CHAPTER IV

AN ECONOMETRIC MODEL OF INDIA'S BALANCE OF PAYMENTS: 1960-61 TO 1985-86

This Chapter attempts to identify factors influencing movements in major components of India's Balance of Payments viz. Merchandise Imports, Merchandise Exports, Service Imports, Service Exports and Long-Term Capital Flow (Net). All these being dependent variables we have run different regressions (Single and Multivariate) for the period from 1960-61 to 1985-86, which is represented by N=26, and sub-period 1970-71 to 1985-86 represented by N=16. However, we have taken into account those equations which have greater explanatory powers. All equations were estimated in log-linear terms by Ordinary Least Squares (OLS) method. Since all variables have been expressed in logarithmic terms the estimated coefficients give respective elasticities. The specification of the equations used in this study have been drawn from the studies by Mohsin Khan (1974), M.R. Aggarwal (1984) and Kannan (1989) with slight variations.

EMPIRICAL RESULTS

Merchandise Imports:

The volume of Imports (M) is hypothesized to be an increasing function of the real gross domestic product (Y2) and net foreign exchange assets (FR) and decreasing function of the relative price ratio (MP/WP) i.e., the ratio of import price to domestic price. We also introduced a dummy variable (D1) to account for the hike in oil price. The estimation of the import demand functions yield the following results:
(1) \[ \ln M = -2.515 + 0.596 \ln Y_2 \]
\[ (2.891) \quad (7.867) \]
\[ N = 26, R^2 = 0.721, \bar{R}^2 = 0.709, SE = 0.104, \]
\[ F(1,24) = 61.889, DW = 1.043 \]

(2) \[ \ln M = -3.571 + 0.691 \ln Y_2 - 0.061 D_1 \]
\[ (2.280) \quad (4.957) \quad (-0.813) \]
\[ N = 26, R^2 = 0.728, \bar{R}^2 = 0.705, SE = 0.105, \]
\[ F(2,23) = 30.838, DW = 1.048 \]

(3) \[ \ln M = -3.722 + 0.719 \ln Y_2 - 0.029 \ln FR \]
\[ (-1.308) \quad (2.511) \quad (-0.446) \]
\[ N = 26, R^2 = 0.723, \bar{R}^2 = 0.699, SE = 0.106, \]
\[ F(2,23) = 30.011, DW = 1.037 \]

(4) \[ \ln M = -5.993 + 0.942 \ln Y_2 - 0.065 \ln FR \]
\[ (+1.380) \quad (2.189) \quad (-0.780) \]
\[ + 0.092 \ln MP/WP \]
\[ (0.699) \]
\[ N = 26, R^2 = 0.729, \bar{R}^2 = 0.692, SE = 0.107, \]
\[ F(3,22) = 19.725, DW = 1.045 \]

(5) \[ \ln M = -5.751 + 0.875 \ln Y_2 + 0.093 \ln (MP/WP) \]
\[ (-3.892) \quad (6.846) \quad (0.984) \]
\[ N = 16, R^2 = 0.792, \bar{R}^2 = 0.760, SE = 0.085, \]
\[ F(2,13) = 24.770, DW = 1.545 \]
(6)  \[ \ln M = -13.867 + 1.691 \ln Y2 + 0.306 \ln (MP/WP) - 0.164 \ln FR \]
\[ (-2.928) \quad (3.592) \quad (2.072) \quad (-1.790) \]
\[ N = 16, R^2 = 0.836, R^2 = 0.795, SE = 0.079, \]
\[ F(3,12) = 20.380, DW = 1.520 \]

(7)  \[ \ln M = -14.295 + 1.731 \ln Y2 + 0.323 \ln (MP/WP) - 0.167 \ln FR \]
\[ (-2.615) \quad (3.220) \quad (1.811) \quad (-1.725) \]
\[ -0.016 D1 \]
\[ (-0.183) \]
\[ N = 16, R^2 = 0.836, R^2 = 0.777, SE = 0.082, F(4,11) = 14.062, \]
\[ DW = 1.532 \]

It is evident from equation (1) that the coefficient of real income (Y2) is found to be statistically significant at 5 per cent level, with proper sign. It explains about 70.9 per cent of the variation in the aggregate demand for imports. There is a decline in the explanatory power of equation (2) to 70.5 per cent, when a dummy variable (D1) is considered along with the variable Y2. In equation (3) the variables Y2 and foreign exchange reserve (FR) are considered. These two variables explained 69.9 per cent of the variation in the aggregate demand for imports. There is a further decline in the explanatory power of equation (4) to 69.2 per cent when the variables Y2, FR and relative price ratio (MP/WP) are considered together, compared to equation (3). In all the four equations the value of the DW Statistic indicates the presence of autocorrelation. The variables real income (Y2) and relative price ratio (MP/WP) are considered in equation (5). These two variables explained 76 per cent of the variation in the aggregate demand for imports. There is an increase in the explanatory power of equation (6) to 79.5 per cent when the variables Y2, (MP/WP) and FR are considered together. There
is a decline in the explanatory power of equation (7) to 77.7 per cent when a dummy variable is added to the variables Y2, MP/WP, and FR, Compared to equation (6). The values of DW Statistic in the equations (5), (6) and (7) indicate that there is no evidence of autocorrelation.

However, it is found, from equations (1) to (7) that the only coefficient real income (Y2) is statistically significant at 5 per cent level, with expected positive sign. The coefficients of (MP/WP), FR and D1 are not significant at 5 per cent level in any of the estimated equation. They have unexpected signs too. So real income is the only explanatory variable which explains the emergence of a large proportion of total imports. It is also clear from the results that the values of income elasticity of demand for imports as compared to price elasticity of demand for imports are quite high.

**MERCHANDISE EXPORTS**

The world demand for the India's volume of exports (X) is hypothesized to be favourably affected by an increase in the world real income (WGDP) and negatively related to the exchange rate (ER) and competitive position, which is measured by the ratio of India’s export unit values to that of world export unit values (PX/PW). On account of devaluation of the Indian rupee in June, 1966 and substantial rise in subsidies for exports after 1974-75 we also used dummy variables.

The estimated results of the export demand functions are the following:
(8) \[ \ln X = 1.169 + 0.760 \ln \text{WGDP} \]
\[ (4.818) \quad (13.549) \]
\[ N = 26, \quad R^2 = 0.884, \quad \bar{R}^2 = 0.880, \quad SE = 0.082, \]
\[ F(1,24) = 183.59 \]

(9) \[ \ln X = 1.995 + 0.552 \ln \text{WGDP} + 0.137 \text{D2} \]
\[ (4.691) \quad (5.255) \quad (2.285) \]
\[ N = 26, \quad R^2 = 0.906, \quad \bar{R}^2 = 0.898, \quad SE = 0.075, \]
\[ F(2,23) = 110.541, \quad DW = 1.152 \]

(10) \[ \ln X = 0.646 + 0.928 \ln \text{WGDP} - 0.026 \text{ER} \]
\[ (1.427) \quad (6.857) \quad (-1.357) \]
\[ N = 26, \quad R^2 = 0.893, \quad \bar{R}^2 = 0.884, \quad SE = 0.080, \quad F(2,23) = 95.928, \quad DW = 1.046 \]

(11) \[ \ln X = 1.645 + 0.659 \ln \text{WGDP} - 0.160 \ln \left( \frac{\text{PX}}{\text{PW}} \right) \]
\[ (2.299) \quad (4.304) \quad (-0.709) \]
\[ N = 26, \quad R^2 = 0.887, \quad \bar{R}^2 = 0.877, \quad SE = 0.082, \]
\[ F(2,23) = 90.136, \quad DW = 0.835 \]

(12) \[ \ln X = 1.725 + 0.640 \ln \text{WGDP} - 0.174 \ln \left( \frac{\text{PX}}{\text{PW}} \right) + 0.009 \text{D2} \]
\[ (1.779) \quad (2.917) \quad (-0.679) \quad (0.126) \]
\[ N = 26, \quad R^2 = 0.887, \quad \bar{R}^2 = 0.872, \quad SE = 0.084, \quad F(3,22) = 57.525, \]
\[ DW = 0.831 \]

(13) \[ \ln X = 1.012 + 0.843 \ln \text{WGDP} - 0.087 \ln \left( \frac{\text{PX}}{\text{PW}} \right) - 0.025 \text{ER} + 0.02 \text{D2} \]
\[ (0.884) \quad (3.007) \quad (-0.328) \quad (-1.150) \quad (0.274) \]
\[ N = 26, \quad R^2 = 0.894, \quad \bar{R}^2 = 0.873, \quad SE = 0.084, \quad F(4,21) = 44.106, \]
\[ DW = 0.995 \]

(14) \[ \ln X = 8.422 + 0.022 \ln Y2 - 0.87 \ln \text{ER} \]
\[ (3.830) \quad (0.181) \quad (-4.018) \]
\[ N = 16, \quad R^2 = 0.698, \quad \bar{R}^2 = 0.652, \quad SE = 0.065, \quad F(2,13) = 15.047, \quad DW = 1.567 \]
\[ (15) \ln X = 3.839 + 0.126 \ln \text{WGDP} + 0.210 \ln (\text{PX/PW}) + 0.234^* D4 \]
\[ (3.908) \quad (0.586) \quad (0.813) \quad (3.406) \]
\[ N = 16, R^2 = 0.740, \bar{R}^2 = 0.675, SE = 0.063, \]
\[ F(3,12) = 11.376, DW = 2.320 \]

From the estimated equations (8) to (13) it is observed that the statistical fits of all six equations are reasonably good. All the coefficients of the variables considered in the model bear expected signs but are insignificant at 5 per cent level of significance except, the coefficient of the variable WGDP. Above results show that a major portion of growth in export volume was due to the growth in world real income (WGDP). It is evident from equation (14) that the coefficient of the variable real effective exchange rate index (ER) is found to be statistically significant at 5 per cent level with proper sign. This implies that changes, in the exchange rates of rupee, help significantly exports earnings of India. While the variable real gross domestic product (Y2) is not significant. In equation (15) the variable WGDP and PX/PW are not significant at 5 per cent level of significance but the coefficient of the dummy variable, which is considered to account for the substantial rise in subsidies for exports, is found to be statistically significant implying that the increasing government incentives for exports seemed to have favourable effect on the volume of exports. There does not seem to be any auto-correlation problem in the equations (14) and (15) as can be seen from the values of Durbin-Watson (DW) Statistic.

**IMPORT OF SERVICES**

Import of services, which represent the debit side of invisible items under the current account of balance of payments, is specified as a log-linear function of the merchandise imports.
(MNPM) and external debt (EDO). Higher imports lead to higher amount of shipping, transport and other insurance charges and higher amount of external debt which in turn lead to higher amount of interest payments. Generally, it is expected that signs of the coefficients of merchandise imports (MNPM) and external debt outstanding (EDO) would be positive implying that increases in the merchandise imports and external debt would lead to increase in the import of services. The estimated relations are as follows:

\[
\begin{align*}
\text{(16) } \ln MS &= -0.914 + 0.912 \ln MNPM \\
&\quad (-2.651) (21.842) \\
&N = 26, R^2 = 0.952, \bar{R}^2 = 0.950, SE = 0.212, F(1,24) = 477.054
\end{align*}
\]

\[
\begin{align*}
\text{(17) } \ln MS &= -1.706 + 0.696 \ln MNPM + 0.296 \ln EDO \\
&\quad (-5.019) (10.826) (3.909) \\
&N = 26, R^2 = 0.971, \bar{R}^2 = 0.969, SE = 0.168, F(2,23) = 388.071, \\
&\text{DW} = 0.595
\end{align*}
\]

\[
\begin{align*}
\text{(18) } \ln MS &= -9.380 + 1.571 \ln MNPM + 0.235 \ln EDO \\
&\quad (-7.449) (7.194) (2.498) \\
&N = 16, R^2 = 0.984, \bar{R}^2 = 0.981, SE = 0.106, F(2,13) = 390.067, \\
&\text{DW} = 2.108
\end{align*}
\]

It is evident from the above results that the coefficient of the variable merchandise imports (MNPM) in equation (16) is found to be statistically significant with proper sign. The variable explains 95 per cent of the variation in the import of services. There is an increase in the explanatory power of equation (17) to 96.9 per cent when the variable external debt outstanding (EDO) is considered along with the variable MNPM. It can also be observed from the above equations (16), (17) and (18) that the influence of the variable merchandise imports
(MNPM) on the import of services (MS) is much larger than the external debt outstanding.

**EXPORT OF SERVICES**

Export of Services, which represent credit side of invisible items under the current account of balance of payments, is hypothesized to be favourably affected by an increase in the world real income (WGDP), and adversely affected by the increases in the ratio of consumer price index in India to the world (RCPI) and the real exchange rate (ER). The expected sign of the coefficient of the ratio of consumer price index in India to the world is negative, which implies that with an increase in consumer price index in India, as compared to that of world, the value of the variable RCPI increases. This will therefore, lead to lower inflow of tourists to India and hence lower export of services. The coefficient of real exchange rate has been estimated only in the case of 1970-71 to 1985-86 period because the system of fixed exchange rate remained operative up to 1971 on the international scene. The estimated relations are the following:

(19) \[ \ln ES = -10.919 + 4.182 \cdot \ln WGDP \]

\[ (-7.730) \quad (12.799) \]

\[ N = 26, R^2 = 0.872, \bar{R}^2 = 0.867, SE = 0.475, F(1,24) = 163.821 \]

(20) \[ \ln ES = -8.607 + 3.722 \cdot \ln WGDP - 2.083 \cdot \ln RCPI \]

\[ (-7.199) \quad (13.819) \quad (-4.337) \]

\[ N = 26, R^2 = 0.930, \bar{R}^2 = 0.924, SE = 0.360, \]

\[ F(2,23) = 152.106, DW = 1.802 \]
It is evident from the above estimated equations that all the estimated coefficients are found to be statistically significant at 5 per cent level of significance, except the coefficient of real exchange rate in equation (21), and bear expected signs.

Moreover, all the equations appear to be well specified with the fairly high values of $R^2$ and $F$ and no evidence of autocorrelation. Variations in exchange rate and devaluation of Indian rupee did not materially affect our exports of services abroad or to the tourists at home. Demand for exports of Indian Services is more influenced by the WGDP which Symbolizes the incomes of the importers of our services.

**LONG-TERM CAPITAL FLOW (NET)**

Net long-term capital flow is hypothesized to be favourably affected by the increases in the domestic public sector saving investment gap (PUSIGAP), growth rate of net foreign exchange assets (GNFA) and the ratio of consumer price index in India to the world (RCPI), and negatively related to the current account balance (CUB).

The expected signs of the coefficients of the variables PUSIGAP, GNFA and RCPI are positive implying that higher the gap between the domestic public sector saving and investment more would be LCAP. Recent Indian experience indicates that net foreign assets are replenished by borrowings from international financial institutions and in situation of
higher domestic inflation rate, which represents either higher budget deficit or increasing gap between demand and supply of goods, the government resorts to external borrowing. While the negative sign of coefficient of the variable CUB implies that a country would seek capital inflow to offset its current account deficit and would acquire foreign securities to spend its surplus. The estimated relations are as follows:

\[
\text{LCAP} = 565.320 - 0.293 \text{CUB} - 0.078 \text{PUSIGAP} + 0.506^* \text{GNFA} - 463.613 \text{RCPI}
\]

\[
(0.396) \quad (-1.918) \quad (-1.309) \quad (4.435) \quad (-0.469)
\]

\[
N = 16, R^2 = 0.898, \bar{R}^2 = 0.860, SE = 436.754, F(4, 11) = 24.099, DW = 2.320
\]

It is evident from equation (22) that the coefficients of the variables CUB and GNFA have expected signs, where only the coefficient of GNFA is found to be statistically significant at 5 per cent level of significance, but the coefficients of the variables PUSIGAP and RCPI have neither expected signs nor statistically significant. However, the explanatory power of the equation is reasonably good. Also, there does not seem to be any auto-correlation problem as can be seen from the value of Durbin-Watson (DW) Statistic. An important finding of this study is that a major portion of growth in long-term capital flow was due to the growth in net foreign exchange assets.