output of a sector at 1970-71 prices by \( L \), we may find \( \text{ED}_t \) by

\[ 57 \text{ Standard Person Year is defined as "8 hours of work for 273 days"}, \text{ in the Technical Note for the Sixth Plan.} \]
where $F_t$ is a diagonal matrix having vector $FD_t$ in its principal diagonal and "diag" denotes "diagonal of the matrix following it" in parentheses. More clearly, the diagonal elements of the matrix $\left[ L (I - A_t)^{-1} F_t \right]$ will give us sectoral direct employment.

4.1.8.2 *Sectoral Indirect Employment I*

Sectoral Indirect Employment I is the employment generated in other sectors through backward linkages due to production activity in a sector.

If we denote a vector $U$ of the order $1 \times 14$ having all its elements as unity, we can express $EI_t$ as,

$$EI_t = U (L (I - A_t)^{-1} F_t) - ED_t \quad \cdots \text{(XIV)}$$

4.1.8.3 *Sectoral Indirect Employment II*

Sectoral Indirect Employment II may be defined as employment generated in a sector due to production activity in sectors other than itself. Mathematically,

$$EII_t = (L (I - A_t)^{-1} F_t) U' - ED_t \quad \cdots \text{(XV)}$$

where $EII_t$ is a $14 \times 1$ vector having Sectoral Indirect Employment II as its elements.
4.1.9 **Nominal Total Gross Domestic Capital Formation**

Nominal Total Gross Domestic Capital Formation may be viewed as weighted sum of Real Sectoral Total Gross Domestic Capital Formation, weights being the respective implicit price deflators for these variables. Thus, we have

\[ AGDKFT_t = PI^t \cdot \bar{I}_t \]  

...(XVI)

4.2 **The Behaviouristic Block**

This block is based on (49) behaviouristic and determinatic equations of linear and non-linear form and (13) identities. The behaviouristic equations are estimated through the Ordinary Least Square technique. Various specifications of equations are tried and selection of equations was made on the basis of maximum adjusted coefficient of multiple determination in case of multiple regressions and on the basis of maximum coefficient of determination in case of simple regression. However, care is taken to choose equations with correct signs and sensible magnitudes of regression coefficients, instead of choosing them mechanically. Also, trial specifications are avoided wherever some sound specifications are a priori available.
The equations are presented along with coefficient of correlation or multiple correlation (R), adjusted coefficient of determination or multiple determination (R²) and Durbin-Watson d-statistic (dw). Respective t-statistic for each coefficient is given in brackets below the coefficient.

The statistical significance of the regression coefficient has been shown by stars placed above the coefficients. One star represents statistical significance at 1%, two stars at 5% and three stars at 10% level of significance. The star (one) is also used as a multiplication symbol in some equations.

4.2.1 Macro Variables: Nominal Gross Domestic Product and its Implicit Price Deflator, Nominal Disposable Income, Private Consumption and Implicit Price Deflator for Indirect Taxes less Subsidies.

This set of equations determines Nominal Gross Domestic Product and its Implicit Price Deflator, Nominal Disposable Income, Private Consumption and Implicit Price Deflator for Indirect Taxes less Subsidies.

Nominal Gross Domestic Product at Factor Cost

Nominal Gross Domestic Product is defined with the help of a determinatic equation, which is

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58 It should be noted that dw, though presented along with each equation, is not valid in all the cases, e.g. in the presence of lagged variables in the equation.
where $V_t$ is the vector of Sectoral Gross Value Added determined in the Input-Output Block and $PV_t$ is a vector of order $14 \times 1$, representing Implicit Price Deflators for Sectoral Gross Values Added estimated within the Behaviouristic Block.

We have also defined here Real Gross Domestic Product at factor cost as it is required in this block for determining the Implicit Price Deflator for Gross Domestic Product. This is defined as sum of the Sectoral Gross Values Added. Mathematically,

$$\text{BGDPFC}_t = U \cdot V_t \quad (2)$$

where $U$ is a vector of the order $1 \times 14$ having all its elements as unity.

**Nominal Disposable Income**

Nominal Disposable Income has been expressed as a linear function of Nominal Gross Domestic Product.

$$\text{ADISIN}_t = -4089.8 + .915625 \cdot \text{AGDPFC}_t$$

$$R = .99 \quad R^2 = .99 \quad dw = 2.13$$

**Per Capita Nominal Private Consumption**

In a developing economy like ours, Private Consumption is expected to form a major component of the Final Demand, and hence requires special attention.
In the controversy surrounding the theory of consumption function, Friedman (1957) suggested that in aggregate consumption function, the permanent income could be viewed as a weighted average of past income with geometrically declining weights. Mathematically, if we denote permanent income in period $t$ by $Y_p$, past incomes by $Y_{t-L}$ and weight by $W$, $L$ being lag, then for period $T$ we have,

$$Y_p = \sum_{L=0}^{T} W Y_{t-L}$$

This approach suggests to formulate the consumption function as

$$C_t = a_0 + a_1 \sum_{L=0}^{T} W Y_{t-L} + e_t$$

With suitable mathematical manipulations, this can be transformed into the following function,

$$C_t = b_0 + b_1 C_{t-1} + b_2 Y_t + \epsilon_t$$

where $C_t$ is aggregate consumption in period $t$.

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60 Notations used here are relevant to this part of discussion only.
This form of consumption function, however, creates estimation problems in both linear and double-log forms, when it is tried with Indian data, due to extreme multicollinearity between $C_{t-1}$ and $Y_t$. The degree of multicollinearity is so extreme that it does not only depresses the t-ratio of $b_1$, but also reverses the direction of relationship between $C_t$ and $C_{t-1}$, which is very strongly positive in the absence of $Y_t$. The negative sign of $b_1$ suggests a cyclical pattern in $C_t$, which is not observable in the data.

In the light of above finding, we decide to drop $C_{t-1}$ from the function and explain consumption in period $t$ as function of Current Disposable Income.

To take care of money illusion, the function is estimated with nominal values of Aggregate Consumption and Disposable Income. Effect of Population is considered by estimating the function in per capita terms. The functional form considered is double-log, as the assumption that marginal and average propensity to consume declines with increase in income, (i.e., income elasticity of consumption remains constant) appears more appropriate than assuming the marginal propensity to consume as constant, which is an implied assumption for a Linear Consumption function. We, thus have the following consumption function:\footnote{A comparison of functions with and without $C_{t-1}$ reveals that the value of $R^2$ improves on dropping $C_{t-1}$.}
\[
\log \frac{\text{DPCEMP}_t}{\text{POPULN}_t} = 0.150923 + 0.928445 \log \frac{\text{ADISIN}_t}{\text{POPULN}_t} \tag{4}
\]

\[R = 0.99 \quad R^2 = 0.99 \quad dw = 1.77\]

**Real Aggregate Private Consumption**

The Real Aggregate Private Consumption is estimated by using information from equation (4) along with a definitional identity.

\[\text{BPCEMP}_t = (\text{Antilog THETA}) \frac{\text{POPULN}_t}{\text{DPCEMP}_t} \tag{5}\]

where \(\text{THETA} = \log \frac{\text{BPCEMP}_t \cdot \text{DPCEMP}_t}{\text{POPULN}_t}\), obtained from equation (4).

For equation (4) and (5), \(\text{POPULN}_t\) is given exogenously where as \(\text{ADISIN}_t\) is estimated within the Behaviouristic Block. Estimation of \(\text{DPCEMP}_t\) is carried out in the Input-Output Block.

**Implicit Price Deflator for Gross Domestic Product at Factor Cost**

Implicit Price Deflator for Gross Domestic Product is defined as ratio of Nominal Gross Domestic Product and Real Gross Domestic Product, both estimated within the Behaviouristic Block.
This deflator is equivalent to weighted average of Deflators for Sectoral Gross Values Added, weights being proportions of Real Sectoral Gross Values Added in Real Gross Domestic Product, which itself is sum of Real Sectoral Gross Values Added.

**Implicit Price Deflator for Indirect Taxes less Subsidies**

Implicit Price Deflator for Indirect Taxes less Subsidies is expressed as a function of Implicit Price Deflator for Gross Domestic Product at factor cost. The two deflators are found to be closely related according to the following behaviouristic equation.

\[
\log \text{DINTAX}_t = 0.000286 + 1.06698 \log \text{DGDPFC}_t + 0.045804 \text{ DUM} + 0.140884 (\log \text{DGDPFC}_t) * \text{DUM} \\
(0.036) (20.393) \quad (1.980) \quad (7)
\]

\[
R = 0.99 \quad R^2 = 0.99 \quad dw = 2.01
\]

Use of intercept and slope dummies, whose coefficients turn out to be statistically significant at 5% level, is justified and indicates intercept and slope changes in post Oil Price rise period.
4.2.2 *Money Supply*

Recent studies by Pandit (1973, 1977, 1978, 1982, 1984); Ahluwalia (1979); Sinha (1977); Srivastava (1981); Bhattacharya (1982, 1984) and Krishnamurty, Saibaba and Kazmi (1984), recognise the role of budgetary deficit in governing Money Supply. The resource gap of the public sector determines its demand for Reserve Bank credit. Reserve Bank Credit to government is the most important component of high powered money or the monetary base which also includes credit to banks and development banks, foreign exchange reserves and the non-monetary liabilities of the Reserve Bank. Using this high powered money as an explanatory variable along with some other variables, most of the models, traditionally explain the money supply. For example, Krishnamurty *et al.* (1984), explain money supply with the help of its own lagged value and high powered money in a partial adjustment framework. Pandit (1984), has regressed money supply on high powered money, lending rate, an intercept dummy and an interaction dummy to take care of upward shift in money multiplier. The intercept dummy equals 1 in the post 1961-62 period. We, however, radically depart from these traditional explanations and assume that ultimate causes of changes in money supply are changes in Total Nominal Gross Domestic Capital Formation and Nominal Value of Government Consumption, since these two variables
are mainly responsible for causing budgetary deficit if the government revenues and total savings are not sufficient enough to meet these requirements. On this assumption, we omit the intermediate mechanism working through budgetary deficit, Reserve Bank Credit to government and high powered money. Thus, our equation for money supply has sum of Nominal Government Consumption and Nominal Total Gross Domestic Capital Formation as an explanatory variable. A dummy in intercept and an interaction dummy have also been included in our specification to take care of change in accounting method by commercial banks from January 1979, when they started showing larger proportion of their demand deposits as time liabilities, thereby bringing in a downward shift in the intercept and reduction in the slope of equation explaining the money supply. This intercept dummy equals 1 for 1978-79 onwards.

Money Supply at Current Prices

\[
\log MONEYS_t = .0331881 + .900881 \log (AGDKFT_t + AGCEMP_t) \\
(2.697) \quad (36.533) \quad ^* \\
-.743393 ACDUM - .143081 \log (AGDKFT_t + AGCEMP_t) \\
(1.918) \quad (1.984) \quad ^* \\
ACDUM \\
\]

\[
R = .99 \\
R^2 = .99 \\
dw = 1.46 \quad (8)
\]

The equation (8) has a very high explanatory power and we may, therefore, justify our ignoring the intermediate economic mechanism through which the money supply is actually influenced by the sum of Nominal Total.

62 Demand deposits form a part of Money Supply (narrow definition M₁) where as time deposits are not included in M₁.
Investment and Nominal Government Consumption. This equation is sufficient to serve our purpose while carrying out our simulation experiments.

4.2.3. **Real Sectoral Gross Domestic Capital Formation (Private)**

The NAS data shows Private Gross Domestic Capital Formation in all of our sectors except Communications. Thus our sectors, Fishing and 'Real Estate and Ownership of Dwellings' have only Private Investment.\(^63\) Electricity, Gas and Water Supply and Railways have very little Private Investment. Mining and Quarrying is yet another sector where there has been very little Private Investment in the post-mid-seventies period, when most of the mines were nationalised leading to a sharp decline in the Private Investment.

In most of our equations, Real Sectoral Private Gross Domestic Capital Formation is explained by Real Sectoral Income in the previous year, Real Sectoral Government Gross Domestic Capital Formation in the previous year, Implicit Price Deflator for Sectoral Gross Output which is a proxy for prices of Sectoral Output, Intercept Dummy to determine the effect, if any, of political instability during the period 1977-80 and a

\(^63\) Terms Gross Domestic Capital Formation and Investment are used interchangeably and have same meaning in our text.
"change of government" dummy for 1980. We have thus assumed that the Real Private Investment in a sector is guided by (i) the Real Income in the sector in the previous year, which represents profitability in the sector on the one hand and the resource availability for investment within the sector, on the other, (ii) Government Investment in a sector either encourages Private Investment or discourages it, thus presence of Government Investment as an explanatory variable would capture the complementarity and crowding-out effects due to it, (iii) Implicit Price Deflator for Sectoral Gross Output is expected to take care of Private Investors being guided by the prices of sectoral output and (iv) Political instability and "change of government dummy" would capture the effect of these phenomena on Private Investment.

However, for certain sectors, the Private Investment functions deviate from above-mentioned specification due to some reasons typical to these sectors. Moreover, variables turning out to be statistically insignificant are dropped from the equations thereby giving different specifications.

Though, all these equations have statistically significant coefficients of determination, we do have equations with moderately high explanatory power. However, we do not claim that these specifications cannot be improved upon, but we do not try such improvements because luckily
moderate explanatory powers are found in cases of those sectors whose Private Investment has relatively very little contribution towards Real Total Gross Domestic Capital Formation (less than 5%). Therefore, over or under estimation of Private Investment for these sectors is not expected to distort much, our results of simulation experiments, which are the very objective of constructing our model.

**Real Private Investment in the Agricultural Sector**

\[
\text{BDKFP.AG}_t = -795.989 + 27407 \text{ BGVAP.AG}_{t-1} + 1.13456 \text{ BDKFG.AG}_{t-1}^{.241} \quad (1.942)^{***} \quad (2.414)^* \\
+ 942.217 \text{ DVOPF.AG}_{t-1}^{(1.826)^{***}} + 1980.02 \text{ POLDUM}^{(2.061)^*}
\]

\[ R = .94 \quad R^2 = .85 \quad dw = 1.59 \]

Real Government Investment in Agriculture shows a complementarity effect on the Real Private Investment in the next period. Both Agricultural Real Income and Implicit Price Deflator for Agricultural Gross Output encourage Private Investment in the sector in the next period. During the period of political stability an upward shift in the Real Private Investment took place. This upward shift in the intercept, apart from other reasons, can be attributed to the fact that distribution of grain from the buffer stocks along with the continuation of procurement
policy would have lead the investors to think of increased demand with assured price, and hence, they might have taken decision to go in for more investment.

Real Private Investment in the Forestry and Logging Sector

$$BDKFP\cdot FL_t = -50.4844 + 0.016466 BGVA\cdot FL_{t-1} - 0.096287 BDKFG\cdot FL_{t-1} + 34.2444 DVOPF\cdot FL_{t-1}$$

$$R = 0.71 \quad R^2 = 0.65 \quad dw = 1.46$$

This equation has a moderately high \( R^2 \). The Implicit Price Deflator for Gross Output of the sector shows relatively stronger influence on the Private Investment in the sector, as compared to other explanatory variables, when judged from t-values. All the slope coefficients turn out to be statistically significant, though the first two are significant at 10% level only. Both Real Sectoral Income and Implicit Price Deflator for Gross Output have positive influence on the Real Private Investment in the next period. However, Real Government Investment appear to crowd-out Private Investment in the next year.

Real Private Investment in the Fishing Sector

This sector has only Private Gross Domestic Capital Formation. The investment function for this sector has a partial adjustment framework. The equation has a
moderate $R^2$ associated to it, but the sector itself is very small in terms of Gross Domestic Capital Formation and Gross Value Added. We, therefore, do not try to improve the specification.

$$\text{BDKFP.FS}_t = -2.67305 + 0.11808 \text{BGVAF.FS}_{t-1} + 0.423362 \text{BDKFP.FS}_{t-1}$$

$$(.022) \quad (1.970)*** \quad (2.217)**$$

$$-135.035 \text{ GOVDUM}$$

$$(2.137)**$$

$$R = .73 \quad R^2 = .45 \quad dw = 1.48$$

Both sectoral income and Private Gross Domestic Capital Formation encourage Private Investment in the sector in the next year.

**Real Private Investment in the Mining and Quarrying Sector**

In this sector, the behaviour of Real Private Investment is quite erratic because of indivisibilities of investment. Nationalisation, during mid-seventies, of most of the mines including those of coal, copper, mica, etc., further complicates the problem of formulating a function for explaining over time movements of Real Private Investment in the sector. Towards the end of our sample period, most of the Private Gross Domestic Capital Formation was mainly confined to lime stone mines which again adds to complexity of the problem.

64 Real Gross Domestic Capital Formation in the Fishing Sector is around 0.5% of the Real Total gross Domestic Capital formation in the Economy and Real Value Added around 1% of the Real GDP.
In the light of above-mentioned facts, we need a function which is capable of explaining the behaviour of Private Investment in (i) pre-nationalisation period and (ii) post-nationalisation period in which Private Investment was confined mainly to limestone mines which achieves a maximum and then declines due to limited scope of expansion and consequentially investment opportunity for Private investors in these mines. With this objective, several specifications are made and the one with sensible coefficients and satisfactory explanatory power is chosen. The selected function suggests that the Private Investment is positively related to itself with two years’ lag. It is encouraged by Real Government Investment in the previous year, but is crowded-out by square of Real Government Investment in the previous year. In the post-nationalisation period, the response of Private Investment to its lagged value became negative, whereas with lagged Real Government Investment and Square of Real Government Investment remained as earlier but became sluggish, i.e., magnitudes of coefficients became smaller. The equation is as follows:

\[
BDKFP_{t} = -1021.74 + 0.396364 BDKFP_{t-2} + 2.52644 BDKPG_{t-1} - 0.001339 (BDKFG_{t-1})^2 - 0.692487 (BDKFP_{t-2} \times NDUM) - 1.4947 (BDKFG_{t-1} \times NDUM) + 0.011896 (BDKFP_{t-1})^2 \times NDUM - 380.112 GOVDUM
\]

\[
(2.773) (1.866)*** (3.103)\quad (2.953)* \quad (1.684) \quad (2.477)* \quad (2.781)* \\
\]

\[
R = .86 \quad \bar{R}^2 = .59 \quad dw = 2.40
\]
Real Private Investment in the Manufacturing Sector

Manufacturing is a major sector from the Private Investment point of view as the Real Private Investment in this sector constitutes about 20 percent of the Total Real Investment in the economy. Thus, special attention is paid to explain the behaviour of Real Private Gross Domestic Capital Formation in this sector.

A close look at time-series for Real Private Investment in this sector reveals, that except for early sixties, there are clear four-year cycles in the movement of the variable. The cycle dips abnormally low during the period of political instability and picks up sharply after the change of government in 1980.

Despite the best efforts, the cause of these cyclical movements is not traceable. An attempt to explain this behaviour with the help of distributed lag specifications also proved futile due to strong multicollinearity. Under such situation, trigonometric functions, though they explain only mechanically the behaviour of explained variable, come to our rescue. We have, therefore, tried a function with Sine terms along with lagged Real Gross Value Added in the sector as explanatory variables. The estimated equation is as follows:
BDKFP.MF = -5961.49 + 38045 BGVAF.MF -805.041 t \sin \left( \frac{(t-1)\pi}{2} \right) \\
+ (5.065)*(17.218)*(4.160)* \\
-0.09308 BGVAF.MF \cdot t \sin \left( \frac{(t-1)\pi}{2} \right) \\
(3.155)* \\
-3384.16 POIDUM - 1556.88 GOVDUM \\
(4.256)* (1.866)** \\
R = .98 \quad R^2 = .96 \quad dw = 2.78 \\

Same set of parameters would be obtained if the variable 
\[ t \sin \left( \frac{(t-1)\pi}{2} \right) \] 

is replaced by 
\[ t \cos \left( \frac{\pi}{2} \right) \].

The graphical representation of observed and estimated values of Real Private Investment in the Manufacturing sector is presented in Figure 4.1 to demonstrate how closely our equation traces the actual behaviour of the variable.

![Graph showing observed and estimated values of Real Private Investment from 1970-71 to 1980-81](image)
The estimated equation appears to satisfactorily explain year to year changes in Real Private Investment in the Manufacturing sector. Equation, though mechanical in nature to some extent, shows that the Real Private Investment in the sector is positively related to the lagged Real Gross Value Added. This positive relationship is quite strong (indicated by high t-value of the coefficient) once the oscillations over time are accounted for with the help of trigonometric terms of the function.

It is noteworthy that the equation, despite being mechanical, serves our purpose of carrying out simulation experiments, as it traces fairly accurately the movements in Real Private Investment in the sector, more so, in the post 1970-71 period, which we intend to consider for simulation experiments.

**Real Private Investment in the Construction Sector**

This is another sector in which Real Private Investment shows quite erratic behaviour which is not explained by Real Gross Value Added. On trying various specifications, its movements are found to be negatively related to lagged Real Government Investment and positively to Implicit Price Deflators for its Gross Output. Also, it is positively influenced by the current Real Private Investment in the Real Estate and Ownership of Dwellings Sector. The behavioural equation is as follows:
The estimated equation suggests that increase in the prices of Gross Output of the sector encourages Real Private Investment in the sector in the subsequent year. The Real Government Investment in the sector has a crowding-out effect on Real Private Investment in the next year, whereas current Real Private Investment in the Real Estate and Ownership of Dwellings sector has complementarity effect. The complementarity between Real Private Investment in the Construction and Real Estate and Ownership of Dwellings sectors is an expected one. As is commonly known, a substantial amount of demand for Construction activity comes from Real Estate and Ownership of Dwellings sector, and, hence an increase in the Real Private Investment in the latter sector is expected to positively influence the investment activity in the former.

Real Private Investment in the Electricity, Gas and Water Supply Sector

Most of the investment activity in this sector is related to electricity generation and distribution. Therefore, in our analysis of Real Private Investment behaviour, we have concentrated on the investment in
electricity generation and distribution. It may be noted at the outset that this sector has very little Real Private Investment - bulk of investment comes from the government.

At first sight, the behaviour of Real Private Investment in this sector appears to be very erratic. However, a careful look reveals that it is closely related to electricity shortages. In the years of electricity crisis, the Real Private Investment goes up, whereas in the normal years of electricity generation, it remains negligible. To take care of this phenomenon, we propose to introduce an intercept dummy in our equation which takes a value 1 in the years of electricity crisis and zero in other years. The phenomenon also suggests that the Private Investment in the sector is need based and comes up when need arises. It appears, profit making is not the objective of Private Investment in this sector.

Superimposing graphically, the movements of Real Government Investment in this sector over those in Real Private Investment, we get an indication that the government Investment in a year has a crowding-out tendency for Private Investment in the following year, also, the square of government Investment encourages Real Private Investment up to some extent. The quadratic nature of response of the Real Private Investment in this sector to the lagged Real Government Investment may be attributed, to a great extent, to the crowding-out effect of the latter
on the former. But a heavy dose of Government Investment leads to complementary activity in the sector, particularly, distribution activity part of which is with private companies.

The estimated equation, which is based on observations discussed in the preceding paragraphs, is as follows:

\[
BDKFP_{EG,t} = 616.184 - 1.73644 BDKFG_{EG,t-1} + 0.000013 (BDKFG_{EG,t-1})^2 + 535.137 BSHDUM_{t-1} \\
(2.520) (2.327) (2.597) (5.423)
\]

\[
R = .84 \quad R^2 = .65 \quad dw = 1.94
\]

In the above specification, the crowding-out and complementary effects of Real Government Investment on Real Private Investment in the following year have a tendency to cancel out each other. We can calculate that Real Government Investment of more than Rs. 6.7 billion in a year will have an overall complementary effect on the Real Private Investment in the subsequent year, whereas Real Government Investment which is less than this amount will have an overall effect of crowding-out the Real Private Investment in the following year.

**Real Private Investment in the Other Transport and Storage Sector**

The Real Private Investment in this sector is explained with the help of Real Sectoral Income and lagged values of the variable itself, the lag being one year.
The major factor that explains the movements is the sectoral Real Gross Value Added, reflected by the $t$-value. The estimated equation is as follows:

$$BDKFP_{t} = 684.394 + .126529 \times BGVAF_{t-1}$$

$$(1.590) (3.149)$$

$$+ .278036 \times BDKFP_{t-1} - 532.179 \times GOVDUM_{t-1}$$

$$(1.864) (1.905)$$

R = .84  \quad R^{2} = .65  \quad dw = 1.76

The estimated equation reveals that Real Private Investment in the sector is encouraged by increase in its value and also that in Real Sectoral Income in the previous year.

Real Private Investment in Trade, Hotels and Restaurant Sector

The behaviour of Real Private Investment over time in this sector is explained by Real Sectoral Gross Value Added and Real Government Investment in the previous year. The Sectoral Income has a positive influence on Real Sectoral Private Investment, whereas Real Government Investment has a tendency to discourage it. The magnitude of the coefficient associated with the lagged value of Real Government Investment suggests a strong crowding-out effect on Real Private Investment. The estimated equation is as follows:
-15.\nu-

\[
BDKFP.TR_t = -3775.08 + 0.194138 \cdot BGVAF.TR_{t-1} \\
(2.710)** (5.424)* \\
- 0.356446 \cdot BDKFG.TR_{t-1} + 2242.1 \cdot POLDUM \quad (17) \\
(1.864)*** (1.886)***
\]

\[R = 0.85 \quad \hat{R}^2 = 0.67 \quad dw = 1.51\]

**Real Private Investment in Banking and Insurance Sector**

This sector underwent an important structural change in late seventies when a bulk of its activity was nationalised. However, some portion of this sector remained under private control even after nationalisation.

The movement of Real Private Investment in this sector is explained by its own lagged values and Real Sectoral Income. The equation is estimated with and without a binary dummy in the intercept to investigate whether there are any intercept shifts in the variable due to nationalisation. The coefficient of this dummy turns out to be statistically insignificant and hence, we drop it from our specification and consider the equation without intercept dummy which is as follows:

\[
BDKFP.BI_t = -13.0393 + 0.010845 \cdot BGVAF.BI_{t-1} + 0.68891 \cdot BDKFP.BI_{t-1} \\
(0.558) \quad (2.261)** \quad (3.713)*
\]

\[R = 0.91 \quad \hat{R}^2 = 0.80 \quad dw = 2.37 \quad (18)\]
The equation suggests that both the explanatory variables have positive influence on the regressed variable, though the effect of Real Sectoral Income in the previous year is relatively less strong, as judged from respective t-values associated with the coefficients.

Real Private Investment in the Real Estate and Ownership of Dwellings and Business Services Sector

As per the NAS, this sector has no Government Investment and the entire investment comes from private investors. To capture the behaviour of Real Private Investment in this sector, it has been regressed on lagged values of Real Sectoral Income and on its own lagged values, along with two dummies in the intercept. Estimates of the parameters of the equation are:

\[
BDKFP.RE_t = 2179.53 + 0.082647 \times BGVAF.RE_{t-1} + 0.671744 \times BDKFP.RE_{t-1} \\
+ 2075.80 \times POLDUM - 3726.27 \times GOVDUM
\]

\( (1.066) \quad (1.918)*** \quad (4.068)* \)

\( R = .82 \quad R^2 = .59 \quad dw = 1.84 \)

It should, however, be noted that this sector is a major source of generation of unaccounted income and investment which is not expected to be captured in our equation. Most of the estimates are expected to be fragile. However, we rely on these estimates due to paucity of data. The equation suggests that the income in this sector
in the previous year has positive influence and the Private Investment is encouraged by an increase its value in the previous year, the latter influence being relatively stronger than the previous, as judged from t-values.

**Real Private Investment in the Services Sector**

In this sector, relative share of Real Private Investment has been declining over time due to more than proportionate and rapid expansion of investment activity by the Government. The regressors in this equation are Real Government and Private Investment in the previous year. The equation suggests that the Real Government Investment has a crowding-out tendency towards Real Private Investment in the sector, whereas it is encouraged by its value in the previous year with a dampening tendency.

\[
\text{BDKFP.SR}_t = 184.224 - 0.012179 \text{BDKFG.SR}_{t-1} + 0.8029018 \text{BDKFP.SR}_{t-1}^{.530} - 341.905 \text{GOVDUM}_{t-1}^{(20)}
\]

\[ (1.801)^{***} (4.413)^* \]

\[ (1.850)^{***} \]

\[ R = .85 \quad R^2 = .68 \quad dw = 1.92 \]

4.2.4 **Real Sectoral Gross Domestic Capital Formation (Government)**

In our model, the Nominal Sectoral Investments by the Government are considered as policy variables and assumed exogenous. This enables us to change the

@ These regressors have been chosen after trying several specifications which were found to be unsuitable due to one reason or the other.
quantum of these Sectoral Investments and study the responses of employment and prices to these changes through simulation experiments.

The data published by the CSO in the NAS show Government (Public Sector) Gross Domestic Capital Formation in twelve of our sectors. The two sectors against which Government Investment is not shown are (i) Fishing, and (ii) Real Estate and Ownership of Dwellings and Business Services.

The Real Sectoral Government Investment is treated as endogenous and is estimated with the help of identities defining it to be the ratio of Nominal Investment to its Implicit Price Deflator for each sector, Price Deflators being endogenous and estimated within our Behaviouristic Block.

The identities determining the Real Value of Nominal Sectoral Government Gross Domestic Capital Formation are as follows:

\[
\begin{align*}
BDKFG.AG_t &= \frac{ADKFG.AG_t}{DDKFG.AG_t} \quad (21) \\
BDKFG.FL_t &= \frac{ADKFG.FL_t}{DDKFG.FL_t} \quad (22) \\
BDKFG.MQ_t &= \frac{ADKFG.MQ_t}{DDKFG.MQ_t} \quad (23) \\
BDKFG.MF_t &= \frac{ADKFG.MF_t}{DDKFG.MF_t} \quad (24) \\
BDKFG.CN_t &= \frac{ADKFG.CN_t}{DDKFG.CN_t} \quad (25) \\
BDKFG.EG_t &= \frac{ADKFG.EG_t}{DDKFG.EG_t} \quad (26) \\
BDKFG.RL_t &= \frac{ADKFG.RL_t}{DDKFG.RL_t} \quad (27) \\
BDKFG.OT_t &= \frac{ADKFG.OT_t}{DDKFG.OT_t} \quad (28)
\end{align*}
\]
4.2.5 **Real Sectoral Gross Domestic Capital Formation (Total): The Elements of Vector $\mathbf{I}_t$**

The Total Real Sectoral Gross Domestic Capital Formation is defined as sum of Real Private and Government Gross Domestic Capital Formation for each sector. Thus, we have the following set of definitional identities:

$$
\begin{align*}
\text{BDKFG.CM}_t &= \text{ADKFG.CM}_t / \text{DDKF.GM}_t \\
\text{BDKFG.TR}_t &= \text{ADKFG.TR}_t / \text{DDKF.TR}_t \\
\text{BDKFG.BI}_t &= \text{ADKFG.BI}_t / \text{DDKF.BI}_t \\
\text{BDKFG.SR}_t &= \text{ADKFG.SR}_t / \text{DDKF.SR}_t \\
\text{BDKFT.AG}_t &= \text{BDKFP.AG}_t + \text{BDKFG.AG}_t \\
\text{BDKFT.FL}_t &= \text{BDKFP.FL}_t + \text{BDKFG.FL}_t \\
\text{BDKFT.FS}_t &= \text{BDKFP.FS}_t \\
\text{BDKFT.MQ}_t &= \text{BDKFP.MQ}_t + \text{BDKFG.MQ}_t \\
\text{BDKFT.MF}_t &= \text{BDKFP.MF}_t + \text{BDKFG.MF}_t \\
\text{BDKFT.CN}_t &= \text{BDKFP.CN}_t + \text{BDKFG.CN}_t \\
\text{BDKFT.ER}_t &= \text{BDKFP.ER}_t + \text{BDKFG.ER}_t \\
\text{BDKFT.CP}_t &= \text{BDKFP.CP}_t + \text{BDKFG.CP}_t \\
\text{BDKFT.TR}_t &= \text{BDKFP.TR}_t + \text{BDKFG.TR}_t \\
\text{BDKFT.BI}_t &= \text{BDKFP.BI}_t + \text{BDKFG.BI}_t \\
\text{BDKFT.RE}_t &= \text{BDKFP.RE}_t \\
\text{BDKFT.SR}_t &= \text{BDKFP.SR}_t + \text{BDKFG.SR}_t 
\end{align*}
$$
4.2.6 **Implicit Price Deflators for Sectoral Gross Value Added: The Elements of Vector \( PV_t \)**

Implicit Price Deflators are explained by using Money Supply and per capita Real Gross Outputs. Money Supply is expected to positively influence these Price Deflators, whereas per capita Real Gross Outputs are expected to have negative effect. However, in six of our equations, per capita Gross Output does not turn out to be statistically significant and hence it has been dropped from these equations. Interestingly, the sectors for which per capita Real Gross Output is statistically insignificant are those which do not produce any material Gross Output and/or have administered or substantial degree of administered prices. Mining and Quarrying is the only exception.

Three sectors, viz., Railways, Communications and Electricity are under government control. The first two are fully, and the third almost fully, controlled by the government, and hence, we do not estimate equations for these sectors.

Double-log equations for eleven sectors for their respective Implicit Price Deflators for Sectoral Gross Value Added which are found to be superior over their linear forms in terms of explanatory powers, are as follows:

\[
\log DGVAF.AG_t = 0.294935 + 0.651740 \log MONEYS_t - 1.095130 \log \frac{BVOPF.AG_t}{POPULN_t}
\]

\( R = 0.98 \quad R^2 = 0.96 \quad dw = 1.97 \quad (43) \)
Implicit Price Deflator for Gross Value Added in the Forestry and Logging Sector

\[
\log DGVAFL_t = -1.615980 + 0.646215 \log MONEYS_t + 0.946044 \log POPULN_t
\]

\[
R = 0.99 \quad R^2 = 0.97 \quad dw = 1.70 \quad (44)
\]

Implicit Price Deflator for Gross Value Added in the Fishing Sector

\[
\log DGVAFFS_t = -3.28266 + 0.930299 \log MONEYS_t - 0.462294 \log POPULN_t
\]

\[
R = 0.99 \quad R^2 = 0.99 \quad dw = 1.61 \quad (45)
\]

Implicit Price Deflator for Gross Value Added in the Mining and Quarrying Sector

\[
\log DGVAFMQ_t = -3.241060 + 0.850652 \log MONEYS_t
\]

\[
R = 0.96 \quad R^2 = 0.93 \quad dw = 1.52 \quad (46)
\]

Implicit Price Deflator for Gross Value Added in the Manufacturing Sector

\[
\log DGVAFMF_t = -2.043060 + 0.813218 \log MONEYS_t - 0.429737 \log POPULN_t
\]

\[
R = 0.99 \quad R^2 = 0.98 \quad dw = 1.84 \quad (47)
\]

Implicit Price Deflator for Gross Value Added in the Construction Sector

\[
\log DGVAFCN_t = -2.437350 + 0.743838 \log MONEYS_t - 0.228090 \log POPULN_t
\]

\[
R = 0.99 \quad R^2 = 0.99 \quad dw = 1.24 \quad (48)
\]
Implicit Price Deflator for Gross Value Added in the Other Transport and Storage Sector

\[
\log DGVA\_OT_t = -2.455820 + 0.636437 \log MONEYS_t \\
(39.670) \quad (40.334) \\
R = 0.99 \quad R^2 = 0.99 \quad dw = 1.35
\]

Implicit Price Deflator for Gross Value Added in the Trade, Hotels and Restaurants Sector

\[
\log DGVA\_TR_t = -3.038190 + 0.794344 \log MONEYS_t \\
(28.216) \quad (28.943) \\
R = 0.99 \quad R^2 = 0.98 \quad dw = 1.82
\]

Implicit Price Deflator for Gross Value Added in the Banking and Insurance Sector

\[
\log DGVA\_BI_t = -3.562460 + 1.218070 \log MONEYS_t - 0.992015 \log \frac{POPULN_t}{MONEYS_t} \\
(30.514) \quad (14.973) \quad (5.132) \\
R = 0.99 \quad R^2 = 0.99 \quad dw = 1.28
\]

Implicit Price Deflator for Gross Value Added in the Real Estate and Ownership of Dwellings and Business Services Sector

\[
\log DGVA\_RE_t = -1.788470 + 0.627324 \log MONEYS_t - 0.429610 \log \frac{POPULN_t}{MONEYS_t} \\
(5.104) \quad (13.468) \quad (1.815) \\
R = 0.99 \quad R^2 = 0.98 \quad dw = 1.56
\]

Implicit Price Deflator for Gross Value Added in the Services Sector

\[
\log DGVA\_SR_t = -2.120000 + 0.552734 \log MONEYS_t \\
(44.608) \quad (45.630) \\
R = 0.99 \quad R^2 = 0.99 \quad dw = 1.16
\]
4.2.7 Implicit Price Deflators for Sectoral Government Gross Domestic Capital Formation

Implicit Price Deflators for Sectoral Government Gross Domestic Capital Formation are explained by Implicit Price Deflators for Total Sectoral Investment, latter being estimated in the Input-Output Block of our model. Both linear and double-log forms are tried and linear specifications chosen on the basis of higher explanatory power. As expected, all equations suggest a strong positive relationship between the two deflators for each of the sectors which has Government Investment.

Implicit Price Deflator for Government Investment in the Agricultural Sector

\[ DDKFG.AG_t = -0.36624 + 1.04686 DDKFT.AG_t \]  
\[ (0.923) \quad (38.532)^* \]

\[ R = 0.99 \quad \hat{R}^2 = 0.99 \quad dw = 1.21 \]

Implicit Price Deflator for Government Investment in the Forestry and Logging Sector

\[ DDKFG.FI_t = 0.033940 + 0.963142 DDKFT.FI_t \]  
\[ (2.229)^* \quad (96.735)^* \]

\[ R = 0.99 \quad \hat{R}^2 = 0.99 \quad dw = 1.09 \]

65 Variables DDKFT.@_t are elements of vectors PI_t estimated by relationship (X) of the Input-Output Block, @_t is the abbreviation for the sector.
Implicit Price Deflator for Government Investment in the Mining and Quarrying Sector

\[ DDKFG.MQ_t = 0.006394 + 0.989839 DDKFT.MQ_t \quad (56) \]

\[ R = 0.99 \quad R^2 = 0.99 \quad dw = 1.19 \]

Implicit Price Deflator for Government Investment in the Manufacturing Sector

\[ DDKFG.MF_t = 0.111669 + 0.913978 DDKFT.MF_t \quad (57) \]

\[ R = 0.99 \quad R^2 = 0.99 \quad dw = 1.14 \]

Implicit Price Deflator for Government Investment in the Construction Sector

\[ DDKFG.CN_t = -0.126368 + 1.066850 DDKFT.CN_t \quad (58) \]

\[ R = 0.99 \quad R^2 = 0.98 \quad dw = 1.56 \]

Implicit Price Deflator for Government Investment in the Electricity, Gas and Water Supply Sector

\[ DDKFG.EG_t = -0.000037 + 0.999925 DDKFT.EG_t \quad (59) \]

\[ R = 0.99 \quad R^2 = 0.99 \quad dw = 1.45 \]

This equation gives an almost perfect fit with the value of \( R^2 \) as 0.999996. Such a high explanatory power of this equation is due to the fact that bulk of the investment in this sector is made by the government, the weight of Private Investment being negligible, and hence, the two deflators move very close to each other.
Implicit Price Deflator for Government Investment in the other Transport and Storage Sector

$$DDKFG.OT_t = .013658 + .980205 DDKFT.OT_t$$ (85.791)*

$$R = .99 \quad R^2 = .99 \quad \text{dw} = 1.61$$

Implicit Price Deflator for Government Investment in the Trade, Hotels and Restaurants Sector

$$DDKFG.TR_t = .056425 + .950651 DDKFT.TR_t$$ (29.615)*

$$R = .99 \quad R^2 = .98 \quad \text{dw} = 2.76$$

Implicit Price Deflator for Government Investment in the Banking and Insurance Sector

$$DDKFG.BI_t = -.019314 + 1.002990 DDKFT.BI_t$$ (41.935)*

$$R = .99 \quad R^2 = .99 \quad \text{dw} = 1.27$$

Implicit Price Deflator for Government Investment in the Services Sector

$$DDKFG.SR_t = -.003493 + 1.003960 DDKFT.SR_t$$ (519.924)*

$$R = .99 \quad R^2 = .99 \quad \text{dw} = 2.08$$
Fig. 4.2

FLOW DIAGRAM OF THE MODEL

LAGGED ENDOGENOUS VARIABLES
BGVAF.@@t-1
DVOPF.@@t-1
BDKFP.@@t-1
BDKFG.@@t-

INPUT-OUTPUT BLOCK

BEHAVIOURISTIC BLOCK

@@ denotes abbreviation for some sector.
For notations see appendix to this chapter.
4.3 Mechanism of the Model

Nominal Government Consumption and Nominal Sectoral Government Gross Domestic Capital Formation, which are considered as policy variables in our model and are treated as exogenous, determine Money Supply, on the one hand, and determine with the help of other respective Implicit Price Deflators, the Real Government Consumption and Real Sectoral Government Gross Domestic Capital Formation, on the other. The endogenously estimated Real Sectoral Private Gross Domestic Capital Formation is added to the Real Sectoral Government Gross Domestic Capital Formation to obtain the Real Sectoral Total Gross Domestic Capital Formation in the economy. This in turn, forms a part of a vector of components of Real Final Demand containing also the endogenously estimated Real Private Consumption, Real Government Consumption, Real Changes in Stocks and exogenous exports. The vector of components of Real Final Demand is converted into a vector of Real Sectoral Final Demand, with the help of an exogenously estimated conversion matrix. The vector of Real Sectoral Final Demand, along with exogenously estimated Leontif's Inverse, determine the Real Gross Output vector. This vector estimates also the Direct and Indirect Sectoral Employment by using the exogenous vector of sectoral labour/output ratios.

66 The Mechanism of the Model is also presented in the form of a flow diagram (see figure 4.2).
The Real Gross Output vector finds with the help of an exogenous matrix the Real Sectoral Gross Value Added, and computes by using the exogenous vectors, requirement of Oil Imports and Imports other than Oil.

The endogenously estimated Money Supply along with the Real Sectoral Gross Output and the exogenously growing population estimates Implicit Price deflators for Sectoral Gross Value Added. These deflators determine the Implicit Price Deflator for Gross Domestic Product which, in turn, determines the Implicit Price Deflator for Indirect Taxes less Subsidies. The deflators so obtained are used to find Implicit Price Deflators for Sectoral Gross Output incorporating exogenous information regarding Unit Value Indices for Oil and non-oil Imports. The Implicit Price Deflators for Sectoral Gross Value Added give us, Implicit Price Deflators for components of Final Demand with the help of the conversion matrix and some other exogenous vectors of coefficients.

Implicit Price Deflator for Gross Domestic Product is defined as the ratio of Nominal to Real Gross Domestic Product, where the former is defined as the weighted sum of Real Sectoral Gross Value Added, weights being their respective Implicit Price Deflators, and the latter is the sum total of Real Sectoral Gross Values Added. The Nominal Gross Domestic Product determines the Nominal Disposable Income which after being converted in per capita terms, estimates Nominal per capita Private Consum-
tion. The Nominal per capita Private Consumption multiplied with the exogenously growing Population gives us Total Nominal Private Consumption. This is converted into Real Private Consumption using the endogenously estimated Implicit Price Deflator for Private Consumption.

Lagged values of Real Sectoral Gross Value Added, Implicit Price Deflators for Sectoral Gross output, Real Sectoral Government Investment, and its own lagged values determine Real Sectoral Private Gross Domestic Capital Formation.

The Implicit Price Deflators for Sectoral Government Gross Domestic Capital Formation are determined by endogenously estimated Implicit Price Deflators for Sectoral Total Gross Domestic Capital Formation.

Changes in stocks are obtained with the help of an exogenous vector and endogenous Real Sectoral Total Gross Domestic Capital Formation.

A.4.4 Appendix to Chapter Four
(Glossary of Notations used in the Model)

A.4.4.1 Construction of Abbreviations for Variables

Abbreviations used in this model are of three types: (i) those used to denote various matrices, vectors and scalars pertaining to input-output framework, 67

67 All of such variables have less than six letters and hence can be distinguished from other abbreviations.
(ii) those which refer to macro-variables - having six or more letters; and (iii) abbreviations representing sectoral variables - all of these consisting of a "dot" followed by abbreviation for a sector.\footnote{All abbreviations containing a dot pertain to sectoral variables.}

The abbreviations starting with letter A are for values of the variables at current prices (except ACDUM) whereas those with B are at constant (1970-71) prices. Letter D in the first place indicates implicit price deflator for the variable (except DUM). In the abbreviations for sectoral variables, the second, third and the fourth letters form the abbreviation for the variable. Letters G, P, T and F at fifth place indicates Government, Private, Total and Factor Cost, respectively. The abbreviations are followed by a subscript "t" referring to the time period.

Thus, ADKFG.MF stands for Government Gross Domestic Capital Formation in the Manufacturing Sector at current prices, and DGVAF.\_MG represents Gross Value Added at Factor Cost in the Agricultural Sector at constant (1970-71) prices and DVOFF.\_CN stands for Implicit Price Deflator for Gross Output at Factor Cost in the Construction Sector; base 1970-71 = 1.0.

68 All abbreviations containing a dot pertain to sectoral variables.
A.4.4.2 Matrices, Vectors, Scalars and Variables used
in the Input-Output Block (All at constant
1970-71 prices).

<table>
<thead>
<tr>
<th>Notation</th>
<th>Order</th>
<th>Matrix, Vector, Scalar or Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>14 x 14</td>
<td>Input-Output coefficient matrix net of imported inputs. $A = (a_{ij})$; $a_{ij} =$ amount of sector i's output required per rupee of sector j's output.</td>
</tr>
<tr>
<td>B</td>
<td>14 x 14</td>
<td>Diagonal matrix representing share of gross value added in one rupee of gross output. $B = (b_{ij})$; $b_{ij} = 0$ for $i \neq j$ and $b_{ij} =$ proportion of gross value added in one rupee worth of sector i's output for $i = j$.</td>
</tr>
<tr>
<td>BGCEMP</td>
<td>Variable</td>
<td>Real Government Consumption Expenditure at market prices, (Million Rs.)</td>
</tr>
<tr>
<td>C</td>
<td>14 x 14</td>
<td>Vector of proportions of outputs of sectors of production at factor cost in one rupee worth of Real Private Final Consumption at market prices. $C = (c_i)$; $c_i =$ output of sector i at factor cost purchased for private consumption in one rupee worth of Real Private Final Consumption at market prices.</td>
</tr>
<tr>
<td>CMO</td>
<td>1 x 1</td>
<td>Proportion of Imports other than Oil for private consumption in one rupee worth of Real Private Final Consumption at market prices.</td>
</tr>
<tr>
<td>CNO</td>
<td>1 x 1</td>
<td>Proportion of Oil Imports for private consumption in one rupee worth of Real Private Final Consumption at market prices.</td>
</tr>
<tr>
<td>D</td>
<td>1 x 18</td>
<td>Vector of components of Final Demand (for details, see Input-Output Block of the model).</td>
</tr>
<tr>
<td>Notation</td>
<td>Order</td>
<td>Matrix, Vector, Scalar or Variable</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>DGHSTK</td>
<td>Variable</td>
<td>Implicit Price Deflator for Changes in stocks (Base 1970-71=1).</td>
</tr>
<tr>
<td>DGCEMP</td>
<td>Variable</td>
<td>Implicit Price Deflator for Government Final Consumption Expenditure (Base 1970-71=1)</td>
</tr>
<tr>
<td>DPCEMP</td>
<td>Variable</td>
<td>Implicit Price Deflator for Private Final Consumption Expenditure (Base 1970-71=1).</td>
</tr>
<tr>
<td>ED</td>
<td>1 x 14</td>
<td>Direct Sectoral Employment</td>
</tr>
<tr>
<td>EI</td>
<td>1 x 14</td>
<td>Indirect Sectoral Employment due to each sector.</td>
</tr>
<tr>
<td>EII</td>
<td>1 x 14</td>
<td>Indirect Sectoral Employment in each sector.</td>
</tr>
<tr>
<td>F</td>
<td>18 x 14</td>
<td>Final Demand Conversion Matrix. F = (f_{ij}); f_{ij} = sector i's output at factor cost required per rupee of final demand component j at market prices.</td>
</tr>
<tr>
<td>FD</td>
<td>1 x 14</td>
<td>Vector of Real Sectoral Final Demand at factor cost.</td>
</tr>
<tr>
<td>G</td>
<td>14 x 1</td>
<td>Vector of proportion of outputs of sectors of production at factor cost in one rupee worth of Real Government Consumption Expenditure at market prices; G = (g_i); g_i = Output of sector i at factor cost purchased for government consumption in one rupee worth of Real Government Consumption Expenditure at market prices.</td>
</tr>
<tr>
<td>GMG</td>
<td>1 x 1</td>
<td>Proportion of Imports other than Oil in one rupee worth of Real Government Consumption Expenditure at market prices.</td>
</tr>
</tbody>
</table>

69 Vectors C, G, S and matrix K are portions of this matrix. The matrix F has been shown with bold border in Figure 3.2.
<table>
<thead>
<tr>
<th>Notation</th>
<th>Order</th>
<th>Matrix, Vector or Scalar</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMO</td>
<td>1 x 1</td>
<td>Proportion of Oil Imports in one rupee worth of Real Government Consumption Expenditure at market prices.</td>
</tr>
<tr>
<td>I</td>
<td>14 x 14</td>
<td>Identity Matrix.</td>
</tr>
<tr>
<td>I</td>
<td>1 x 14</td>
<td>Vector of Real Total (Private+ Government) Sectoral Gross Domestic Capital Formation.</td>
</tr>
<tr>
<td>K</td>
<td>14 x 14</td>
<td>Real Total Sectoral Gross Domestic Capital Formation Composition matrix by sector of use. $K = (K_{ij})$; $k_{ij}$ = sector $i$'s output at factor cost required per rupee of Real Total Gross Domestic Capital Formation in sector $j$ at market prices.</td>
</tr>
<tr>
<td>KM</td>
<td>1 x 14</td>
<td>Vector of proportion of Imports other than Oil at sectoral level in one rupee worth of Real Total Gross Domestic Capital Formation in that sector.</td>
</tr>
<tr>
<td>L</td>
<td>14 x 14</td>
<td>Diagonal matrix of sectoral employment/output ratios. $L = (l_{ij})$; $l_{ij}$ = Employment in Standard Person Years per million rupees of gross output in sector $i$. for $i = j$ and $l_{ij} = 0$ for $i \neq j$.</td>
</tr>
<tr>
<td>MG</td>
<td>1 x 14</td>
<td>Vector of proportions of Imports other than Oil at sectoral level in one rupee worth of gross output of that sector.</td>
</tr>
<tr>
<td>MG</td>
<td>Variable</td>
<td>Total Imports other than Oil (Million Rs.)</td>
</tr>
<tr>
<td>MO</td>
<td>1 x 14</td>
<td>Vector of proportions of Oil Imports at sectoral level in one rupee worth of gross output of that sector.</td>
</tr>
</tbody>
</table>

70 Vector $\bar{T}$ is a portion of vector $J$. 
<table>
<thead>
<tr>
<th>Notation</th>
<th>Order</th>
<th>Matrix, Vector or Scalar</th>
</tr>
</thead>
<tbody>
<tr>
<td>MO</td>
<td>Variable</td>
<td>Total Oil Imports (Million Rs.).</td>
</tr>
<tr>
<td>PI</td>
<td>14 x 1</td>
<td>Vector of Implicit Price Deflators for Total Sectoral Gross Domestic Capital Formation.</td>
</tr>
<tr>
<td>PV</td>
<td>14 x 1</td>
<td>Vector of Implicit Price Deflators for Sectoral Gross Value Added.</td>
</tr>
<tr>
<td>PX</td>
<td>14 x 1</td>
<td>Vector of Implicit Price Deflators for Sectoral Gross Output.</td>
</tr>
<tr>
<td>Q</td>
<td>1 x 14</td>
<td>Vector of proportions of Sectoral Changes in Stocks per rupee of Real Total Gross Domestic Capital Formation at market prices in that sector.</td>
</tr>
<tr>
<td>Q̄</td>
<td>Variable</td>
<td>Total Changes in Stocks in the Economy (same as S) in Million Rs.</td>
</tr>
<tr>
<td>S</td>
<td>14 x 1</td>
<td>Vector of proportions of gross output in one rupee worth of total changes in stocks in the economy.</td>
</tr>
<tr>
<td>ȳ</td>
<td>Variable</td>
<td>Total Changes in stocks in the economy (same as Q̄) in Million Rs.</td>
</tr>
<tr>
<td>T</td>
<td>1 x 14</td>
<td>Vector of proportions of Indirect Taxes less Subsidies in one rupee worth of gross output for that sector.</td>
</tr>
<tr>
<td>TC</td>
<td>1 x 1</td>
<td>Proportion of Indirect Taxes less Subsidies in one rupee worth of Real Private Final Consumption at market prices.</td>
</tr>
<tr>
<td>TK</td>
<td>1 x 14</td>
<td>Vector of proportions of Indirect Taxes less Subsidies in one rupee worth of Real Total Gross Domestic Capital Formation at market prices for each sector.</td>
</tr>
<tr>
<td>TG</td>
<td>1 x 1</td>
<td>Proportion of Indirect Taxes less Subsidies in one rupee worth of Real Government Consumption at market prices.</td>
</tr>
</tbody>
</table>
Notation Order Matrix, Vector or Scalar

- \( U \) \( 1 \times 14 \) Vector having each of its element equal to 1.
- \( V \) \( 14 \times 1 \) Vector of Real Sectoral Gross Value Added (Million Rs.).
- \( X \) \( 14 \times 1 \) Vector of Sectoral Gross Output.

A.4.4.3 List of Macro Variables

<table>
<thead>
<tr>
<th>Notation</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACDUM</td>
<td>Dummy for accounting change in accounting method of Commercial Banks from January 1978 when they started showing a larger proportion of demand deposits as time liabilities thereby bringing in an artificial decline in the Money Supply (M1) which does not include time liabilities. ACDUM = 1 for period 1978-79 onwards.</td>
</tr>
<tr>
<td>ADISIN</td>
<td>Personal Disposable Income at current prices (Million Rs.).</td>
</tr>
<tr>
<td>AGCEMP*</td>
<td>Government Consumption Expenditure at current market prices (Million Rs.).</td>
</tr>
<tr>
<td>AGDKFT*</td>
<td>Government Gross Domestic Capital Formation (Total for all sectors) at current market prices (Million Rs.).</td>
</tr>
<tr>
<td>AGDPFC</td>
<td>Gross Domestic Product at factor cost current prices (Million Rs.).</td>
</tr>
<tr>
<td>BCHSTK</td>
<td>Total Changes in Stock in the economy at constant 1970-71 prices in Million Rs. ( (BCHSTK = S = S) )</td>
</tr>
<tr>
<td>BEXPQR*</td>
<td>Total Exports from the country at constant 1970-71 f.o.b. rupee prices (Million Rs.).</td>
</tr>
<tr>
<td>Notation</td>
<td>Variable</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>BGCEMP</td>
<td>Real Government Consumption Expenditure at market prices. (Million Rs. at constant 1970-71 prices).</td>
</tr>
<tr>
<td>BGDPFPC</td>
<td>Real Gross Domestic Product at factor cost (Million Rs. at constant 1970-71 prices).</td>
</tr>
<tr>
<td>DIMOIL*</td>
<td>Implicit Price Deflator for Oil Imports at c.i.f. prices (Rupees Unit Value Index: 1970-71=1.0).</td>
</tr>
<tr>
<td>DIMOTO*</td>
<td>Implicit Price Deflator for Imports other than Oil at c.i.f. prices (Rupee Unit Value Index: 1970-71=1.0).</td>
</tr>
<tr>
<td>DINTAX</td>
<td>Implicit Price Deflator for Indirect Taxes less Subsidies (1970-71=1.0).</td>
</tr>
<tr>
<td>DPCEMP</td>
<td>Implicit Price Deflator for Private Consumption Expenditure at market prices (1970-71=1.0).</td>
</tr>
<tr>
<td>DUM</td>
<td>Dummy for accounting changes in the post-oil-price-hike period. DUM=1 for 1974-75 onwards.</td>
</tr>
<tr>
<td>ESHDUM</td>
<td>Dummy for electricity shortage/crisis. Takes a value 1 for the years of shortages; 0 otherwise.</td>
</tr>
</tbody>
</table>

* Variables marked with asterisk are exogenous. Apart from these, all matrices and vectors of coefficients are exogenous. Nominal Government Consumption, Sectoral Government Gross Domestic Capital Formation at current prices and Implicit Price Deflators for Gross Value Added in 'Electricity, Gas and Water Supply,' Railways and Communications, are also exogenous.*
Notation | Variable
--- | ---
GOVDUM | Dummy for capturing the effect of change in Government in January 1980. Takes a value 1 for 1979-80; zero for rest of the years.
POPULN* | Population of the country (Million persons).

---

A.4.4.4 List of Abbreviations for the Names of the Sectors

<table>
<thead>
<tr>
<th>Sector No.</th>
<th>Abbreviation</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AG</td>
<td>Agriculture (including Animal Husbandry and allied activities).</td>
</tr>
<tr>
<td>2.</td>
<td>FL</td>
<td>Forestry and Logging</td>
</tr>
<tr>
<td>3.</td>
<td>FS</td>
<td>Fishing</td>
</tr>
<tr>
<td>4.</td>
<td>MQ</td>
<td>Mining and Quarrying</td>
</tr>
<tr>
<td>5.</td>
<td>MF</td>
<td>Manufacturing (Registered+ Unregistered).</td>
</tr>
<tr>
<td>6.</td>
<td>CN</td>
<td>Construction.</td>
</tr>
<tr>
<td>7.</td>
<td>EG</td>
<td>Electricity, Gas and Water Supply.</td>
</tr>
<tr>
<td>8.</td>
<td>RL</td>
<td>Railways.</td>
</tr>
<tr>
<td>9.</td>
<td>OT</td>
<td>Other Transport and Storage</td>
</tr>
<tr>
<td>10.</td>
<td>CM</td>
<td>Communications.</td>
</tr>
<tr>
<td>Sector No.</td>
<td>Abbreviation</td>
<td>Sector</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------</td>
</tr>
<tr>
<td>11.</td>
<td>TR</td>
<td>Trade, Hotels and Restaurant</td>
</tr>
<tr>
<td>12.</td>
<td>BI</td>
<td>Banking and Insurance</td>
</tr>
<tr>
<td>13.</td>
<td>RE</td>
<td>Real Estate and Ownership of Dwellings; and Business Services.</td>
</tr>
<tr>
<td>14.</td>
<td>SR</td>
<td>Public Administration, Defence and other Services.</td>
</tr>
</tbody>
</table>

A.4.4.5 **List of Sectoral Variables**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>DKFG</td>
<td>Government Gross Domestic Capital Formation at market prices.</td>
</tr>
<tr>
<td>DKFP</td>
<td>Private Gross Domestic Capital Formation at market prices.</td>
</tr>
<tr>
<td>DKFT</td>
<td>Total (Government+Private) Gross Domestic Capital Formation at market prices.</td>
</tr>
<tr>
<td>GVAF</td>
<td>Gross Value Added at factor cost.</td>
</tr>
<tr>
<td>VOPF</td>
<td>Gross Output at factor cost.</td>
</tr>
</tbody>
</table>