CHAPTER 4

THE RELATIONSHIP BETWEEN IMPORTS, EXPORTS AND GROWTH

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4.1 INTRODUCTION

The links between international trade and economic growth have interested economists for a long time. The review of literature on theories of economic development revealed that there has been a debate on the role of trade and on the choice of trade strategy for the development process of developing countries. This debate has been between trade pessimists and trade proponents. The former prescribes Import substitution strategy whereas the latter advocates export promotion strategy as a means to growth in developing countries. These theories mainly concentrate their effort to explain the causes, process and limits of development subject to the experience of industrial nation rather than structural transformation of socio-economic system through which an economy has to develop. Moreover theories are concerned about the operations of market and state but not about how market develops and how states change the structure of the economy. Trade theories are isolated theories of development economies as it apparently appears in the literature. The most common and unfortunate phenomena in the trade theories from the past now is that it merely treats external sector has an export sector only.

A trade development model can be composed of namely Import-led Growth and Growth-led Export. Import sector shall play prominent role in the two stages of economic development namely traditional economy and developing stage. The process of development in any country begins at the stage of traditional economy. The economy is purely an agrarian economy characterised by common economic and non-economic characteristics of under development such as low productivity, high rate of population growth, limited role of external trade, low level of savings, dependency on primary products, anti developmental socio-politico-institutional geostructure, poverty, inequality

etc. Unbalanced developmental activities slowly and gradually crop up in same growth centers in the economy and the same process pushes the economy to developing stage. But this process will take very long period in the absence of appropriate external developmental induces. If the traditional economy effectively grabbed the developmental conducive forces from external trade, aid, investment and technology transfer, it can achieve faster rate of development in all the sectors of the economy. Import of sectoral inputs from developed countries helps to remove the constraints of development and to bring high forward and backward linkages between different sectors, regions and other macro-developmental environment created at the stage of traditional economy. It is easier to achieve higher rate of economic development in developing stage and to lift up the economy to developed stage. In addition to improvement income, output and employment, it typically involves radical changes in institution, social and administrative structure etc.

As quoted by David Wall[1], at the United Nations conference on Trade and Development in 1964 the policy objective prescribed for the less developed countries was an increase in the rate of growth of import capacity. The justification was that the outcome of a less-developed country's attempts to accelerate its rate of economic growth depends on the rate of investment in fixed capital. Moreover there is an assumption that most less-developed countries are unable to produce most of the machinery and equipment required by the investment process, the success of a growth programme is dependent upon the import of such goods. The ability to import such goods is obviously subject to the constraint of the availability of adequate supplies of foreign exchange. If domestic saving falls short of investment requirements, this only increases the potential constraining role of a shortage of foreign exchange, and foreign investment in the form of either a balance-of-payments deficit or aid becomes more important. Second, whatever the level of domestic saving, foreign exchange shortages can always frustrate the achievement of the optimum composition of investment. UNCTAD held the view that acceleration in the rate of growth of all developing countries requires additional investment; and the import content of this investment is normally much higher than that of income as a whole. This view of the development process meant that UNCTAD saw as the main obstacles to development the various constraints on the growth of the import capacity of the less-developed countries. Its attention was focused on the constraints

preventing the expansion of the export income of the less-developed countries, especially the trade policies of the developed countries. The emphasis on imports as a crucial factor in the growth process is embodied in the Mosak model; this model equates import capacity with imports on a one-for one basis. The model assumes that any relationship that it indicates as existing between imports and growth also exists between import capacity and growth, a view adhered by UNCTAD.

The Mosak model assumes growth to be primarily a process of fixed capital formation. The rate of gross domestic fixed capital formation is assumed to be function of, only, imports of investment goods. The proportion of import capacity which is devoted to imports of investment goods is a policy variable, depending on how far a government is prepared to allow increases in consumer demand to be satisfied with increases in consumer-goods imports. If import capacity is increasing, the policy decision involves a trade-off at the margin between increased current consumption and faster growth.

The mechanism by which imports can lead to growth can be explained by following three theoretical operations namely industrialisation, technological development and capital accumulation. [2]

4.1.1 Industrialisation

The main bottle necks faced by traditional or developing stage economy to industrialise are, lack of capital goods and other machinery, scarce skill labour and entrepreneurship ability, low productivity of factors, under developed agriculture sector, scanty technical know how, lack of infrastructural facility, institutional rigidity etc. Thus development-curbing forces have an upper hand over developmental induced forces. The economy has to seize the conducive forces from import of sectoral inputs to extract the constraint of industrialisation, external flow of goods, aid, technology and technical services deter developmental curbing forces and stimulated process of industrialisation in the economy. Slowly and gradually some growth centers are developed with external force stimulation owing to operation of domestic structure. By grabbing the developmental stimulant from import of sectoral inputs, basic heavy and infrastructural

industries develop with dynamic structural linkage to industrial, agriculture and infrastructure service sectors.

Once the stimulant industrial activities have a tendency towards growth, dynamic linkages are set up among various sectors as well as regions and other developmental variables in multidirectional such as forward, backward, inter firm and industrial counter ways in different phases.

4.1.2 Technological Development

Since there is a large stock of knowledge in developed economies, developing economies can make use of this knowledge to extract the constraints of lack of qualified scientists engineers, technicians, entrepreneurs, inability to invest huge amount on R and D and to develop the indigenous technical capability. Inward flow of technology in the form of investment add aid, removes all constraints and develop the diversified dynamic industrial sector, mechanised and commercialised agriculture and wide ranged infrastructure sector. Technological flow contributes higher induced income, growth induced employment, efficient allocation of resources, improvement in human capital etc. Import of technical input also promotes links between trade and long run growth in the economy. Import of technical inputs can be divided into two categories namely input and output technical knowledge. Import of these techniques contains technical process and services.

Import of input of technical knowledge comprises all the original scientific tools and knowledge which can empower the economy to produce capital goods and develop new techniques, input of services and diffusion of techniques process methods within its own production structure with original technical knowledge. But output technique involves end-use product and services, which directly contribute output in the economy such as import of tractors, textile machinery, airplanes and of service scientists, engineers. Thus the flow of input technique provides basic capacity of manufacturing capital input technical method and technical service input is inevitable for the development of various sectors in the economy. Where as in case of flow of output technique economy has to rely continuously on imported knowledge owing to its

contribution of end-use product and service and not the capacity of producing those. It is necessary that economy have to import input technical knowledge rather than output technical knowledge for augmenting of technological capability in the developing stage of economy. Of course import of output technique can be employed only to adjust with short run gap created by demand forces and by the span of time to absorb, and the adoption of input technical knowledge in traditional stage economy.

4.1.3 Capital Accumulation

Capital accumulation is the vital factor for the economic development of any country. Capital investment improves the quality and quantity of the existing physical and human resources and promotes rapid economic development by developing dynamic industrial and non-industrial sectors. There are two sources of financing capital in any economy. They are domestic and foreign saving. Both these sources of finance can be employed for accelerating capital accumulation in the economy. The principal constraints for accelerating capital formation generally affiliate with the four kinds of economic gaps which emerge at the beginning process of economic development of traditional stage and developing stage economy viz., Import gap, Investment gap, Government expenditure gap, and to Technical gap. To realize higher economic development such gaps like the above once should be filled up through the pursuing of potential investment, potential demand and supply forces and potential economic growth in any economy. Hence traditional and developing stage economies have to opt for foreign aid and investment, import of sectoral inputs and other source of external finance.

Thus, Import sector as a leading sector pursues the higher, self-sustainable, self developed all round development in the traditional and developing stage economy thorough import-led growth mechanism.

4.1.4 The Chapter Plan

The chapter is broadly divided in the following sections: Section 1. Introduction. Section 2 Empirical Survey. Section 3 Data. Section 4 deals with the Literature Survey on the Methodology. Section 5 provides the Econometric Methodology applied. In Section

6, we examine Causal Relationship Between Exports and Imports. Section 7 extends the study of the nexus between Exports. Imports and GNP_{MP} Finally section 8 compiles the findings and compares with other empirical work.

4.2 EMPIRICAL WORK

David Wall[3] in his paper examines the UNCTAD assumption that a simple relationship exists between import capacity and growth. It also investigates into the assumption that imports play the dominant role in the growth process. UNCTAD offers support for its belief in the strength of the relationship in the results of a rank correlation test in which rates of growth of Gross Domestic Product (GDP) were correlated with rates of growth of import capacity (Import capacity was calculated according to its definition in UNCTAD document TD/B/C.3/4/Add 1: a figure for net current foreign exchange receipts was arrived at by summing receipts from merchandize exports, net invisible payments, and "net private and official capital flows of an autonomous character."), for the period 1953-63 for 20 countries. The value of Spearman's rank correlation coefficient for this test was 0.7 with a standard error of 0.23. This apparent corroboration of the UNCTAD position is, however, spurious. It results from correlating the rate of growth of a variable with an often large component of that variable. The relevant rank correlation for testing the UNCTAD view is that between the rates of growth of GDP and import capacity as a share of GDP; in this case the value of Spearman's rank correlation coefficient is 0.26, which, with a standard error of 0.22. reveals no relationship at all. In other words, the empirical evidence does not support the UNCTAD view that countries that achieve reasonable rate of growth of GDP tends to be those with relatively high ratios of import capacity to GDP. Further applying two regression equations to time series for 20 countries for the period 1953-63; i.e. GDP regressed on import capacity and the other equation was log of GDP regressed on log of import capacity. In only seven out of the 20 cases, however, was a reasonable R^2 obtained with significant coefficients. Furthermore, of the seven countries for which good fits were obtained, six were receivers of substantial quantities of aid over the period covered. In the test the import series used were those for raw materials and semi-finished industrial inputs and machinery. It was possible to find broken-down import data for only twelve countries, and then only for eight years. The GDP series were

adjusted by fitting a trend to the agricultural output series and substituting the trend value for the actual value in the GDP figures for each year. Four regression equations were fitted to the data pooled. (i)Adjusted GDP was regressed on current growth imports. (ii) Adjusted GDP was regressed on current growth imports allowed for the possibility of a one-year lag. (iii) Third equation attempted to relate current GDP to current imports of raw materials and industrial inputs and imports of machinery lagged one year. (iv) The fourth equation sought to explain changes in GDP by changes in "growth" imports. The results for the four equation shows that only four cases were good fits with significant positive coefficients obtained. Therefore it is difficult to draw any general conclusion as claimed by UNCTAD.

Wan-Wen Chu[4] his paper investigates the Export-led Growth and Import Dependence in the case of Taiwan for the period 1969-1981. Many of the studies using cross-country data and adopting the aggregate growth rate as the indicator, find that an export promotion scheme performs better than an import-substitution one. Recently, doubt has been expressed about export-promotion policies, especially on the demand side. At issue is the question of whether markets in developed countries are large enough to allow other less developed countries (LDCs) to follow the example of the few successful newly developed countries (NICs), or whether trade barriers will impede this development. The question is the supply side issue of whether the NICs can sustain their growth in the future. The method employed is Leontief input-output framework. It is found that the level of import content in exports increased during the course of Taiwan's export-led growth. On a sectoral level, the level of import dependence also increased for all but some leading export sectors. Linkage effects of exports are not large enough to offset the price effect and the effect of the spreading of import-dependent technology to other sectors. The decline in export's domestic content has been more than offset by the increase in quality of exports, so that Taiwan's income has been growing.

This decline in the domestic content slowed from 1976 to 1981, but so did the growth in export volume, which reflects the effects of protectionism and the difficulty of finding enough new exportables.

Hadi Salehi Esfahani [5] in the article titled Exports, Imports and economic growth in semi-industrialised countries, makes a study of a sample of 31 semi-industrialised and 'marginally' semi-industrialised countries for the periods 1960-1973, 1973-1981, and 1980-1986. In evaluating the role of export expansion in the growth performance of semi-industrialised countries, the first and foremost purpose of the exports, the provision of foreign exchange for imports has been neglected and too much emphasis has been placed on the externality effects of competing in world markets. Although the latter effect may carry some weight of their own, but the major contribution of exports to the GDP growth rate is to relieve the import shortage that many SICs confront. Once the import supply effect of exports has been taken into account, there doesn't seem to be any significant externality effect left. Moreover, contrary to a number of previous studies, increases in the share of manufactured goods among exports don't seem to help the export externality effect.

Gross distortions in the factor and product markets of the manufacturing sector in many SICs may indeed have cancelled out any external economies of participation in world markets.

In the previous studies of export-GDP relationship in SICs have found a lower export 'externality' effect for the 1973-1981 period as compared to the 1960-1973 period. This change has been attributed to 'unfavourable' world environment since 1973. However, for 1980's, when the world environment was even more unfavourable for exports than the 1970s, we find that the coefficient of export expansion in the GDP growth equation used in those studies has increased. His analysis suggests that the source of these changes must be traced back to the availability of foreign exchange for SICs during each period. In the 1970s, the shortage of foreign exchange for SICs was reduced as a result of the increased supply of petro-dollars following the oil price hikes, while in the 1980s, the world recession and the debt crisis tightened the external constraint for most of the SICs. In his study the relative import shortage of each country is defined as the discrepancy between the actual and 'expected import-GDP ratio of that country. To specify the expected import-GDP ratio, ran a cross-country regression of import-GDP ratio on logs of GDP percapita, population area, and squares of these logs. These variables showed highly negative effects on the import-GDP ratio. Further the

simultaneous equations model of GDP, export and import growth rates developed in the study shows that exports donot appear to have had much direct externality effect on the GDP of SICs, export promotion policies in these countries can be quite valuable in supplying foreign exchange, which relieves import shortages and permits output expansion. Although in this role exports may temporarily replaced by foreign assistance, long term growth of any developing country ultimately depends on the steady and strong expansion of its export sector.

Jong-Wha Lee[6] in his paper examines the role of capital goods imports on economic growth. Using an endogenous growth framework of a two-sector open economy where a 'core' capital goods sector, which is produced by combining foreign and domestic capital goods, is an 'engine of growth', the model points out that lower income countries with relatively smaller capital stocks have a comparative advantage in the consumption goods and that they can grow faster by importing relatively cheaper capital goods from higher income countries. The theoretical predictions accord with the regression results using cross-country data for the period of 1960-85. The ratio of imported to domestic capital goods in the investment sector has a significant positive effect on the per capita income growth rates across countries, in particular, in developing countries. Thus, it is implied that imported capital goods have a higher productivity than domestically produced capital goods. The growth rate is higher in a country that uses relatively more imported capital goods for the production of capital stock than other countries a the same stage of economic development.

The paper highlights the importance of the composition of investment in addition to the size of total investment in determining economic growth. While the importance of investment in economic growth has always been emphasized in the literature, the issue of how to build the investment sector has been somewhat neglected. This paper shows that the ratio of foreign to domestic components of investment is an important factor in economic growth. More use of imported inputs, which are relatively cheaper and more efficient than domestic capital goods, increase efficiency of capital accumulation and thereby growth rates of income. Therefore, any trade distortions that restrict the importation of capital goods hurt the economy in the long run

Rati Ram[7] in his paper he examines the relationship between imports and economic growth in 48 LDCs for the period 1960-61 to 1984-85. The main objective of the study is to examine the nexus between trade regimes and economic growth through an assessment of the import-growth connection instead of the usual practice of considering the effect of export on growth. An investigation of the import-growth linkage could provide some clue to the mechanism through which exports generate the observed positive effect on growth.

The main conclusion is that evidence from both cross-section and time-series data indicates positive impact of imports on growth, thus supporting the view that liberal trade policy probably helps growth, and also indicating that such exports provide for import-growth nexus seem to vary greatly across countries, there appear important differences between the low-income and the middle-income sub-groups, especially in the post-1973 era. In particular, cross-section evidence indicates no statistically significant favourable effect of imports on growth during 1974-85 in the low-income subgroup despite a sizeable and significant effect over the earlier period 1960-73. This pattern is the opposite of that observed for exports whose effect on growth in low-income LDCs was small over the 1960s but seems to have shown a large increase during the 1970s.

4.3 THE DATA

In the light of the above mentioned theoretical and empirical survey explaining the possible features linking exports, imports and Growth. We endeavor to an attempt to study the relationship or nexus between exports, imports and Economic growth (GNP) with reference to India. The data on exports and imports at current price covers following periodisation 1949-50 to 1995-96, 1960-61 to 1995-96, 1967-68 to 1995-96, 1970-71 to 1995-96 and 1980-81 to 1995-96. Whereas in real terms (base: 1978-79 = 100) the periodisation refers to 1960-61 to 1995-96, 1967-68 to 1995-96, 1970-71 to 1995-96 and 1980-81 to 1995-96. The data on GNP_{MP} at current price and in real terms (base: 1978-79 = 100) covers the following break up of period, 1960-61 to 1994-95, 1967-68 to 1994-95, 1970-71 to 1994-95 and 1980-81 to 1994-95.

4.4 THE LITERATURE SURVEY ON THE METHODOLOGY OF INTEGRATION, CO-INTEGRATION, ERROR CORRECTION MECHANISM

4.4.1 Test of Stationary

The unit root hypothesis has generated a considerable amount of interest among economists and statisticians in recent times.[8] Before the popularizations of the unit root theory, economists working with macroeconomic time-series believed that 'trends' and 'cycles' could be viewed as separate processes. The long-run growth theory is supposed to explain the deterministic trend in most of the macro variables like output, capital stock, l labour, etc., while business cycle theories attempt to explain short-term fluctuations around that trend (Stock and Watson 1988). The 'stochastic trend' concept has changed this compartmentalization significantly. It tries to show that 'short-term fluctuations' should not be termed so, since these fluctuations are not transitory. The unit root hypothesis tests whether the particular time-series variable has a univariate time structure (or univariate vector autoregressive, UVAR), which has a stochastic trend (or variable trend).

Nelson and Plosser[9] were the first to systematically study the time-series properties of USA macroeconomic data, which were later, reaffirmed by Perron[10]. However, Perron found the above conclusion spurious if one allows for exogenous shocks to the deterministic trend function-like the great depression of 1929 and oil price shock of 1973-to be treated as' aberrant' or 'outliers'. Before we proceed further, let us stat a very brief outline of the essentials.

A time-series random variable is stationary if its distribution does not depend on time. It is called weakly stationary if its mean and variance are constant over time. Also, normally, we assume that the series, which is stationary, has finite variances and covariances. Usually, most of the macroeconomic time-series works assume stationeries of mean and variance (normally, in natural logarithmic values as the level values are unlikely to be stationary). However, radical changes in mean and variance of major

variables lead to improved statistical analysis, which finally leads to the unit root tests for UVAR processes[11].

According to Engle and Granger[12], an economic time series has two types of memories, long and short. A short memory system does not carry the exogenous shocks too far, while a long memory will carry noticeable effects of the old shock for a considerable period of time. The simplest textbook-style example is as follows:

Let x_t (possibly, in logarithm) be UVAR of order 1: or in short, it is AR (1). Then x_t is generated by (called, data generating process of a random variable or DGP):

$$x_t = \alpha x_{t-1} + u_t$$

With α being less than one in modulus value, and where u_t is a white noise term with zero mean and zero auto covariance. The equation above solves to give a DGP: $x_t = \Sigma\alpha^J u_{t-1}$. This is a concrete example of a short memory where the random exogenous shocks through u_t die out over time. This is also an example of a deterministic trend since fluctuations eventually peter out around a trend, if it exists.

The situation radically changes to long memory as also to stochastic (or variable) trend type scenario, if $\alpha = 1$. This is because in this case, $x_t = x_{t-1} + u_t$, which is known as random walk. In such a case, a variable can have a stochastic trend if it has a random walk component, since this AR (1) process does not return to a stationary trend value once a random shock occurs in the system. However, interestingly, $x_t - x_{t-1} = z_t$ (say) is a short memory, which is the original process in the first difference form. This denoted as x_t is distributed over as I (1) or integrated of order one. This means: $x_t = \Sigma z_{t-1}$, which is called an integration (or sum). In general, if a UVAR variable is differenced 'd' times to become short memory or stationary, it is said to be I (d). Thus, it follows that an AR (1) stationary series is I (0) since it needs differencing zero time. It also follows logically that (i) an I (0) series will return to its mean value often whereas an I (1) series will almost never return to any particular value (like mean).

Most of the macroeconomic variables may show I(1) processes, but that does not preclude the possibility that some of the series are I(2), so that their growth rates are stochastic trends (Stock and Watson 1988). Now, in the presence of unit root, the UVAR series becomes a random walk having a variance, which tends to infinity with time t. Thus, the standard OLS theory fails to test the unit root hypothesis in a regression of x_t on x_{t-1}, since the test statistic tends to follow a non-standard distribution. Here comes the Dickey-Fuller (DF) test for unit root, which gives tables for non-standard distributions. Since the DF test assumes first order autoregressive schemes only, Augmented Dickey-Fuller (ADF) test is used for auto regression of the higher order as well as for ARMA or ARIMA processes, where the MA captures moving average values in the random, error term. To note, the use of DF or ADF test is influenced by the presence of any trend term in the data generating process.

Separate test statistics are available to test unit root in the presence of trend. Also, the DGP can have a constant term, which will make a drift. It is to be noted, however, that the DF and ADF test statistics are all asymptotic distributions, which may not be powerful for small sample sizes.

4.4.2 Cointegration

By definition, two I (1) processes are said to be cointegrated if there exists some linear combination of them, which is stationary (Stock and Watson[13], Engle and Granger[14]). This is also known as the common trend hypothesis, whereby two integrated series contain a common stochastic trend, which when eliminated, makes the difference between the two variables stationary. Engle and Granger take considerable pains to explain the meaning of the statistical property of cointegration from the point of view of economics. According to them (1987), individual economic variables may wander extensively, but some pairs of series, due to some known economic forces are bound together, so that they do not drift too much apart.

This is really meaningful if one considers long-run equilibrium relationships between two macro variables, following some economic theory, since cointegrating is

statistically a powerful concept only for very large values of time. So, in short run, the variables can well drift apart, thereby leading to disequilibrium situations. Examples from economics are not far to seek. Some of the important ones, which are theoretically justifiable and hence worth considering, are the steady state growth in GNP, permanent consumption hypothesis, long-run demand for money, etc. As Engle and Granger (1991 state in their introduction, cointegration is actually a very unlikely event and should be carefully justified. Once established both empirically and theoretically, this reveals a number of interesting properties. As Engle and Granger (1991) have shown, there is common I(1) factor in the two series which are cointegrated, since it is this factor, which when eliminated through some linear combination, makes the two series co-integrated. It is thus that cointegration is a sufficient condition for the existence of an attractor, and this attractor can correspond to certain types of equilibrium that arise in macro-economic theory.

4.4.3 Error-Correction Models[15]

Engle and Granger (1987) also showed that there could be an error correction mechanism, which corrects the short-run disequilibrium errors and leads to the long-run equilibrium.

On an intuitive level, the standard Granger causality test examines whether past changes in one variable, y, help to explain current changes in another variable, x, over and above the explanation provided by past changes in x. If not, then one concludes that y does not granger cause. To determine whether causality runs in other direction, from x to y, one simply repeats the experiment, but with y and x interchanged. Four findings are possible: 1) neither variable Granger causes the other; 2) y causes x, but not vice-versa; 3) x causes y, but not vice versa; and 4) y and x Granger cause each other.

Engle and Granger provide a more comprehensive test of causality, which specifically allows for a causal linkage between two variables stemming from a common trend or equilibrium relationship. More specifically, this alternative to the standard test for Granger causality considers the possibility that the lagged level of a variable, y do

not. The intuition is that if y and x have common trend, then the current change in x partly is the result of x moving into alignment with the trend value of y. Such causality may not be detected by the standard Granger Causality test, which only examines whether past changes in a variable help to explain current changes in another variable. As with the standard Granger causality test, one may find reverse or even two-way causality. So long as x and y have a common trend, however, causality must exist in at least one direction. The finding of no causality in either direction-one of the possibilities with the standard Granger causality test-is ruled out when the variables share a common trend. In more formal terms, this alternative test for Granger causality is based on error correction models that incorporate information from the co-integrated properties of time series variables. Two (or more) variables are co-integrated (have an equilibrium relationship) if they share common trend(s). To test for causality when variables are co-integrated, one uses the following error correction equation:

$$\Delta x_t = \alpha_0 + \sum \beta_{xi} \Delta x_{t-i} + \sum \beta_{yi} \Delta y_{t-i} + \alpha_1 \mu_{t-1} + e_t$$

Where xt and yt have been identified as first-differenced stationary, co-integrated time series, and where $u_{t-1}$is the lagged value of the error term from the following co-integration equation:

$$x_t = \gamma y_t + \mu_t$$

The inclusion of μ_{t-1}, which must be stationary if the first differenced stationary x and y series are co-integrated, differentiates the error-correction model from the standard Granger causality regressions. By including μ_{t-1}, the error-correction model introduces an additional channel through which Granger causality can emerge.

Based on above equation, the null hypothesis that y does not Granger cause x is rejected not only if the β_{yi}'s are jointly significant, but also if the coefficient on μ_{t-1} is significant. Thus, in contrast to the standard Granger causality test, the error-correction approach as discussed by Granger allows for the finding that y Granger causes x, even if the coefficients on lagged changes in y are not jointly significant.

4.4.4 Final Prediction Error (FPE) Criterion

The method of FPE developed by Akaike[16]([a]1969, [b]1970)

Is used to determine the number of lags in the models. This method is explained in section 5.b.

4.5. THE ECONOMETRIC METHODOLOGY

4.5.1 Integration

Since the series of exports and imports has to be tested for the exact order difference stationarity. Hence we regress the first differenced series of exports variable against a linear trend of one lagged difference, one lagged series of exports, and time. A similar equation is run in case of imports at current price.

$$\Delta X_t = \Delta X_{t-1} + X_{t-1} + t + e_t \qquad (1)$$

Where Δ, is the first difference operator, note that $\Delta X_t = (X_t - X_{t-1})$

$\Delta X_{t-1} = (X_{t-1} - X_{t-2})$

t = time

$$\Delta X_t = \Delta X_{t-1} + e_t \qquad (2)$$

4.5.2 The Following Formula Has Been Applied To Determine The Optimum Lag

$$FPE = T + m + 1 \div T - m - 1 \times SSE \div T$$

Where SSE is the error sum of the squares of the equation, T is the sample size and m is the order of lags. First, given Y_t and X_t regress Y_t on Y_{t-j} for j = 1,2,3,... until you get a

minimum Akaike FPE criterion and select the optimum lag length where FPE is minimum. Second, regress X_t on X_{t-i}

For i = 1,2,3,... and Y_{t-j} (with j optimum obtained from the first stage) and then obtain the optimum lag length i for X. If there is a trivariate system, then the lag length for the third variable can be obtained by regressing this on its past values and the other variables with its optimum lags obtained from the previous stages.

4.5.3 The following formula is worked out for cointegration

The cointegration equations relate to X on Y and vice-versa. We run the cointegration equations in both directions, since Hendry[17] points out that both directions are equally valid a priori. To check for cointegration, the residuals from these regressions are tested for non-stationarity; co-integration requires stationary residuals.

$\Delta e_t = \Delta e_{t-1} + e_{t-1} + t + u_t$ (1)

Where Δ, is the first difference operator, note that $\Delta e_t = (e_t - e_{t-1})$

$\Delta e_{t-1} = (e_{t-1} - e_{t-2})$

t = time

$\Delta e_t = \Delta e_{t-1} + u_t$ (2)

4.5.4 F-Statistics Calculation

The following is the approximate F-statistic, which has been calculated under the hypothesis that the coefficients of the lagged or lead values are jointly zero.

$$F = (SSE_2 - SSE_1)/(DF_2 - DF_1) \div SSE_1/DF_1$$

Where SSE_1 and SSE_2 are the residual sum of squares of with and without lagged values, respectively for the ADF test. DF_1 and DF_2 are degrees of freedom with and without lagged or lead values, respectively.

If the F value calculated is greater than Dickey Fuller Table value then we reject the hypothesis of non-stationarity of the series in favour of the alternative hypothesis that the series is stationary.

4.5.5 The Following Formula is Modelled to Apply the Error Correction Mechanism

$\Delta Y_t = \Delta Y_{t-1} + \Delta Y_{t-2}$ 1

$\Delta Y_t = \Delta Y_{t-1} + \Delta Y_{t-2} + \Delta X_{t-1} + \Delta X_{t-2} + U_{t-1}$ 2

U_{t-1}, is the error term of regressing of Y on X

Finally find F value

$\Delta X_t = \Delta X_{t-1} + \Delta X_{t-2}$ 3

$\Delta X_t = \Delta X_{t-1} + \Delta X_{t-2} + \Delta Y_{t-1} + \Delta Y_{t-2} + U_{t-1}$ 4

U_{t-1}, is the error term of regressing of X on Y

Finally find the F value.

4.6 NEXUS BETWEEN EXPORTS AND IMPORTS

4.6.1 A Causality Test of Export and Imports At Current Price

We begin our empirical investigation of the existence of causal relationship between exports and imports at current price for the periods1949-50 to 1995-96, 1960-61 to 1995-96, 1967-66 to 1995-96, 1970-71 to 1995-96 and 1980-81 to 1995-96. Each of the time series is first examined for the probable order of difference stationarity, because co-integration (error-correction) equations require the use of non-stationary (stationary) variables. A key step in understanding the co-movement between exports and imports, exports and GNP, imports and GNP is to find out whether each of the series contains a stochastic trend and second whether they share a common stochastic trend. The former is called a test of whether a series is integrated of order d I(d), while the latter refers to a test of whether two or more variables are co-integrated. Before any test of co-integration, it

is necessary in the first place to ascertain that the concerned series are I(0), and also exact order of integration since co-integration between two variables arises only when they are of the same order. Hence, the test for unit root becomes obvious.

The Dickey-Fuller test ([a]1979, [b]1981) [18] is generally used. "Now if a time series is differenced once and the differenced series is stationary, we say that the original (random walk) series is integrated of order 1, denoted by I(1). Similarly, if the original series has to be differenced twice (i.e., take first difference of the first difference) before it becomes stationary, the original series is integrated of order 2, or I(2). In general, if a time series has to be differenced d times, it is integrated of order d or I(d). Thus, any time we have an integrated time series of order 1 or greater, we have a non-stationary time series. By convention, if d = 0, the resulting I(0) process represents a stationary time series. We will use the term a stationary process and an I(0) process as synonymous." [19]

Briefly stating Cointegration, error-correction modeling involves mainly four steps. First, each series is differenced until it emerges as stationary. This enables us to determine the order of integration for each series. Second, cointegration regression is estimated using variables with the same order of integration. That is, if X is I(d) and Y is also (d), where 'd' is the same value, then these two series can be cointegrated. Third, residuals of the cointegration regressions are tested for stationarity. If X and Y are cointegrated of the same order with stationary residuals then the two variables are said to be in long-term equilibrium. That is, there is an existence of a long-term relationship between X and Y. Fourth, error-correction models are constructed to test the existence of a short-term relationship (causality) between the two variables.

If both the variables are found cointegrated with stationary residuals then the error-correction model is tested. If the error-correction coefficient is found to be significant, then it is concluded that the two variables are found to have a stable relationship in both the short and the long-term.

We have summarized our findings in Table II.35, Table II.36, Table II.37 and Table II.38. In Table II.35 and Table II.36, we assess whether the export and import

variables for different time periods can be viewed as I (1) or I (0). This is done by forming Dickey-Fuller test and its augmented version, which are reported in column 8 of the table. The null hypothesis of the test is that the series in question is I (1). Rejections of this null hypothesis at 1% and 5% level are reported in the table as starred entries. As is immediately apparent, almost all of the export and import series under different time periods can be viewed as integrated of order I (0) and have confirmed that the properties of the time series are stationary. The main reason for this is that the integration and cointegration properties of the data are critical in the subsequent analysis. For example, if cointegration is not accounted for, our regression models are misplaced and standard causality tests become invalid in principle. Each time series is examined for the probable order of difference stationarity, because cointegration (error-correction) equations require the use of stationary variables. The column 2 of the table shows that the optimum lag is one by applying FPE criterion.

Given this property, it is important to ascertain whether the variables are also cointegrated. To check for cointegration, the residuals from the regressions (exports on imports and imports on exports) are tested for stationarity. The results of the bi-variate Augmented Dickey Fuller test are presented in Table II.37. As shown, by the double asterisk in the column 8 which correspond to the bi-variate combinations for which the null hypothesis of no-cointegration is rejected at 1% level, for the period 1960-61 to 1995-96 and 1970-71 to 1995-96. There appears to be no evidence of a common trend in the movement of the two variables exports and imports for other time break-ups.

As a result of the findings of cointegration between exports and imports at current price for the period 1960-61 to 1995-96 and further in the period 1970-71 to 1995-96. Hence we effort to fulfill our main goal of examining the possible evidence with regard to the bi-directional causality between exports and imports. This requires application of error-correction models to the time series of exports and imports for determining causality. In table II.38 the results of ADF tests are shown in the 10^{th} column. However we fail to reject the null hypothesis of no-causality either from exports to imports or imports to exports.

4.6.2 A Causality Test Between Exports And Imports At Constant Price (Base: 1978-79 = 100)

Further we attempt to examine the causal nexus between exports and imports in real terms (Base year: 1978-79 = 100) for the following periods 1960-61 to 1995-96, 1967-66 to 1995-96, 1970-71 to 1995-96 and 1980-81 to 1995-96.

The empirical investigation requires examining the basic time series properties of the data, for exports time series, the summary of the findings are presented in Table II.39 and for the imports in the table II.40. The asterisk in the column 8 of the tables shows that in case of exports the null hypothesis of non stationarity is rejected for the period 1960-61 to 1995-96 at 1% significance level and 1967-66 to 1995-96, 1970-71 to 1995-96 at 5% significance level based on Dickey Fuller (DF) test but for the period 1980-81 to 1995-96, we cannot reject the null hypothesis. However in case of imports we failed to reject the null hypothesis. Hence it is essential for the integration and cointegration that the properties of the data on exports and imports are stationary of the same order. Therefore these two series were second-differenced, but the results presented in the table II.41 and table II.42 shows that, non-stationarity cannot be rejected at the 1% and 5% level of significance. Further, we subjected the series of exports and imports to the third order difference, but only for the period 1960-61 to 1995-96 and 1967-68 to 1995-96.

The period of 1970-71 to 1995-96 and 1980-81 to 1995-96 was considered since the observation would have becomes too small to derive meaningful results. The results presented in the table II. 43 and table II.44 shows that once again we had to accept the null hypothesis of non-stationarity at 1% and 5% significance level. Therefore, the overall results has to be interpreted that stationarity could not be established at first/second/third order difference. Hence test of cointegration and error-correction cannot be estimated.

Table II.35
Time Series Properties of Exports at Current Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔX_{t-1}	X_{t-1}	t	R^2	1st Differences
1949-50 to 1995-96	1	ΔX	-46.87	-0.63	0.39	-25.78	0.94	
				(0.18)	(0.03)	(19.77)		
		ΔX	194.71	1.18			0.79	
				(0.08)				53.68**
1960-61 to 1995-96	1	ΔX	-198.24	-0.64	0.4	-35.38	0.94	
				(0.21)	(0.04)	(38.73)		
		ΔX	284.13	1.17			0.78	
				(0.10)				39.37**
1967-68 to 1995-96	1	ΔX	-604.38	-0.64	0.39	-21.08	0.93	
				(0.24)	(0 05)	(67.86)		
		ΔX	387.91	1.16			0.76	
				(0.12)				30.21**
1970-71 to 1995-96	1	ΔX	-815.5	-0.64	-0.39	-5.42	0 93	
				(0.25)	(0.05)	(90.60)		
		ΔX	470.99	1.15			0 75	
				(0.13)				26.31**
1980-81 to 1995-96	1	ΔX	-2545.29	-0.89	-0.34	-688.98	0.94	
				(0.30)	(0.07)	(320.44)		
		ΔX	1106.75	1.09			0.67	
				(0.21)				23.57**

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.36

Time Series Properties of Imports at Current Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔM_{t-1}	M_{t-1}	t	R^2	1st Differences
1949-50 to 1995-96	1	ΔM	-726.16	-0.27	-0.36	-99.09	0.86	
				(0.27)	(0.05)	(40.88)		
		ΔM	66.26	1.33			0.73	
				(0.12)				19.64**
1960-61 to 1995-96	1	ΔM	829.8	-0.33	0.40	-194 0	0.86	
				(0.31)	(0.07)	(80.71)		
		ΔM	102.14	1.32			0.72	
				(0.14)				16.39**
1967-68 to 1995-96	1	ΔM	765.74	-0.40	0.45	-341.49	0.86	
				(0.34)	(0.08)	(143.41)		
		ΔM	158.64	1.32			0.70	
				(0.17)				14.34**
1970-71 to 1995-96	1	ΔM	738.95	-0.47	0.49	-476 7	0.86	
				(0.36)	(0.09)	(191 41)		
		ΔM	162.53	1.32			0.68	
				(0.19)				13.62**
1980-81 to 1995-96	1	ΔM	-5040.51	-0.61	0.50	-324.16	0.85	
				(0.52)	(0.15)	(668.53)		
		ΔM	593.26	1.30			0.62	
				(0.29)				7.95*

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.37

Cointegration Test Between Exports and Imports at Current Price

Time Period	No. of Lags	Dependent Variable	Constant	Δe_{t-1}	e_{t-1}	t	R^2	1st Differences
1949-50 to 1995-96	1	Δe	217.23	-0.35	-0 29	-10.7	0 3	
Exports regressed on Imports				(0 16)	0 14	23.07		
		Δe	-6 007	-0 52			0 23	
				0.14				2 05
1949-50 to 1995-96	1	Δe	-429.7	-0 34	-0.32	21 7	0.31	
Imports regressed on exports				0 16	0.15	26.70		
		Δe	42.64	-0.53			0.23	
				0.14				2 36
1960-61 to 1995-96	1	Δe	218.28	-0.34	-0 32	15.77	0 31	
Exports regressed on Imports				0.19	0 17	40 58		
		Δe	-27.4	-0.53			0 23	
				0.16				39 37**
1960-61 to 1995-96	1	Δe	658 48	-0.33	0.4	21.86	0.86	
Imports regressed on exports				0.31	0.07	9.09		
		Δe	-11 5	1.32			0.72	
				0.14				16 39**
1967-68 to 1995-96	1	Δe	162.95	-0.33	-0 34	-19.07	0.32	
Exports regressed on Imports				0 22	0 20	64.84		
		Δe	-71.45	-0 53			0 24	
				0 19				1.45
1967-68 to 1995-96	1	Δe	-443 74	-0.31	-0.39	44 92	0 33	
Imports regressed on exports				0 22	0 21	74.17		
		Δe	142.01	-0 54			0 24	
				0 19				1 65
1970-71 to 1995-96	1	Δe	-76.77	-0 33	-0.37	-7.34	0 34	
Exports regressed on Imports				0 24	0.22	81 34		
		Δe	-144	-0 54			0.24	
				0.2				26 31**
1970-71 to 1995-96	1	Δe	-187.23	-0 31	-0 42	36 37	0 35	
Imports regressed on exports				0 24	0 23	92 36		
		Δe	-15 81	1.32			0 68	
				0 19				13.93**
1980-81 to 1995-96	1	Δe	-890.12	0.04	-1 31	208.42	0.54	
Exports regressed on Imports				0 37	0 55	235.46		
		Δe	-142 64	-0 62			0.29	
				0 27				3 80
1980-81 to 1995-96	1	Δe	660.99	0.13	-1 48	-115 52	0.56	
Imports regressed on exports				0 38	0.6	231 48		
		Δe	317 18	-0 61			0 28	
				0 28				4 29

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.38

Test Statistics for the Error-Correction Model Based on Cointegration Regressions Between Exports and Imports at Current Price

Year	Dependent Variable	Constant	ΔM_{t-1}	ΔM_{t-2}	ΔX_{t-1}	ΔX_{t-2}	U_{t-1}	R^2	ADF
1960-61 to 1995-96	ΔMt	344.05	-0.41	-0.37	0.99	1.33	-0.115	0.86	
			(0.58)	(0.39)	(0.41)	(0.67)	(0.21)		
	ΔMt	-262.94	0.88	0.72				0.77	
			(0.21)	(0.25)					6 01
1960-61 to 1995-96	ΔXt	140.35	0.4	1 3	-0.07	-0.2	-0.18	0.95	
			(0.19)	(0.32)	(0.28)	(0.18)	(0.11)		
	ΔXt	137	0.16	1.26				0.94	
			(0.11)	(0.12)					1.27
1970-71 to 1995-96	ΔMt	893.95	-0.49	-0.43	0.96	1.44	-0.19	0.85	
			(0.73)	(0.49)	(0.51)	(0.84)	(0.29)		
	ΔMt	-450.23	0.89	0.73				0.74	
			(0.26)	(0.32)					4 18
1970-71 to 1995-96	ΔXt	-18.7	0.41	1.3	-0.07	-0.2	-0.2	0.94	
			(0.25)	(0.4)	(0.35)	(0.23)	(0.16)		
	ΔXt	231.92	0.16	1.26				0.94	
			(0.14)	(0.15)					0.78

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.39
Time Series Properties of Exports at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔX_{t-1}	X_{t-1}	t	R^2	1st Differences
1960-61 to 1995-96	1	ΔX	-750 49	-0.07	0.39	-70.12	0.68	
				(0.32)	(0.09)	(26.87)		
		ΔX	81.29	1.16			0.45	
				(0.22)				10.74**
1967-68 to 1995-96	1	ΔX	-1270.37	-0.18	0.47	-102.46	0.68	
				(0.37)	(0.12)	(44.57)		
		ΔX	93.34	1.16			0.42	
				(0.27)				9.63*
1970-71 to 1995-96	1	ΔX	-1547.40	-0.17	0.48	-112.72	0.67	
				(0.40)	(0.14)	(54.91)		
		ΔX	130.88	1.15			0.41	
				(0.29)				8.09*
1980-81 to 1995-96	1	ΔX	-2518	-0.15	0.34	-69.52	0.68	
				(1.63)	(0.23)	(170.55)		
		ΔX	152.13	1.28			0.45	
				(0.40)				5.20

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.40

Time Series Properties of Imports at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔM_{t-1}	M_{t-1}	t	R^2	1st Differences
1960-61 to 1995-96	1	ΔM	-1413.84	-0.49	0 23	20.95	0.20	
				(0.33)	(0.20)	(95.67)		
		ΔM	855.59	0.03			0.001	
				(0.17)				3.59
1967-68 to 1995-96	1	ΔM	-1243.81	-0.38	0.13	93.90	0.18	
				(0.46)	(0.33)	(208.53)		
		ΔM	1103.4	0.01			0.0001	
				(0.20)				2.54
1970-71 to 1995-96	1	ΔM	-1003.4	-0.33	0.09	139.4	0.17	
				(0.61)	(0.47)	(334.9)		
		ΔM	1272.89	-0.01			0.0003	
				(0.21)				2.12
1980-81 to 1995-96	1	ΔM	-2221.1	-0.53	0.31	427.4	0.68	
				(1.20)	(0.97)	(755.71)		
		ΔM	1902.93	-0.06				
				(0.29)			0.004	1.50

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.41

Time Series Properties of Exports at Constant Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	$\Delta\Delta X_{t-1}$	ΔX_{t-1}	t	R^2	2nd Differences
1960-61 to 1995-96	1	ΔΔX	-215.2	-0 70	0.36	15.60	0.24	
				(0 30)	(0 34)	(17.47)		
		ΔΔX	176.08	-0.43			0.08	
				(0 24)				0.07
1967-68 to 1995-96	1	ΔΔX	-298.07	-0.74	0.36	26.12	0.28	
				(0.34)	(0.40)	(25 27)		
		ΔΔX	210.89	-0.47			0.10	
				(0.27)				0.08
1970-71 to 1995-96	1	ΔΔX	-91.98	0.69	0.47	-5.25	0.87	
				(0.06)	(0.16)	(15.10)		
		ΔΔX	263.94	-0.45			0.09	
				(0.31)				56.48**
1980-81 to 1995-96	1	ΔΔX	-409.02	-0.65	-0.02	148.56	0.37	
				(0.65)	(0.97)	(152.60)		
		ΔΔX	449.52	-0.53				
				(0.46)			0 10	2.75

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.42

Time Series Properties of Imports at Constant Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	$\Delta\Delta M_{t-1}$	$\Delta\Delta M_{t-2}$	ΔM_{t-1}	t	R^2	2nd Differences
1960-61 to 1995-96	1	ΔΔM	-796.22	-0 46		-0 75	105.22	0.58	
				(0 42)		(0 42)	(53.31)		
		ΔΔM	419.47	-1 08				0.51	
				(0 18)					0 03
1967-68 to 1995-96	1	ΔΔM	-803.02	-0 41		-0 84	151.20	0.59	
				(0 47)		(0.48)	(81.26)		
		ΔΔM	545.84	-1.09				0.52	
				(0.20)					0.03
1970-71 to 1995-96	1	ΔΔM	-792.97	-0 47		-0.82	193.22	0.60	
				(0.52		(0.52)	(107.69)		
		ΔΔM	575.86	-1 10				0.52	
				(0.22)					1.9
1980-81 to 1995-96	2	ΔΔM	-803.58	0.60	0.90	-1.96	696.21	0.72	
				(1.63)	(1.04)	(1.45)	(408.54)		
		ΔΔM	1067.01	-1.19	0.06				
				(0.37)	(0.61)			0.56	2.0

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.43

Time series properties of Exports at constant price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	$\Delta\Delta\Delta X_{t-1}$	$\Delta\Delta X_{t-1}$	t	R^2	3rd Differences
1960-61 to 1995-96	1	ΔΔΔX	-296 1	0.03	-1.55	31.02	0.58	
				(0.27)	(0 47)	(14.22)		
		ΔΔΔX	97.04	-0 74			0 40	
				(0.16)				0.10
1967-68 to 1995-96	1	ΔΔΔX	-299.0	0.04	-1.61	43.10	0 60	
				(0.31)	(0.54)	(21.38)		
		ΔΔΔX	133.81	-0.75			0 42	
				(0.18)				0.09

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.44
Time Series Properties of Imports at Constant Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	$\Delta\Delta\Delta M_{t-1}$	$\Delta\Delta M_{t-1}$	t	R^2	3rd Differences
1960-61 to 1995-96	1	ΔΔΔM	-652 62	0 17	-2 38	73.85	0.81	
				(0.31)	(0 44)	(53.84)		
		ΔΔΔM	-49 11	-1 33			0.61	
				(0 19)				0.10
1967-68 to 1995-96	1	ΔΔΔM	-431.26	0 19	-2.41	89.68	0.81	
				(0 36)	(0.51)	(82.78)		
		ΔΔΔM	-6 70	-1.34			0.61	
				(0.21)				0.10

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

4.7 A CAUSALITY TEST BETWEEN EXPORTS, IMPORTS AND GNP_{MP} AT CURRENT PRICE

In this section we try to analyse the type of causality that exist between exports and GNP_{MP}, and imports and GNP_{MP} for the time period 1960-61 to 1994-95, 1967-68 to 1994-95, 1970-71 to 1994-95, 1980-81 to 1994-95. As required we begin our empirical investigation by examining the stationary properties of the data, a univariate analysis of each of the three time series (GNP_{MP}, exports, imports at current price) was carried out to assess whether the variables can be viewed as I(1) or I(0). This is done by forming Dickey-Fuller unit-root test statistics, which are reported in column 8 of the Table II.45 for exports at current price, Table II.46 for imports at current price, and table II.47 for GNP_{MP} at current price. The null hypothesis of the test is that the series in question is non-stationary and integrated of order I (1). Rejections of the null hypothesis at 1% and 5% significance level are reported in the table II.45, table II.46 and table II.47 as starred entries. As is immediately apparent, almost all the three time series can be viewed as I (0). Given this property it is important to assess whether the variables are also cointegrated. We run the cointegration equations in both directions, since both directions are equally valid a priori. To check for cointegration, the residuals are obtained by

regressing exports on GNP_{MP} and GNP_{MP} on exports and tested for non-stationarity; co-integration requires stationary residuals. Similarly, the check for cointegration is done between imports and GNP_{MP}. The results are presented in the table II. 48 and table II.49 were the ADF test mentioned in the column 8 shows that we fail to reject the null hypothesis of no-cointegration at 1% and 5% significance level. Since exports and imports do not cointegrated with the GNP_{MP}, then we cannot include error-correction model to test the causality.

4.8 A CAUSALITY TEST BETWEEN EXPORTS, IMPORTS AND GNP_{MP} AT CONSTANT PRICE (BASE YEAR: 1978-79 = 100)

We extend our purpose to consider the causality issue between exports, imports and GNP_{MP} at constant price (Base year: 1978-79 = 100) for the period 1960-61 to 1994-95, 1967-68 to 1994-95, 1970-71 to 1994-95, 1980-81 to 1994-95 with the aid of cointegration and error-correction modeling. Each time series is first examined for the probable order of difference stationarity, because co-integration (error correction) requires the use of stationary variables. Table II.50, Table II.51 and Table II.52 reports our non-stationary tests for all the time series for the above-mentioned three variables, using the Dickey-Fuller test and its augmented version. The column 8 of the tables shows the asterisks only for exports and GNP_{MP} for the period 1960-61 to 1994-95, showing that the null hypothesis of non-stationarity is rejected at 5% level significance. But in all other category of time, and in case of imports for the entire break up of time periods we fail to reject the hypothesis of non-stationarity at 1% and 5% significance level. Given the stationary properties of the exports and GNP_{MP} for the time period 1960-61 to 1994-95, we run the cointegration equations in both directions. To check for cointegration, the residuals from these regressions are tested for non-stationarity; cointegration requires stationary residuals. The column 8 of the table II. 53 show no asterisks, which means that we accept the hypothesis of non-cointegration at 1% and 5% significance level.

Therefore we do not further the test for error-correction, to test for the causality, since the variables do not cointegrated. In order to find the possibility of stationarity the variables of exports, imports and GNP_{MP} are differenced further and the stationary

properties and the order of integration examined. The table II.54, table II.55, table II.56 summarizes the results of second order-differenced series tested for stationarity. The absence of asterisk, in case of exports and imports means we fail to reject the hypothesis of non-stationarity. However in case of GNP_{MP} for the period 1960-61 to 1994-95, 1970-71 to 1994-95, 1980-81 to 1994-95 we reject the null hypothesis at 1% significance level in the former period and the latter two periods at 5% level significance. But for cointegration test between export and GNP_{MP}, or import and GNP_{MP}, it requires they should be not only stationary but also integrated of same order. Therefore the three variables were third-order differenced but the period considered was only 1960-61 to 1994-95 and 1967-70 to 1994-95 and tested for the properties of stationarity. The table II.57, table II.58, table II.59 summarizes the results, that only exports and GNP_{MP} show the properties of stationarity at 1% level of significance.

Given this property, it is important to ascertain whether the exports and GNP_{MP} are cointegrated. The table II.60 report the cointegrating equations relating exports and GNP_{MP} and vice versa. We run the co-integration equations in both directions using the residuals from these regressions and tested for non-stationarity; cointegration requires stationary residuals. The column 8 of the table II.60 shows the results of ADF test with no asterisk, means that we fail to reject the null hypothesis of non-cointegration at 1% and 5% significance level. Since we cannot account for cointegration, the error correction model to test the causality becomes invalid in principle.

Table II.45
Time Series Properties of Exports at Current Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	ΔX_{t-1}	X_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95	1	ΔX	-217.6	-0.60	0.38	-30.75	0.89	
				(0.28)	(0 07)	(44.74)		
		ΔX	440.19	0.97			0.77	
				(0.09)				15.81**
1967-68 to 1994-95	1	ΔX	-618.8	-0.58	0.38	-11.7	0.88	
				(0.33)	(0.09)	(78 65)		
		ΔX	598.29	0.95			0.75	
				(0.11)				13**
1970-71 to 1994-95	1	ΔX	-820.44	-0.58	0.37	8.02	0.87	
				(0.35)	(0.10)	(104.67)		
		ΔX	718.46	0.94			0 74	
				(0.12)				9.5*
1980-81 to 1994-95	1	ΔX	-2327.12	-0.75	0 29	742.31	0 89	
				(0.41)	(0.12)	(347.94)		
		ΔX	1571 5	0.86			0.65	
				(0.18)				8.30*

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.46

Time Series Properties of Imports at Current Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	ΔM_{t-1}	M_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95	1	ΔM	92.65	-0 45	0 31	-65.83	0.85	
				(0 21)	(0 05)	(59.08)		
		ΔM	629.97	0.94			0.58	
				(0.14)				26.1**
1967-68 to 1994-95	1	ΔM	-1.006	-0 47	0.33	-111.43	0.83	
				(0.24)	(0.06)	(111.48)		
		ΔM	887.11	0.91			0.55	
				(0.16)				18.11**
1970-71 to 1994-95	1	ΔM	116.45	-0.50	0.35	-179.73	0.82	
				(0.26)	(0.07)	(153.53)		
		ΔM	1066.01	0.89			0.52	
				(0.18)				15.83**
1980-81 to 1994-95	1	ΔM	-3206.74	-0.71	0.27	624.59	0.86	
				(0.31)	(0.10)	(462.45)		
		ΔM	2209.46	0.78			0.41	
				(0.28)				14.46**

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.47

Time Series Properties of GNP_{MP} at Current Price ADF Test

Time Period	No of Lags	Dependent Vanable	Constant	ΔY_{t-1}	Y_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95	1	ΔY	-948.70	-0.32	0 20	-172.73	0.97	
				(0 24)	(0.03)	(205.9)		
		ΔY	-42 41	1 17			0.93	
				(0.05)				8.28*
1967-68 to 1994-95	1	ΔY	-2525 74	-0 32	0 20	-120.76	0.96	
				(0 28)	(0.038)	(399.05)		
		ΔY	74.10	1.17			0.92	
				(0.06)				11**
1970-71 to 1994-95	1	ΔY	-2075 93	-0.32	0 20	-264.78	0.96	
				(0.30)	(0.04)	(564.04)		
		ΔY	121.17	1.17			0.91	
				(0.07)				11.87**
1980-81 to 1994-95	1	ΔY	-5249.07	-0.51	0.2	624.59	0.86	
				(0.31)	(0.10)	(462.45)		
		ΔY	2209.46	0.78			0.41	
				(0.28)				14.46**

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.48
Cointegration Test Between Exports and GNP_{MP} at Current Price

Time Period	No of Lags	Dependent Variable	Constant	Δe_{t-1}	e_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95 GNP regressed on exports	1	Δe	10551 7	0.15	0 02	-753 9	0 14	
				(0.26)	(0.15)	(786.15)		
		Δe	-1275 1	0.27			0 07	
				(0.17)				1 27
1960-61 to 1994-95 Exports regressed on GNP	1	Δe	-1274 09	0.10	0 09	97.31	0 20	
				(0.28)	(0 16)	(66.46)		
		Δe	195 69*	0 33			0 11	
				(0 17)				1 63
1967-68 to 1994-95 GNP regressed on exports	1	Δe	17579.67	-0 0002	0.084	-1550	0 16	
				(0 32)	(0.19)	(1281.11)		
		Δe	-11170.98	0 23			0.05	
				(0 19)				1 44
1967-68 to 1994-95 Exports regressed on GNP	1	Δe	-1893.15	-0.05	0.14	181.23	0 22	
				(0.33)	(0.19)	(109 34)		
		Δe	217 83	0 29			0.08	
				(0.19)				1.90
1970-71 to 1994-95 GNP regressed on exports	1	Δe	23143.99	-0 11	0.13	-2285.21	0.18	
				(0 35)	(0.21)	(1661.36)		
		Δe	-1057 66	0 20			0.04	
				(0.21)				1 62
1970-71 to 1994-95 Exports regressed on GNP	1	Δe	-2373.01	-0 17	0 19	255 51	0 24	
				(0 37)	(0 20)	(142 50)		
		Δe	229.35	0.27			0.07	
				(0 21)				1 96
1980-811 to 1994-95 GNP regressed on exports	1	Δe	58970 64	-0 99	0 34	-9746 93	0.55	
				(0 45)	(0 27)	(3473 54)		
		Δe	1340.20	0 009			0 00009	
				(0 29)				5 42
1980-81 to 1994-95 Exports regressed on GNP	1	Δe	-6013 25	-0 99	0 35	1063 22	0 58	
				(0 44)	(0.25)	(343 65)		
		Δe	64 01	0 06			0.004	
				(0.29)				6 17

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.49

Cointegration Test Between Imports and GNP_{MP} at Current Price

Time Period	No. of Lags	Dependent Variable	Constant	Δe_{t-1}	e_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95 GNP regressed on Imports	1	Δe	7474 09	-0 002	0 003	-562 9	0 08	
				(0 24)	(0 18)	(494 35)		
		Δe	-1510 34	0 063			0.003	
				(0 19)				1.21
1960-61 to 1994-95 Imports regressed on GNP	1	Δe	-874 91	-0 025	0 04	67.96	0 10	
				(0 24)	(0 18)	(46 52)		
		Δe	191 11	0 086			0 006	
				(0.19)				1 51
1967-68 to 1994-95 GNP regressed on Imports	1	Δe	8203 9	-0.022	-0 20	-786 52	0 10	
				(0 27)	(0.20)	(734.43)		
		Δe	-1695 5	0 037			0 001	
				(0 22)				1 21
1967-68 to 1994-95 Imports regressed on GNP	1	Δe	-977.97	-0 04	0.02	98 57	0 11	
				(0.27)	(0.21)	(69.44)		
		Δe	240.33	0 06			0 0035	
				(0.22)				1.42
1970-71 to 1995-96 GNP regressed on Imports	1	Δe	8743 33	-0.027	-0 024	-884 97	0.096	
				(0 28)	(0 22)	(926 74)		
		Δe	-2007 06	0 018			0.0003	
				(0 23)				0 36
1970-71 to 1995-96 Imports regressed on GNP	1	Δe	-919 63	-0 045	0.01	109.3	0.10	
				(0 29)	(0.22)	(89.49)		
		Δe	271 32	0 040			0 0013	
				(0 23)				0 95
1980-81 to 1995-96 GNP regressed on Imports	1	Δe	26295 23	-0 53	0.12	-5609 45	0 46	
				(0 36)	(0.28)	(2497 14)		
		Δe	151 16	-0 04			0.001	
				(0 32)				3 82
1980-81 to 1995-96 Imports regressed on GNP	1	Δe	-3660 55	-0 54	0 14	632.87	0 10	
				(0 36)	(0 26)	(249 77)		
		Δe	137.98	-0 013			0 0001	
				(0 32)				3 98

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.50

Time Series Properties of Exports at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔX_{t-1}	ΔX_{t-2}	X_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95	1	ΔX	-393.84	-0.02		0.18	-17.27	0.54	
				(0.22)		(0.07)	(21.05)		
		ΔX	195.41	0.62				0.30	
				(0.16)					7.56*
1967-68 to 1994-95	1	ΔX	-559.85	-0.06		0.19	-19.21	0.54	
				(0.28)		(0.10)	(35.73)		
		ΔX	250.04	0.58				0.26	
				(0.20)					5.95
1970-71 to 1994-95	1	ΔX	-610.67	-0.05		0.19	-19.68	0.48	
				(0.28)		(0.11)	(44.06)		
		ΔX	300.10	0.55				0.24	
				(0.21)					4.38
1980-81 to 1994-95	1	ΔX	237.54	-0.17	-0.20	-0.06	268.33	0.71	
				(0.37)	(0.38)	(0.18)	(138.01)		
		ΔX	264.36	0.47	0.43			0.37	
				(0.32)	(0.38)				4 10

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.51
Time Series Properties of Imports at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔM_{t-1}	M_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95	1	ΔM	-1442.18	0.18	0.38	-77.62	0 32	
				(0.41)	(0.20)	(99 76)		
		ΔM	518.66	0.83			0.14	
				(0.37)				3.83
1967-68 to 1994-95	1	ΔM	-2056.44	0.11	0.57	-212 96	0.31	
				(0 48)	(0.37)	(243.78)		
		ΔM	702.91	0.79			0 12	
				(0.42)				3 02
1970-71 to 1994-95	1	ΔM	-3028.5	-0.01	0.72	-322.58	0.31	
				(0.59)	(0.54)	(392.22)		
		ΔM	759.43	0.76			0 10	
				(0.48)				2.89
1980-81 to 1994-95	1	ΔM	-23464.3	-1.03	2.32	-1297.44	0 50	
				(1.09)	(1.30)	(1023.65)		
		ΔM	1080.99	0.95			0.13	
				(0.72)				3.33

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.52
Time Series Properties of GNP_{MP} at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	ΔY_{t-1}	ΔY_{t-2}	Y_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95	1	ΔY	175.37	-0 21		0 01	204 76	0 34	
				(0 19)		(0 05)	(240 59)		
		ΔY	3787.11	0.16				0 02	
				(0 18)					7.30*
1967-68 to 1994-95	2	ΔY	4911.16	-0 24	-0 13	-0 05	-0 05	0 37	
				(0 28)	(0.22)	(0 16)	(454.92)		
		ΔY	3882.39	0.076	0.19			0.04	
				(0.22)	(0.22)				5.23
1970-71 to 1994-95	1	ΔY	10451.17	-0.24		-0 14	1176.79	0.39	
				(0.21)		(0.10)	(566 62)		
		ΔY	5034.76	0.07				0.004	
				(0.22)					6.01
1980-81 to 1994-95	1	ΔY	93002.05	0.17		-0.86	6418.79	0.46	
				(0.31)		(0.36)	(2559.65)		
		ΔY	8350.70	-0.16				0 02	
				(0.30)					3.66

The figures in the parenthesis are Standard Error.
* 5% level of significance
** 1% level of significance.

Table II.53
Cointegration Test Between Exports and GNP_{MP} at Constant Price

Time Period	No. of Lags	Dependent Variable	Constant	Δe_{t-1}	e_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95 GNP regressed on exports	1	Δe	3481.17	0 04	-256 95	-753 9	0 103	
				(0 23)	(0 17)	(171 53)		
		Δe	561 54	-0 053			0 0025	
				(0 18)				1 63
1960-61 to 1994-95 Exports regressed on GNP	1	Δe	-295 55	-0 17	0 08	23 7	0 12	
				(0.23)	(0 16)	(12 07)		
		Δe	75 30	-0 014			0 0002	
				(0 18)				2 01

The figures in the parenthesis are Standard Error.
* 5% level of significance
** 1% level of significance.

Table II.54

Time Series Properties of Exports at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	$\Delta\Delta X_{t-1}$	$\Delta\Delta X_{t-2}$	ΔX_{t-1}	t	R^2	2nd Differences
1960-61 to 1994-95	1	ΔΔX	-151.13	-0.14		0 56	27 69	0 33	
				(0 25)		(0.32)	(18 34)		
		ΔΔX	80.21	-0 43				0 19	
				(0 18)					2 92
1967-68 to 1994-95	1	ΔΔX	-94.96	-0 16		0.59	37 97	0.35	
				(0.25)		(0.32)	(18.34)		
		ΔΔX	108 69	-0.45				0.21	
				(0.18)					2.26
1970-71 to 1994-95	1	ΔΔX	-99.31	-0.13		-0 64	48.61	0.38	
				(0.27)		(0.34)	(22.80)		
		ΔΔX	112.79	-0.46				0.21	
				(0.19)					2.46
1980-81 to 1994-95	2	ΔΔX	77.52	0.54	0.26	1.83	274.01	0.62	
				(0.64)	(0.41)	(0.86)	(123 22)		
		ΔΔX	306.60	-0.62	-0.29				
				(0.32)	(0.36)			0.31	2.44

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.55

Time Series Properties of Imports at Constant Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	$\Delta\Delta M_{t-1}$	ΔM_{t-1}	t	R^2	2^{nd} Differences
1960-61 to 1995-96	1	ΔΔM	-681.59	-0 82	0 49	59 84	0.23	
				(0 41)	(0 62)	(51 87)		
		ΔΔM	490.35	-0 53			0.12	
				(0 26)				2
1967-68 to 1995-96	1	ΔΔM	-694.93	-0 77	0 39	94 15	0.23	
				(0 48)	(0.73)	(85 22)		
		ΔΔM	674.35	-0.54			0.12	
				(0.29)				1.5
1970-71 to 1995-96	1	ΔΔM	-1120.65	-0.88	0.53	137.43	0.27	
				(0.51)	(0.79)	(101.83)		
		ΔΔM	703.35	-0.53			0 12	
				(0.31)				1.84
1980-81 to 1995-96	2	ΔΔM	-2006.89	-1.23	1.04	431.21	0.42	
				(0 75)	(1.15)	(306)		
		ΔΔM	1269.18	-0.56				
				(0.48)			0.56	2.0

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.56

Time Series Properties of GNP_{MP} at Constant Price ADF Test

Time Period	No of Lags	Dependent Variable	Constant	$\Delta\Delta Y_{t-1}$	ΔY_{t-1}	t	R^2	2nd Differences
1960-61 to 1995-96	1	$\Delta\Delta Y$	1149 82	0 13	-1 36	320 41	0 60	
				(0 19)	(0.29)	(91 62)		
		$\Delta\Delta Y$	416 47	-0 54			0 29	
				(0 15)				11 62**
1967-68 to 1995-96	1	$\Delta\Delta Y$	2022 36	0 16	-1 44	437 10	0 63	
				(0 21)	(0.33)	(135)		
		$\Delta\Delta Y$	407 32	-0 55			0 30	
				(0 17)				3 02
1970-71 to 1995-96	1	$\Delta\Delta Y$	-4663.96	-1.41	1 58	-394.26	0.64	
				(0 25)	(0.40)	(192.37)		
		$\Delta\Delta Y$	-249.25	-0 62			0.33	
				(0.19)				7 75*
1980-81 to 1995-96	2	$\Delta\Delta Y$	8089.03	0.03	1.25	210.5	0.59	
				(0 36)	(0.56)	(352.36)		
		$\Delta\Delta Y$	743.74	-0.58				
				(0.25)			0.34	7.47*

The figures in the parenthesis are Standard Error.
* 5% level of significance
** 1% level of significance.

Table II,57

Time Series Properties of Exports at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	$\Delta\Delta\Delta X_{t-1}$	$\Delta\Delta X_{t-1}$	t	R^2	3rd Differences
1960-61 to 1994-95	1	$\Delta\Delta\Delta X$	-141.47	0.47	-2 16	16 34	0.78	
				(0.18)	(0.30)	(9 08)		
		$\Delta\Delta\Delta X$	20.32	-0.64			0.39	
				(0.14)				23 93**
1967-68 to 1994-95	1	$\Delta\Delta\Delta X$	-122.61	0.49	-2.23	20.33	0 81	
				(0.19)	(0 54)	(12 28)		
		$\Delta\Delta\Delta X$	11.52	-0.65			0 41	
				(0 16)				23.15**

The figures in the parenthesis are Standard Error.
* 5% level of significance
** 1% level of significance.

Table II.58

Time Series Properties of Imports at Constant Price ADF Test

Time Penod	No. of Lags	Dependent Variable	Constant	$\Delta\Delta\Delta M_{t-1}$	$\Delta\Delta M_{t-1}$	t	R^2	3rd Differences
1960-61 to 1994-95	1	ΔΔΔM	-773 68	-0.24	-1 18	82 63	0 59	
				(0 31)	(0.54)	(47.13)		
		ΔΔΔM	342 90	-0.83			0.49	
				(0.15)				3.29
1967-68 to 1994-95	1	ΔΔΔM	-725	-0 22	-1.22	106.09	0.59	
				(0.34)	(0.60)	(67.49)		
		ΔΔΔM	449 73	-0.83			0 49	
				(0.17)				2.68

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.59

Time Series Properties of GNP_{MP} at Constant Price ADF Test

Time Period	No. of Lags	Dependent Variable	Constant	$\Delta\Delta\Delta Y_{t-1}$	$\Delta\Delta Y_{t-1}$	t	R^2	3rd Differences
1960-61 to 1994-95	1	ΔΔΔY	-181.80	0.38	-2.13	45 93	0.80	
				(0.17)	(0.31)	(87.41)		
		ΔΔΔY	57.20	-0.68			0.46	
				(0 13)				22.95**
1967-68 to 1994-95	1	ΔΔΔY	-75.11	0.35	-2.12	52.31	0.80	
				(0.19)	(0.35)	(120.68)		
		ΔΔΔY	99 40	-0.69			0 48	
				(0.14)				17 6**

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

Table II.60

Cointegration Test Between Exports and GNP_{MP} at Constant Price

(after 3rd difference)

Time Period	No. of Lags	Dependent Variable	Constant	Δe_{t-1}	e_{t-1}	t	R^2	1st Differences
1960-61 to 1994-95 GNP regressed on exports	1	Δe	3481 17	0 04	-256 95	-753.9	0 103	
				(0 23)	(0.17)	(171 53)		
		Δe	561.54	-0 053			0 0025	
				(0 18)				1 63
1960-61 to 1994-95 Exports regressed on GNP	1	Δe	-295 55	-0 17	0.08	23 7	0 12	
				(0.23)	(0.16)	(12.07)		
		Δe	75 30	-0.014			0 0002	
				(0 18)				2 01
1967-68 to 1994-95 GNP regressed on Exports	1	Δe	3425 78	-0 16	0 007	-323.40	0.12	
				(0 25)	(0 19)	(254 51)		
		Δe	-589.83	-0.09			0 0076	
				(0.21)				1 32
1967-68 to 1994-95 Exports regressed on GNP	1	Δe	-310 82	-0 17	0.05	32 87	0 13	
				(0 26)	(0.19)	(19 07)		
		Δe	92 17	-0.05			0 0025	
				(0.21)				1 61

The figures in the parenthesis are Standard Error.

* 5% level of significance

** 1% level of significance.

4.9 CONCLUSION

We have used the analysis a model of integration, cointegration, error-correction mechanism and the Final Prediction Error method to examine the patterns of causation between export and import at current price for the period 1949-50 to 1995-96, 1960-61 to 1995-96, 1967-68 to 1995-96, 1970-71 to 1995-96, 1980-81 to 1995-96 To examine the causation between exports and imports at constant price (base: 1978-79 =100), following periods are considered, 1960-61 to 1995-96, 1967-68 to 1995-96, 1970-71 to 1995-96, and 1980-81 to 1995-96. We offer the following conclusions. First, exports and imports at current price for all the periods are found to be integrated of order zero, I (0) and are stationary at 1% level significance, satisfying the cointegrating restrictions. We suggest that taking these restrictions into account when modelling avoids potentially spurious findings with respect to causality.

Although we found that the cointegration was proved incase of exports and imports at current price for the period 1960-61 to 1995-96 and 1970-71 to 1995-96, thereby observing long run equilibrium or co movement between the two variables. However by applying the error-correction mechanism for the exports and imports at current price for the period 1960-61 to 1995-96 and 1970-71 to 1995-96. We find no causality between exports and imports over the period. Although it must be stressed that we avoid the use of standard Granger causality tests or Sims tests, as our error correction model essentially equates Granger causality but overcomes some of the limitations of the Granger causality. Both the Sims and Granger tests of causality underline certain shortcomings as explained above in the choice of methodology. More specifically, this alternative to the standard test for Granger causality considers the possibility that the lagged level of a variable, y, may help to explain the current change in another variable, x, even if past changes in y do not. The intuition is that if y and x have a common trend, then the current change in x partly is the result of x moving into alignment with the trend value of y. Such causality may not be detected by the standard Granger causality test, which only examines whether past changes in a variable help to explain current changes in another variable. As with the standard Granger causality test, one may find reverse or even two-way causality. So long as x and y have a common trend, however, causality must exist in at least one direction. The finding of no causality in either direction-one of

the possibilities with the standard Granger causality test-is ruled out when the variables share a common trend.

However the causality test between exports and imports in real terms could not be done, since we could not determine the order of integration for each series with the same order even after the series were third-order differenced.

Further in the analysis is to focus on the causal relationship between exports and $GNP_{MP,}$ imports and GNP_{MP}. We offer following results that at current price, although exports and $GNP_{MP,}$ imports and GNP_{MP} were integrated of order zero with optimum lag of one. With this property, the cointegration test was done, but the null hypothesis of no-cointegration could not be rejected between exports and $GNP_{MP,}$ imports and GNP_{MP} However at constant price only exports and GNP_{MP} at first-order difference for the period 1960-61 to 1994-95 and at third-order difference for the period 1960-61 to 1994-95 and 1967-68 to 1994-95 were found to be stationary and integrated of same order. The subsequent investigation of the cointegration between the two, revealed no co-movement or long run (steady state) equilibrium.

We forward the results that there is no causality between imports and growth neither at current price nor in real terms in case of India. However such a finding is compatible with the findings by Ram Rati[20], that Import growth nexus is weaker in low-income LDCs than in middle-income group countries a period 1974-85. In another paper by Wall David[21] also supports our results, were he finds the argument of UNCTAD that there is a "close" or "positive" relationship between import capacity and growth is untenable. He further has shown that there is no evidence of a close association between imports of investment goods and growth.

However with reference to India, there is unidirectional relationship from imports to growth in real terms for the period 1960-61 to 1995-96. The results differ on account of choice of methodology. All the variables are in natural logs and in 1990 prices in National currency. Moreover they use ex-ante predictive ability model and marginal predictive ability models to examine the causation. [22]

Our judgment on exports and growth also finds no causality at current price or in real terms. The result finds some resemblance to the findings by Mukherji Smirti[23], she states, it is evident that in whatever way we might choose to represent export growth and income growth variables, the outcome happens to be same; that is, the case of the Indian economy a higher growth rate in exports has led to a fall in the growth of income over the period 1950-51 to 1980-81. An explanation of this inverse relationship forwarded by her is: (1) "it might be that imports being quite substantial (in fact in most of the years imports have exceeded exports), the desired relationship between growth rate of export and income gets distorted." (2) "In the face of inflated import requirements to make import substitution a success, export growth fails to show the desired effect upon income growth." One of the reasons for no link between exports and growth is in India, there has been little demarcation between the sectors catering to domestic demand and exports[24]. In another paper by Jung and Marshall[25] shows using Granger test of causality could not establish the direction of causality between export and domestic output in India. A similar supporting view is of no significant link between export and economic growth covering a period of 1960-80[26]. However in another study of the India's experience, finds that causality runs one way i.e. export growth causes growth of national income covering the period of 1960-61 to 1985[27].

Further in a study of causal relationship between exports and GDP in real terms for the period 1980-81 to 1992-93 in the case of India shows that export coefficient though positive is found not to be statistically significant[28].

However in another paper using modified Sims test of which Granger and Sims test are special cases[29], by and large supported the bi-directional causation between income growth and exports growth of India for the period 1950-51 to 1991-92. A similar view in contradiction to our findings shows, the bi-directional causality between exports and economic growth in India 1950-51 to 1993-94.[30]

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