CHAPTER VI

DECOMPOSITION
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Abstract

This Chapter uses decomposition model to determine the contribution of export price and export quantity to export earnings of India over a period of 25 years. It also examines the impact of exchange rate fluctuations on export prices. The empirical estimates of regression growth rates of export quantity and export prices and their inter-action effect satisfy the decomposition model almost exactly for the overall period of 25 years. The model is also validated by the year on year growth rates of the core variables of the decomposition model. Export earnings are dominated by the growth of export quantity, though the rising prices of exports also contribute to export earnings substantially. The findings also highlight the significant impact of exchange rate fluctuations on export prices. The findings highlight the need for raising factor productivity in the production of export goods so as to reduce cost and enhance price competitiveness of Indian exports in foreign markets.

6.0 Introduction: Theoretical Framework

International trade is generally considered to be an extension of domestic trade. But the theory of international trade is distinct and different from the theory of internal trade. In fact, there is no theory going by the name theory of domestic trade. The basic differences between the domestic and international trade are (i) International transactions involve cross border movement of commodities, services and financial resources; (ii) Unlike national trade in which goods, services and factors are involved in sales and purchases among the nationals of the same country, international trade involves transactions between two or more countries in only few selected goods and factors; (iii) International transactions are subjected to custom duties/tariffs, which domestically trade goods do not bear; (iv) International trade may also be subject to non-tariff restrictions and other policy impediment; (v) Prices of exports and imports are determined and expressed both in national and international currencies.
Generally, prices are expressed in US dollars; (vi) Export earnings constitute an import source of accumulation of foreign exchange; (vii) Prices of exports and imports are highly sensitive to exchange rate and its fluctuations in the exchange market; (viii) Focus of international trade is on real rather than nominal values of the variables. This makes quantities of traded goods and factors, trade flows and relative rather than absolute prices immensely important for analysis. Even real values of such variables as are measured in monetary terms are of greater interest than their nominal values. For example, foreign exchange earnings in real/constant rather than nominal/current prices, and real rather than nominal exchange rate are of great analytical importance (Cf. Neary, J. Peter, 1996). Besides, empirical analysis of international trade in the chosen theoretical framework generally focuses on medium run issues and problems in equilibrium framework rather than to relate to short run disequilibrium problems. The reason is that such problems as unfavourable balance of trade and payments cannot last over long periods. In fact, no economy can bear the burden of eternal imbalance in payments.

The analysis of international trade concentrates on the following basic theoretical, policy and empirical aspects: (i) Analysis of causes and consequences of international trade; (ii) Pattern and direction of trade and its conformity with the predictions of theory; (iii) Trade, growth and welfare gains of trade; (iv) Favourable terms of trade; (iv) Balance of (a) trade and (b) payments and (v) Package of policy instruments in operation. Such policies fall within the purview of Trade and Tariff policies.

Adam Smith (1773) laid down the foundation of formal theoretical analysis of international trade; he postulated an absolute cost advantage in the production of certain goods in a country to induce its export to other countries. David Ricardo (1817) refined and modified Smith’s theory; he propounded the comparative rather than absolute cost advantage to underlie the occurrence of international trade between any two countries at any point in time. This theory predicts that a country should specialize in the production and export of such goods in the production of which its comparative/relative advantage is greater. The positive layer of the theory also points out that even an inefficient country will gain by engaging in international trade due to differences in the comparative costs of imported and exported goods between the countries. The theory also predicts the direction and pattern of trade, since it stipulates
that each country will export such goods, which it produces at relatively lower cost and which it can sell to other countries relatively cheaper.

The normative layer of the theory deals with the advantages of free trade over protected or restrictive trade practices and policies. In many cases, normative layer of the theory runs counter to such practices as dumping, export subsidies, high tariff walls against imports, or quota restrictions. The theory based policy also diverges from the erstwhile Indian policy of substitution of imports by domestic production irrespective of cost or quality considerations. Similarly, one may encounter partially free and partially restrictive trade practices and policies; such policies are supported by arguments which highlight benefits of such policy relative to the trade under conditions of autarchy (Neary, 1996).

The above theory has the following limitations: (i) It assumes that unit cost of production is independent of scale of production, or factor proportions required in the production of export and import goods. (ii) It does not explain the causes of observed or perceived differences between comparative costs and scale of production.

Hecksher (1919) and Ohlin (1932) independently developed the theory of factor endowment, which overcomes these limitations of the comparative cost theory. They highlighted the differences in factor endowment of the countries as the basic cause of comparative advantage in the cost of production and trade. The theory predicts that a capital abundant and labour scarce country tends to specialize in exports of good(s) the production of which is more capital and less labour intensive. Obviously, factor of abundant supply will be cheaper relatively to scarce factor in factor market. Empirical evaluation of the validity of factor endowment theory by Leontief resulted in paradoxical finding that US, a capital rich and labour scarce country, exported labour intensive goods and imported capital goods. This inspired empirical investigation of Leontief’s thesis across the globe. But the findings remained, by and large, inconclusive in so far as findings confirmed the validity of Hecksher-Ohlin thesis for countries like India, while for some other countries findings are not so conclusive. So, most of the economists still prefer the theoretical framework of comparative advantage along with Hecksher-Ohlin theory with the inclusion of more than two factors to analyze the pattern of trade among the countries.
The above theories also do not explain the empirically observed pattern of trade among the developed countries with similar development levels and factor endowment. Pattern of trade among these countries is explained by differentiated traded products based on super specialization (Cf. Neary, 1996). The theories do not explain the pattern of trade of developing countries with the rest of the world; these countries attempt to transform the structure of their economies by heavy and basic goods centric rapid industrialization, which makes their pattern of trade diverge from the prediction of theory. Shri Prakash, Amit Sharma and Sonia Dhir (2011) adopted the dynamic setting of growth to allow change in technology on the one hand, and factor endowment and its impact on pattern of trade on the one hand, and the impact of pattern of trade on economic structure, which diverges from factor endowment and which is deliberately adopted for the realization of objectives of long run growth, especially the self reliant, and self-sustained strategy of growth on the other.

None of the above theories links the pattern of trade either to balance of trade, or to balance of payments, terms of trade, and the sources of growth of trade in general and growth of exports and export earnings over a period of time in particular. The theories also do not deal with the relation between exchange rate and prices of export goods in international market and its effect on export earnings. The theory does not explain the sources of growth of export earnings. This study attempts to fill up this gap in knowledge.

6.1 Exchange Rate and its Price Effect

Exchange rate is the price of one currency expressed in other country’s (ies) currency (ies). The nominal exchange rate is generally defined as the amount of foreign currency that may be obtained per unit of domestic currency in the exchange market at the given point in time. Exchange rate relates to specific time domain and it fluctuates with time (Cf. Llevellyn, David T., 1996).

The effective and real exchange rates are distinguished from nominal exchange rate. *Effective exchange rate refers to the value of a currency in the basket of selected currencies.* Effective exchange rate is an index of weighted average of the
units of a designated set of foreign currencies that may be acquired per unit of domestic currency. Therefore, rate of change in effective exchange rate is a weighted average of change in the nominal rate in currencies in the chosen basket.

The real exchange rate refers to the units of domestic currency in constant domestic prices (adjusted for domestic inflation rate) per unit of foreign currency in constant prices of the country of the foreign currency. Alternatively, in a situation in which nominal/effective exchange rate changes from time to time, real exchange rate refers to the nominal/effective exchange rate adjusted for changes in relative prices in the countries of the currencies under consideration. For example, if the nominal value of a currency falls by 15% and domestic prices are 5% more than the prices of its competitors, then the real exchange rate will change by 10%.

Exchange rate in constant domestic prices yields the price of domestic exports in foreign currency. Therefore, change in exchange rate in an inflation free state affects the price of domestic exports in foreign currency, which directly affects demand for domestic exports in international markets. Similarly exchange rate in constant foreign currency prices affects the prices of imports, and hence, the demand for imports in the domestic market.

Flow theory of exchange rate differs from portfolio theory of exchange rate. Flow theory of exchange rate deals with the effects of changes in exchange rate on the pattern of international flows of goods and services, which reflect the consequences of price effect of movements of exchange rate on demand for traded goods. The portfolio theory, as against flow theory of exchange rate, deals with the conditions required to be satisfied for assets/wealth holders’ equilibrium state of portfolio. Monetary theory of exchange rate is one of the variants of this approach.

Fluctuations of exchange rate exercise decisive influence on domestic output, employment and prices through changes in quantities, prices of exports and imports, diversity of analytical approaches notwithstanding. It is obvious that quantities, prices and exchange rate are intricately intertwined with each other. This chapter attempts to evaluate the role of these three factors on export earnings of India.
The nominal exchange rate of Indian rupee refers to the units of rupees to be paid per US dollar. As against this, the effective rate of Indian rupee is related to the basket of six and ten foreign currencies.

This chapter is a modest attempt to analyze the changes in quantity and prices of exports as the sources of growth of export earnings. Besides, relation between prices and exchange rate has also been examined in the study.

6.3 Data Sources

This study covers a period of 25 years from 1985 to 2009. The base year for index of export price, export quantity and exchange rate is 1991. These indexes are in rupee terms. The required data of all three series were available only till 2009 for the same base year 1991. Hence, we did not include year 2010, and 2011. The data needs are directly related to the objectives of the study of any research investigation. The objectives of this study highlight the need for data relating to exports price, exports quantity and exchange rate. These data are largely available from secondary sources such as RBI Bulletin, Economic Survey and Internet etc. Publications of CMIE and CSO are two other important sources of data. CMIE’s data base Prowess is also a rich source. It reports detailed data of more than 20,000 Indian companies. All these sources, including department of commercial intelligence, may be explored for trade related data.

6.4 Methods and Models

The study comprises two models: (i) Decomposition Model for decoupling the impact of each variable on export earnings and (ii) Regression model for analyzing the growth of export earnings, changes in (a) export price, (b) export quantity and (c) nominal exchange rate.

6.5 Empirical Analysis

Free international trade has been and still continues to be considered as an engine of growth of the market economies. But all economies of the world were not market economies till recently. In fact, more than 50 countries, including India, adopted the policy of liberalization, privatization and globalization in 1990-91. Many developing countries have adopted these policies much before India. The movement
towards globalization gathered momentum after the disintegration of USSR and emergence of several new countries, which were part of erstwhile USSR. Besides, the member countries of COMECON also opted for market based capitalistic economic structure by demolishing the socialist framework of management of economic affairs. India opted for New Economic Policy in 1991 under which triple processes of privatization, liberalization and globalization were promoted. Wide ranging economic reforms were introduced to dismantle the license, permit and control raj. This heralded the process of opening up of the economy (For detailed discussion of competing theories evolved to explain the policy shift of India, See, Prakash, Shri, 2005).

6.5.1 Policy Shift and Opening Up of Indian Economy

An open economy is characterized by several traits; following are important among these characteristics of market oriented capitalist economies: (i) Private enterprise and capital are allowed to play dominant role in the economy, (ii) Imports are allowed according to dictates of the market with minimum regulation and reasonable tariffs. Consequently, substitution of imports by domestic production cannot be a part of strategy of growth and policy; (iii) Export led growth strategy is followed to pay for imports; (iv) FDI and FII are allowed to enter into most of the sectors of the economy, though there may still be certain restrictions to protect the national interest. Globalization generally leads to certain degree of integration of commodity, services and capital markets.

There are several layers of openness in market oriented economies, especially the erstwhile centrally planned socialist economies and the planned developing mixed economies. Several of these economies are still partially closed and closure is applicable more to international trade than domestic economic and business activities.

Indian economy was largely closed till 1989-90. It pursued the growth strategy of substitution of imports by domestic production. Imports were largely restricted and exports were encouraged to finance essential imports. International trade as a whole was, however, assigned a low priority. The following table portrays the status of trade in Indian economy from 1951 to 2011-12.
Table 6.1 India’s Foreign Trade (Rs. Crore)

<table>
<thead>
<tr>
<th>Year</th>
<th>GNP</th>
<th>Exports</th>
<th>% of GDP</th>
<th>Import</th>
<th>% of GDP</th>
<th>Trade</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>9995</td>
<td>606</td>
<td>6.063</td>
<td>608</td>
<td>6.083</td>
<td>1214</td>
<td>12.146</td>
</tr>
<tr>
<td>1961</td>
<td>16977</td>
<td>642</td>
<td>3.782</td>
<td>1122</td>
<td>6.609</td>
<td>1764</td>
<td>10.391</td>
</tr>
<tr>
<td>1971</td>
<td>44098</td>
<td>1535</td>
<td>3.481</td>
<td>1634</td>
<td>3.705</td>
<td>3169</td>
<td>7.186</td>
</tr>
<tr>
<td>2001</td>
<td>1969248</td>
<td>209018</td>
<td>10.614</td>
<td>245200</td>
<td>12.451</td>
<td>454218</td>
<td>23.066</td>
</tr>
<tr>
<td>2011</td>
<td>7078512</td>
<td>1142649</td>
<td>16.143</td>
<td>1668467</td>
<td>23.783</td>
<td>2826116</td>
<td>39.925</td>
</tr>
<tr>
<td>2012</td>
<td>8198278</td>
<td>1024707*</td>
<td>12.499</td>
<td>1651240</td>
<td>20.141</td>
<td>2675947</td>
<td>32.640</td>
</tr>
</tbody>
</table>


A perusal of the above table reveals that exports, imports, and hence trade, grew from one to another decade consistently.

Trade accounted for 12.14 % of GDP in 1951, 10.39 % in 1961; it declined to 7.2% of GDP in 1971. Trade as a proportion of GDP increased consistently after 1971; it rose to 14.4% in 1981 and remained stable at that level in 1991. But rose sharply to 23% in 2001 and finally it reached as high a level as 32.6% of GDP in 2012. This is a threefold rise. It also highlights the degree of openness of Indian economy.

Liberalization of imports has been the major plank of globalization of Indian economy. Several reforms were introduced in trade sector to achieve the goal of liberalization of imports. Consequently, imports increased consistently over the years; imports accounted for 6.1% GDP in 1951 and it constitutes 20.14 % of GDP in 2012. This represents more than triple rise in imports as a proportion of GDP. Imports have thus increased much more rapidly than exports in the liberalized and globalized Indian economy.

Imports substitution strategy has been replaced by export led growth strategy. Consequently, both exports and imports account for much greater proportion of GDP than ever before. Exports as a proportion of GDP increased from 6% in 1951 to 12.5% in 2012. This represents slightly more than double the value in 1951. Therefore, export earnings are an important source to finance imports and it is an instrument of promotion of growth of the Indian economy. But, export earnings depend basically upon three pivotal factors; (i) quantity, (ii) price(s) in international...
markets, and (iii) exchange rate in the currency market. Each of three components affects export earning both directly and indirectly. Whereas, quantity and price are inversely related in demand function, the same variables are directly related in supply function. The dollar prices are also directly related to the rate of exchange of rupee in terms of US dollar. Greater the dollar exchange rate, greater is the dollar price of Indian exports and lower the dollar exchange rate, lower is the dollar price of Indian exports. In view of the above, it is important to know, a quantitative dimensions of impact of change in price or quantity or exchange rate or two of them or all of them at the same time.

6.5.2 Further Data Analysis

Results are analyzed sequentially.

6.5.2.1 Growth of Export Earnings in Indian Rupees

The OLS estimates of growth curve of export earnings are reported below:

\[ \log Y_t = 3.96 + 0.078T, \quad R^2 = 0.988, \quad F = 2017.95, \quad F^* = 6.53E-24 \]

\[ t = (153.32) (44.92) \]

The function fits the data well on all counts. The function explains almost 99% of temporal growth of export earnings; export earnings have been increasing at a statistically significant annual compound rate of 7.8%.

6.5.2.2 Growth of Export Earnings in US Dollars

\[ \log EE_d = 3.85 + 0.050T, \quad R^2 = 0.96, \quad F = 632.1, \quad F^* = 3.13E-18 \]

\[ t = (128.16) (0.0020) \]

6.5.2.3 Growth of Export Price in US Dollar

\[ \log P_d = 2.13 + 0.041T, \quad R^2 = 0.21, \quad F = 6.46, \quad F^* = 0.018 \]

\[ t = (88.63) (2.54) \]

6.5.2.4 Temporal Change in Export Price

The following are OLS estimates of the growth curve fitted to the data of export prices during the period covered by the study:

\[ \log P_t = 2.249 + 0.031T, \quad R^2 = 0.933, \quad F = 322.16, \quad F^* = 5.04 \]

\[ t = (86.4) (17.94) \]
The function fits the data well as it explains 93.3 per cent of total changes in export prices over a period of 25 years. The annual compound rate of increase in export prices is 3.1 per cent which is statistically significant.

6.5.2.5 Growth of Export Quantity

The OLS estimate of growth curve of export quantity is as follows:

$$\log Q_t = 1.71 + 0.046T, \ R^2 = 0.99, \ F=2827.4, \ F^* = 1.4E-25$$

$$t= (131.4) \ (53.1)$$

This function also fits the data well and it explains 99 per cent of total change in export quantity during a period of 25 years. Besides, the export quantity has been rising at a statistically significant rate of 4.6 per cent.

6.5.2.6 Growth of Nominal Exchange Rate

The following is the estimated growth curve of nominal exchange rate:

$$\log R_t = 2.46 - 0.030T, \ R^2 = 0.87, \ F= 156.34, \ F^* = 9.69E-12$$

$$t= (67.25) \ (-12.5)$$

The function, like three other growth curves, fits the data well though it explains a bit lower proportion of total change in nominal exchange rate. In fact, the function explains 87 per cent of total change in nominal exchange rate.

Estimates of these growth curves have furnished the growth rates required for the evaluation of the validity of the decomposition model.

6.5.2.7 Evaluation of Validity of Decomposition Model for Entire Period

Validation of equation 9, representing decomposition model, requires substitution of estimated growth rates. Substitution of estimated growth rates in equation 9 yields the following relation:

$$G_{yt} = 0.078 = 0.031 + 0.046 + 0.00143 = 0.07843$$

Thus, right hand side exceeds left hand side only by an amount of 0.00043 which is negligible. The above relation shows that the decomposition model is almost exactly satisfied by empirical estimates of growth rates of export price, export quantity, and interaction effect of two growth rates for the study period taken as a whole.
Export earnings have been increasing at an annual compound rate of growth, which is higher than the growth of GDP during the same period. This inference is deducible from the rising share of exports in GDP. Interestingly, growth of export quantity has dominated increase in export prices, since the contribution of export quantity is 1.48 times more than that of rising prices during the period of study. However, the contribution of rising prices to the growth of export earnings has not been negligible or inconsequential. These results may probably be taken to highlight the need for increased factor productivity in production for reducing the cost, which will provide competitive edge in the export market.

The question is now whether the model is also satisfied. For answering the question, year on year growth rates are analyzed to evaluate year wise validity of the decomposition model.

**6.5.2.8 Decomposition Model of Dollar Prices and Exchange Rate**

The OLS estimates of growth rates of dollar prices and exchange rate are substituted in the model outlined earlier which yield the following result:

\[ 0.078 = 0.050 + 0.030 = 0.08 \]

As 0.078~ towards 0.08 on rounding up, the decomposition model stands validated on empirical evidence to support it. Thus, almost 38 percent change in rupee prices of Indian exports are accounted by changes in exchange rate. This highlights the importance of stability of the dollar price of Indian rupee in international currency market. This has a direct relevance for exchange rate policy and measures of stabilization of the value of rupee in currency market by operations of RBI in the current scenario when Indian rupee has depreciated a great deal.

**6.5.2.9 Decomposition Model of Export Earnings and Exchange Rate**

Substitution of OLS estimates of growth rates of exchange earnings in rupee and dollar terms and exchange rate in the decomposition model already outlined in the text furnishes the following relation:

\[ 0.0314 = (0.00412 + 0.0308) = 0.03492 \]

As the difference between the actual and estimated earnings is 0.00352, which is negligible, the empirical estimate of this model validates it.
The empirical results have lent support to the validity of all three models of decomposition which have been developed in the study when the entire period of study is treated as one composite whole.

The question is whether the model is valid for year on year changes in the values of core variables of the model. This question is taken up now.

6.5.2.10 Evaluation of Validity of the Model for year to year

For testing the validity of decomposition model on year on year basis, year wise growth rates from year on year shifting base were calculated for all export earning, prices and quantities of Indian exports. These growth rates and their differentials are shown in the table given below.

Table 6.2 Errors of Estimation of Year on Year Decomposition Model of Export Earnings

<table>
<thead>
<tr>
<th>Rate of change of Yt</th>
<th>Ryt-(RPt+RQt)=0</th>
<th>Ryt-(RPt+RQt)*100</th>
</tr>
</thead>
<tbody>
<tr>
<td>RYt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.072292234</td>
<td>-0.000457737</td>
<td>-0.045773721</td>
</tr>
<tr>
<td>0.142909592</td>
<td>0.00443702</td>
<td>0.443702012</td>
</tr>
<tr>
<td>0.258753614</td>
<td>0.013884744</td>
<td>1.388474413</td>
</tr>
<tr>
<td>0.290800051</td>
<td>0.016239612</td>
<td>1.623961235</td>
</tr>
<tr>
<td>0.367042309</td>
<td>0.028223991</td>
<td>2.82239915</td>
</tr>
<tr>
<td>0.176983151</td>
<td>0.006495866</td>
<td>0.649586593</td>
</tr>
<tr>
<td>0.352901422</td>
<td>0.01868288</td>
<td>1.86827969</td>
</tr>
<tr>
<td>0.219045889</td>
<td>0.009661658</td>
<td>0.966165821</td>
</tr>
<tr>
<td>0.299191626</td>
<td>0.01934908</td>
<td>1.934908004</td>
</tr>
<tr>
<td>0.185273329</td>
<td>0.005886953</td>
<td>0.588695286</td>
</tr>
<tr>
<td>0.286414108</td>
<td>-0.00603446</td>
<td>-0.60634587</td>
</tr>
<tr>
<td>0.117194625</td>
<td>0.00304546</td>
<td>0.304054556</td>
</tr>
<tr>
<td>0.094961159</td>
<td>-0.010470568</td>
<td>-1.047056831</td>
</tr>
<tr>
<td>0.074189085</td>
<td>0.001325313</td>
<td>0.132531334</td>
</tr>
<tr>
<td>0.141743946</td>
<td>-0.00182846</td>
<td>-0.182845962</td>
</tr>
<tr>
<td>0.275819279</td>
<td>0.007708931</td>
<td>0.77089312</td>
</tr>
<tr>
<td>0.026757249</td>
<td>-0.000375641</td>
<td>-0.037564057</td>
</tr>
<tr>
<td>0.220640069</td>
<td>0.000563091</td>
<td>0.056309121</td>
</tr>
<tr>
<td>0.149841066</td>
<td>0.005074642</td>
<td>0.507464202</td>
</tr>
<tr>
<td>0.279421339</td>
<td>0.015533749</td>
<td>1.553374858</td>
</tr>
<tr>
<td>0.216012149</td>
<td>0.010408499</td>
<td>1.040849895</td>
</tr>
<tr>
<td>0.252752959</td>
<td>0.012902035</td>
<td>1.290203489</td>
</tr>
<tr>
<td>0.147058566</td>
<td>0.004631613</td>
<td>0.463161253</td>
</tr>
<tr>
<td>0.28190448</td>
<td>0.016342443</td>
<td>1.634244268</td>
</tr>
</tbody>
</table>
First column of the above table depicts the year on year growth rates of export earnings. Second column furnishes the estimates of year on year differences between the growth rates of export earnings and the sum of the growth rates of quantities and prices. These are the absolute values of the errors of estimation of the model from year on year growth rates of the three variables involved in the model.

The mean of absolute errors is 0.00753, which is quite low. The coefficient of variation is also as low as 83.67%. Absolute errors vary from -0.01047 to 0.02822 range, the value of which is as low as 0.03869. The median of the absolute errors also has a low value of 0.00619. The mean value of errors is greater than the value of the median; it implies that the errors are not normally distributed. The coefficients of kurtosis and skewness are also low, having values of 0.01726 and 0.19475; the positive value of the coefficient of skewness means that the distribution of errors is positively skewed. The coefficient of Kurtosis depict that more errors are concentrated on positive side of the distribution. Observed errors are concentrated more on positive than on negative side of the distribution. These values of the coefficients of skewness and kurtosis make the representativeness of mean doubtful. The absolute errors, however, lend empirical credence to the validity of the year on year decomposition model. A still better picture may probably emerge from the analysis of percentage rather than absolute magnitudes of errors of estimation.

The fact that the errors of estimation are not distributed normally is highlighted by the following graph.

Figure 6.1 Graphical Presentation of Absolute Errors and Percentage Errors
The above graph highlights the fact that (i) distribution of absolute errors seem to approximate random distribution; (ii) the percentage errors are approximated by a straight line; and (iii) in both cases distribution of errors emerges as not normal.

The mean of percentage errors is 0.7527 and the coefficient of variation is 83.6 %. The absolute errors vary in a narrow range of 3.86946 from -1.04706 to 2.8224. Median has a value of 0.61914 which is much lower than the mean. Besides, the coefficients of Kurtosis and Skewed-ness are also as low as 0.01726 and 0.19475. All these features of absolute errors of estimation of decomposition model highlight that the errors of estimation are low but their distribution is positively skewed with more observations being concentrated on positive rather than negative side of the distribution. Thus, both absolute and percentage errors of year on year decomposition model are in sync with each other. This lends empirical credence to show the decomposition model to be valid.

6.6 Findings and Conclusions

The following are the main findings and conclusions of the study.

1. Rate of exchange of Indian rupee in currency market has, however, declined at statistically significant rate, though the rise in price and quantity has neutralized a part of negative effect of decline in exchange rate on export earnings both in rupee and dollar terms.

2. Price effect of negative exchange rate in currency market requires policy intervention for the stabilization and containment of rate fluctuations in a narrow band. This relates to the choice of intermediate/middle policy option.

3. Growth curves of export earnings in Indian rupee and US dollars have grown significantly during 25 years covered by the study. Export Quantity has also grown significantly. Rupee and dollar prices of Indian exports have significantly and positively changed over the years.

4. Both the Decomposition models of exchange earnings are validated by empirical evidence. Decomposition model of price is also validated empirically.