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IMPACT OF INTERNATIONAL TRADE AND FOREIGN ECONOMIC PERFORMANCE ON OUTPUT AND PRODUCTIVITY IN INDIA: *An Application of Vector Autoregressive Model*

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This main purpose of this paper is to analyze the causal relations between exports and domestic GDP (or domestic TFP) in more reliable way. The study examines that what impact changes in foreign economic performance have on Indian exports, output, and productivity. This information can be very important for the policymakers of India who may wish to set policies depending on their expectations of foreign economic performance. The conceptual framework of the study is extended to include productivity export and foreign economic performance in one model and output growth export and foreign economic performance in other model. This study has investigated the long run and short run relationship first between export, foreign economic performance and productivity, and secondly between exports, foreign economic performance and output using multivariate co-integration and vector error correction model. Using export and foreign economic performance as determinants of total factor productivity and output growth, we find significant impact of outward orientation (export) on productivity in short run but export is not found promoting economic growth in case of India. While in the long run we do found support for our hypothesis that the variables in the model have stable long run relation. Further more on investigating the effect of foreign economic performance on the total factor productivity and domestic output, the study found out that its effect is significant in case of total factor productivity. While the study do not found any causal effect of foreign economic performance on domestic output. Productivity is affected by increases in export due to the export led growth hypothesis, and it is positively affected by the increase in foreign economic performance due to the occurrence of knowledge spillovers between countries that can occur without the help of trade.

Keywords: *economic growth, export, total factor productivity and var.*

JEL Classification: *O40, O47, F10, C22.*

Introduction

Development in the theory of international trade and economic growth have identified a number of channels through which productivity (TFP) levels and output level (GDP), representing economic growth, are related to export growth [Voivodas (1973); Michaely (1977); Balassa (1978); Tyler (1981); Kavoussi (1982); and Feeler (1983)]. Export growth enables a country to enhance demand for the country's output and thus serves to increase the productivity. It loses a binding foreign exchange constraint and allows

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increase in productive intermediate imports and hence results in the growth of output. Export promotion establish contacts with foreign competitors which lead to more rapid technical change, the development of indigenous entrepreneurship, and the exploitation of scale economies. In addition to this, competitive pressure may reduce X-inefficiency and may lead to better product quality. Under these assumption, export growth results in higher productivity and output growth, this study investigate the long run and short run relationship first between export and productivity, and secondly between export and output using multivariate cointegration and vector error correction model.

Although this kind of relationship has been studied by a number of researchers very little have included foreign economic performance in their empirical models. Some exceptions are, Kunst and Marin (1989), Marin (1992), Jin and Yu (1996), Shan and Sun (1999) and Wernerheim (2000). The reason for the inclusion of foreign economic performance, proxied by foreign real GDP is to test the hypothesis that increases in foreign real GDP will increase the demand for domestic exports. This primary innovation of the current study is the inclusion of a foreign real GDP measure in the estimations, make estimates of causal relations between exports and domestic GDP (or domestic TFP) more reliable, this inclusion also allows us to observe what impact changes in foreign GDP have on India exports, output, and productivity. This latter information can be very important for the policymakers of India who may wish to set policies depending on their expectations of foreign economic performance.

Studies on the export growth-economic growth nexus have been conducted along a number of divergent lines. The initial tests were done on a bivariate level to study the correlation between exports and economic growth in levels and then in terms of rate of growth.[1] Correlation between exports and economic growth via other economic growth-determining fundamentals such as labour and capital in a production type function with investment (capital formation), manufacturing, and total exports was investigated by Balassa (1978), Tyler (1981), Feder (1982), and Kavoussi (1984). Studies by Kohli and Nirvikar (1989), and Moschos (1989) consider the differential impacts of exports on growth depending on the level of economic/industrial development of the country (critical minimum effort hypothesis). Lastly, there has been a relatively recent emphasis on the causality (uni-and/or bi-directional) between exports and economic growth [Jung and Peyton (1985), Chow (1987), Darrat (1987), Bahmani-Oskooee et al.(1991), Afxentiou and Serletis (1991), Dodaro (1993), and Bahamani Oskooee and Alse (1993)]. Studies relating export to output and export to productivity while excluding foreign economic performance provide different views on the effectiveness of export growth led hypothesis. Four different views can be distinguished in this regard, not all of which are mutually exclusive. The first view suggest that, the direction of causation is from export to economic growth because export expansion will increase productivity by offering greater economies of scale, brings about higher quality products because of the exporter's exposure to international consumption patterns, lead a firm to over-invest in new technology as a strategy for pre-commitment to a large scale of output increasing the rate of capital formation and technological change, permits the rapid expansion of employment and real wages in a labour-surplus economy, contribute to a relaxation of foreign exchange constraints that normally impinge on development efforts, finally, due to the competition in the world market, domestic firms is forced to reduce inefficiencies [Yaghamaiam, (1994), Helpman and Krugman (1985), Krueger (1985), Rodrik, (1988), Voivodas, (1973), Afxentiou and Serletis, (1992)].

The second view is that the causality runs from economic growth to exports because higher productivity leads to lower unit costs which facilitate exports. [Kaldor, (1967), Vernon, (1966), Ghartey (1993), Sharma and Dhakal, (1994)]. The third view is the combination of the first and second: there can be a bi-directional causal relationship between exports and economic growth [Helpman and Krugman, (1985), Kunst and Marin, (19890, Ghartey, (1993), Sharfa and Dhakal, (1994)]. The fourth view is that no causal relationship exists between exports and economic growth. Exports and economic growth are both the results of the process of development and structural change [Pack, (1988) and (1992), Yaghamian, (1994) Afxention and Sertelis (1991), Jung and Marshall (1985), Darrat (1986) and Hsiao (1987)].

Empirical efforts to link the productivity and export promotion also provide mixed results. For example Kunst and Marin (1989) considered, at the macro level, the causal relationship between manufacturing exports and labor productivity in the manufacturing sector using Australian data in a four variable VAR model. The other two variables included in their analysis are the terms of trade and OECD output. They found that exports do not Granger cause productivity; but productivity does Granger cause exports. They also found that OECD output does not Granger cause exports, but OECD output does Granger cause productivity. Marin (1992) looks at the effect of manufacturing exports on labor productivity (manufacturing output per employee) at the macro level, she found that exports uni-directionally Granger-cause labor productivity for Germany, Japan, the UK, and the US (except there may be evidence of Granger causality of labor productivity on exports also for Japan at the 10% level). Marin uses four-variables VAR model considering the same type of variables as in Kunst and Marin (1989), discussed above. Similar to that study, Marin found for all four countries that OECD output does not Granger cause exports, but that OECD output Granger causes productivity. One exception is that Marin found OECD output does not Granger cause US productivity. Based on bivariate analysis, Bodman (1996) reports that exports cause labor productivity growth in Australia and Canada without any feedback except in the Canadian manufacturing sector, for which there is a small, significant causal effect of exports. In another bivariate study Hatemi-J and Irandoust (2001) conduct tests for cointegration and causality between productivity and real exports for several industrial countries using symmetric error correction models. The authors use two measures for productivity labor productivity and total factor productivity. They concluded that, real exports Granger cause, without feedback, labor productivity in France, Italy, Germany, and Sweden. For the UK causality is bi-directional. When total factor productivity is used, their estimated results showed that, causality is running in both directions in Germany, Italy, and the UK. In France total factor productivity causes exports and in Sweden causality exists in the opposite direction. Similarly, In the present text we investigate the two relations the effect of export on output growth and productivity – through two VAR models for the economy of India. In one VAR model we include real export, domestic real GDP and foreign real GDP (proxied by summing the GDP of USA, UK, Germany and Japan). The second VAR model is identical to first one except that instead of using domestic GDP we have included total factor productivity. Our methodology is different from all the previous studied since it involves the application of the VAR to estimate the long run relationship by using multivariate cointegration approach and vector error correction model to check the Granger causality among the variables. The results indicate stable long run relationship among the variables included in the two models. While our result do not support any causal link between export and output growth. But we do found uni-directional causality between export and foreign economic performance to total factor productivity growth. The reminder of the paper is organized as follows, section 2 present the theoretical frame work, section 3 provides methodology, section 4 present the empirical results, and section 5 concluded.

The Theoretical Model

The theoretical model for our empirical study is as follows. Suppose that X represents real exports, Y is domestic real output, and Y^* is foreign real output. We can reasonably expect the following relationships:

$$Y = f(X_L, Y_L^*) \tag{1}$$

And

$$X = g(Y_L, Y_L^*) \tag{2}$$

Where the L subscript indicates a composite of lagged values for the given variable. Thus expressing the variables in natural logarithms, the base regressions are:

$$lnY_t = \alpha_0 + \alpha_1 lnX_t + \alpha_2 lnY_t^* + \varepsilon_1$$

$$lnX_t = \beta_0 + \beta_1 lnY_t + \beta_2 lnY_t^* + \varepsilon_2$$

Where α_1, α_2, β_1 and β_2 are the elasticities and ε_1 and ε_2 are the stochastic terms with standard properties. We expect $\partial Y/\partial X_L^*$ to be positive due to the export-led growth hypothesis. As a result of knowledge spillovers between countries that can occur *without* the help of trade, we have the expectation that $\partial Y/\partial Y_L^* > 0$. The partial derivative $\partial X/\partial Y_L^*$ should be positive since an increase in foreign real income, proxied by foreign real output, will increase the demand for domestic exports. Finally, $\partial X/\partial Y_L$ is expected to be positive. This may be true since if the increased domestic demand is not sufficient to cover the increase in output (due to low domestic absorption or high domestic savings), exports should increase as greater efforts are put into finding additional markets abroad for the excess output, as explained by Kindleberger (1996). This can be exceptionally important for smaller economies. The necessity to export production not covered by domestic demand is the "vent for surplus" argument, as noted by Mill (1848), who with criticism attributed it to Adam Smith and the mercantilists, and as espoused and elaborated upon by Myint (1958) with respect to trade for underdeveloped countries.

Kaldor (1967) claimed that higher economic growth naturally leads to faster import growth, and that ultimately necessitates greater export growth to avoid balance of payments deficits that could hinder further economic growth. Greater export growth is made possible by an important outcome of economic growth–increased productivity. The important linkage from productivity to exports is discussed next.

Kaldor (1967) noted that productivity increases lead to lower unit costs, resulting in improved competitiveness that makes it easier to increase sales abroad. In Kaldor's arguments, productivity increases can arise as economic growth allows greater utilization of economies of scale. In Vernon's (1966) product cycle theory, economies of scale may be exploited through mass production for a maturing product due to commitment on product standards. The originating country (that developing the product) is also hypothesized to export more during the maturing period. This occurs due to there being increasing demand in other countries for the product while the cost of producing and shipping the product from the originating country to the others is cheaper than producing the product in those countries. Implicit in Vernon's theory therefore is that the greater the productivity improvement drops in cost-per-unit in production) for a product due to economies of scale in the originating country, the more it can export of the product.

To examine the interactions of productivity with exports and output, we find it useful to estimate a closely related model to the one presented in Equations in (1) and (2). The new model has real GDP, Y, replaced by total factor productivity, ϕ, and likewise Y_L replaced by ϕ_L, leading to Equations (3) and (4):

$$\Phi = f(X_L, Y_L^*) \tag{3}$$

And

$$X = g(\Phi_L, Y_L^*) \tag{4}$$

Expressing the variables in natural logarithms, the base regression are:

$$\ln \Phi_t = \gamma_0 + \gamma_1 lnX_t + \gamma_2 lnY_t^* + \mu_1$$

$$lnX_t = \delta_0 + \delta_1 ln\ \Phi_t + \delta_2 \ln Y_t^* + \mu_2$$

Where γ_1, γ_2, δ_1 and δ_2 are the elasticities and μ_1 and μ_2 are the stochastic terms with standard properties. Where again the first-order partial derivatives of each of the two above equations are all positive. Since the signs of the partial derivatives involving Y or Y_L for equations (1) and (2), i.e. $\partial Y/\partial X_L$, $\partial Y/\partial Y_L^*$ *and* $\partial X/\partial Y_L$, were based at least in part upon changes-in-productivity arguments, those same arguments can be used for the signs for the corresponding partial derivatives in (3) and (4). Φ is positively affected by increases in X_L due to the export led growth hypothesis, and it is positively effected by the increase in Y_L^* due to the occurrence of knowledge spillovers between countries that can occur without the help of trade. X is positively affected by increases in Φ_L since increased productivity reduces the cost of production, making the exports more competitive, and it is positively affected by increases in Y_L^* since an increase in foreign income (again, proxied by foreign output) will increase the demand for these exports.

Empirical Methodology

The distinction between whether the levels or differences of a series is stationary leads to substantially different conclusions and hence test of non-stationarity that is unit roots are the usual practice today. Engle and Granger (1987), define a non-stationary time series to be integrated of order d if it achieves stationarity after being differentiated d. times. This notion is usually denoted by $X_t \sim I(d)$. Hence all the series are tested for the probable order of difference stationarity by using the augmented Dickey-Fuller (ADF) tests. ADF test is a standard unit root test, it analyze order of integration of the data series. These statistics are calculated with a constant and a constant plus a time trend, respectively these tests have a null hypothesis of non-stationarity against an alternative of stationarity. ADF test to check the stationarity of the series is based on the equation of the form:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta\, Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t$$

ε_t is a pure white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$ etc.

These tests determine whether the estimates of δ are equal to Zero. Fuller (1976) provided the cumulative distribution of the ADF statistics, if the calculated t-ratio of the coefficient δ is less than the critical value from Fuller table, then Y_t is said to be stationary. (Note that 't' ratio of coefficient δ is always with a negative sign). Now, consider for example two series X_t and Y_t both integrated of order (d). Engle and Granger have shown that their linear combination will in general also be I (d). It is an empirical fact that many important macroeconomic variables appear to be integrated of order (d) [or I (d) in the terminology of Engle and Granger (1987)] so that their changes are stationary. Hence, if the variables in the two VAR model are each I (d) than it may be true that any linear combination of these variables will also be I (d). Having established that all the series are integrated of order (d) that is I (d) the study then proceed to determine the long run behavioral relationships among these variables For the purpose to examine the long run relationship among the variables, they must be co-integrated.

Testing Co-Integration Using Vector Autoregressive (VAR) Approach

The VAR model used is denoted as follows:

$$X_t = \rho_1 X_{t-1} + \rho_2 X_{t-2} + \ldots\ldots\ldots + \rho_k X_{t-k+t} + \eta + \mu_t \quad 1 \leq t \leq T$$

Where $\mathbf{X}_t$ is a vector containing Y, X and Y^* in one model and Φ, X and Y^* in other model.

Starting from the highest possible lag order, and sequentially testing down to the lowest, the optimal lag order is chosen based on AIC and SC. This optimal lag order is to be used in the co-integration and Granger-causality tests based on vector-error correction model. The lag order is determined to be 2 for the model containing Y_t, X and Y^*_t while for the model containing ϕ_t, X_t and Y^*_t the lag is decided to be 5. This is justifiable when using quarterly data. After running the VAR model and obtaining the most efficient lag order by observing the AIC and SC values long run relationship among the variables have been tested using the Johansen co-integration technique. Two or more variables are said to be co-integrated if their linear combination is integrated to any order less than 'd'. Co-integration test provides the basis for tracing the long-term relationship. The theory of co-integration put forward by Johansen and Juselius (1990) indicate that the maximum likelihood method is more appropriate in a multivariate system. Therefore this study used this method to identify the number of co-integrated vectors in the model. The selection of "r" co-integrating vector is based on the two statistics defined by Johansen as the maximal eigen-value and the trace statistic. There are "r" or more co-integrating vectors. The Johansen model is given by:

$$\Delta \chi_t = a_0 + \Pi \chi_{t-1} + \sum_{i=1}^{k} \theta_i \Delta \chi_{t-k} + \omega_t \quad 1 \leq t \leq T$$

Where $\mathbf{X}_t$ is a column vector of m endogenous variables, Π and θ are $m \times m$ matrices of unknown parameters and ω_t is a Gaussian error term. can be dichotomised into two $m \times r$ matrices Ω and σ. The reduced rank $r < m$ of Π is hypothesized as H(r): $\Pi = -\Omega\,\sigma^T$. The vectors of σ representing the r linear combinations of $\sigma^T\,\mathbf{X}_t$ are stationary. The matrix Ω represents the error-correction parameters. To investigate the relationship, two main test likelihood ratio test (also known as the trace test to evaluate the null hypothesis of at most r co-integrating vectors) and the Maximum eigenvalue test (used to evaluate the null hypothesis of r co-integrating vectors against the alternative of (r+1) co-integrating vectors) are used.

Vector Error Correction Model (VECM)

If $\mathbf{X}_t$ have r co-integrating vectors, then each $\mathbf{X}_t$ will have an error correction model representation of the form:

$$\Delta x_t = \sum_{t-i}^{k} \Gamma_t \, \Delta x_{t-i} + \Pi \, x_{t-k} + \mu + \eta_t$$

Where, **X**t is the vector of the growth rates of the variables and Ãs are estimable parameters. After expansion, the following system of equations is obtained for model 1:

$$\Delta Y_t = \alpha_o + \sum_{i=1}^{s} \alpha_{1i} \Delta Y_{t-i} + \sum_{j=1}^{u} \alpha_{2j} \Delta X_{t-j} + \sum_{k=1}^{v} \alpha_{3k} \Delta Y^*_{t-k} + \alpha_4 \vee_{t-1} + \mu_{1t} \quad (5)$$

$$\Delta X_t = \beta_o + \sum_{i=1}^{s} \beta_{1i} \, \Delta Y_{t-i} + \sum_{j=1}^{u} \beta_{2j} \Delta X_{t-j} + \sum_{k=1}^{v} \beta_{3k} \, \Delta Y^*_{t-k} + \beta_4 \vee_{t-1} + \mu_{2t} \quad (6)$$

For the second model:

$$\Delta\phi_t = \gamma_o + \sum_{i=1}^{s}\gamma_{1i}\,\Delta\phi_{t-i} + \sum_{j=1}^{u}\gamma_{2j}\,\Delta X_{t-j} + \sum_{k=1}^{v}\gamma_{3k}\,\Delta Y^*_{t-k} + \gamma_4 \vee_{t-1} + \mu_{3t} \quad (7)$$

$$\Delta X_t = \lambda_o + \sum_{i=1}^{s}\lambda_{1i}\,\Delta\phi_{t-i} + \sum_{j=1}^{u}\lambda_{2j}\,\Delta X_{t-j} + \sum_{k=1}^{v}\lambda_{3k}\Delta Y^*_{t-k} + \lambda_4 \vee_{t-1} + \mu_{2t} \quad (8)$$

Where, V_{t-1} is the residuals from the co-integrating equations (Error correction term). The Error Correction Term (ECT) is thus given by a stationary linear combination of the residuals at single lag. The ECT reflects the temporal status of the long-run relationship in the system. The sign and size of the estimated coefficient on the ECT in each equation reflects the direction and speed of adjustment of the dependent variable to temporary deviations from the long-run equilibrium summarized by the co-integrating vector. For example, a negative and significant coefficient on the ECT in Equation ΔY_t would imply a positive response of growth to fluctuations that depress the value of the stationary combination. If, however, ECT is insignificant, that would indicate the absence of any long-run adjustment of the growth measure to movements amongst the system's variables.

Data and Variables

For empirical estimation this study used the data on real export taken from International Financial Statistics (IFS), and economic growth (real GDP), is taken from Penn world table, while TFP (representing productivity level of the country) is derived by taken the relevant variables from Penn world table[2]. Data on real foreign GDP is calculated by summing the real GDP of USA, UK, Germany and Japan taken from the Penn World Table. Analysis is performed by using the annual data spanning the period from 1950 to 2000[3]. All these variables are expressed in natural logarithm and hence their first differences approximate their growth rates.

Results and Discussion

The preliminary step in our analysis is concerned with establishing the degree of integration of each variable. For this purpose we tested for the existence of a unit root in the level and first difference of each of the variables in our sample using the well-known Augmented Dickey- Fuller procedure (ADF test). ADF test statistic checks the stationarity of the series. The result presented in Table 1 reveals that all variables are non-stationary in their level data. However, the stationarity property is found in the first/second differencing level of the variables.

After establishing that all the individual series under consideration are stationary, two VAR models are used to estimate the co-integrating vectors among the variables. As mentioned earlier that, Johansen and Juselius (J-J) maximum likelihood approach is most appropriate for the co-integration test. The result from the J-J test are summarized in table 2 and 3, where both the maximal-eigen value and trace values are used to examine the null hypothesis of no co-integration against the alternative of co-integration.

Starting with the trace statistics, the variables of model 1 (based on equations 1 & 2), show that, there are 2 co-integrating vectors among the three variables. Now turning to the maximal-eigen value test, the null hypothesis of no co-integration is rejected at 5% level of significance in favour of the general alternatives of two co-integrating relationship. Based on the two tests it is confirmed that, there are 2 co-integrating relationship amongst the three I (1) variables of model 1 (based on equation 1 and 2). Now, moving to model 2 (based on equations 3 & 4) and Starting with the null hypothesis of no co-integration among the variables the trace statistics is found above 5% critical value hence it rejects the null hypothesis. As is evident from Table 3, there is only 1 co-integrating relationship among these three variables. The maximal eigenvalue test, do not reject the null hypothesis of no co-integration at 5% level of significance in favour of the general alternative, hence, overall this confirms the conclusion that there is only 1 co-integrating relationship amongst the three I (1) variables included in model two.

Therefore, our annual data from 1950 to 2000 appears to support the proposition that in India there exist a long run relationship among export, output and foreign economic performance and among export, total factor productivity growth (TFP) and foreign economic performance.

Once a co-integrating relationship is established, then a VECM can be estimated to determine the short run behavior among the variables of the two models. Table 4 and 5 reports the results of VECM formulation (Equation 5, 6 of model 1 and 7, 8 of model 2). According to Engle and Granger (1987), co-integrated variables must have in VECM representation. The VECM strategy provides an answer to the problem of spurious correlation. Technically, the error correction term measures the speed of adjustment back to the co-integration relationship. The VECM posited to be a force causing the integrated variables to return their long run relation when they deviate from it, and thus the longer the deviation; the greater would be the force tending to correct the deviation [Banerjee, Galbraith and Henry (1994)]. The coefficients on the lagged values of ΔLY_t, ΔLY_t^*, ΔLX_t and $\Delta L\Phi_t$ are short run parameters measuring the immediate impact of independent variables. In equation 5, the coefficients of lagged values of ΔLY_t^* and ΔLX_t are statistically insignificant, showing no impact of independent variables on ΔLY_t, in the short run, the same is true for the equation 6. While the coefficient of lagged value of ΔX_t and ΔLY_t^* are significant in equation 7, thus indicating the immediate impact on $\Delta L\Phi_t$ in short run. But the coefficient of lagged value of $\Delta \mathbf{L}\Phi_{\mathbf{t}}$ and ΔLY_t^* are found insignificant. Estimation of equation 8 thus indicates no immediate impact of independent variables on ΔX_t in short run. Whereas, the error correction terms of all the equations (V_{t-1}) are statistically significant at 5% level suggesting a powerful long run causality running in the two models.

Overall it could be concluded that, for India that, there is no causal relationship exists between export growth and output growth. Because our finding indicated that, not only export does not cause output growth but also out put growth does not Granger cause export growth.

While by replacing output growth to total Factor productivity, our result showed, strong causality running from export growth to total factor productivity. As far as foreign economic performance is concerned our result do support the hypothesis that foreign economic performance impact total factor productivity growth in India. It means that the spill over of knowledge between India and Trading Countries is strong. According to Helpman *et al.* (1991), countries to benefit (through spill over of knowledge) in this way necessary to have a trading partner that are capable of providing it with products and information in which the country is in short supply. It depends on the trade partners' accumulated knowledge that is embodied in products, technologies and organizations. Thus by trading with an industrial country that has a larger 'stock of knowledge' a developing country stands to gain more in terms of both the products it can import and the direct knowledge it can acquire than it would by trading with another developing country.

Conclusions

The theoretical and empirical literature on economic growth and its determinants is extensive and continues to grow. The literature ranges from theories of neoclassical growth (Solow, 1956; Swan, 1956) and endogenous growth (e.g. Romer, 1994) to empirical estimations which are becoming more refined, include more variables and use a variety of estimation methods as interest expands. Much of the literature investigates the role of convergence (Mankiw, Romer and Weil, 1992; Barro and Sala-i-Martin, 1992; Caselli, Esquivel and Lefort, 1996) while other researchers seek to determine the relationship between their variable (s) of interest and growth, e.g., inflation and growth (Barro, 1996b) or the role of R & D in the growth process (Nonneman and Vanhoudt, 1996); the list goes on. This study, however, is selective in choosing the variables.

This study investigates the effects of export and foreign economic performance on total factor productivity and output growth for time-series data set of India. Our results show that giving the economy a greater outward orientation benefits total factor productivity. We capture outward orientation through the export. While it expansion fails to have an independent effect on output growth. Further more on investigating the effect of foreign economic performance on the domestic variable (total factor productivity and domestic output), we found the effect to be significant only in case of total factor productivity. While the study do not found any causal effect of foreign economic performance on domestic output.

Finally, even though a strong positive influence of export and foreign economic performance on total factor productivity possesses obvious implications for policy, we conclude with a strong word of caution. Productivity is affected by increases in export due to the export led growth hypothesis, and it is positively affected by the increase in foreign economic performance due to the occurrence of knowledge spillovers between countries that can occur without the help of trade. It means that the spill over of knowledge between India and Trading Countries is strong. Hence to benefit (through spill over of knowledge) in this way it is necessary that India should have a trading partner that are capable of providing it with products and information in which the country is in short supply. This is most likely to be achievable after the implementation of WTO in 2005. India has recognized that trade liberalization is beneficial for global economy; freer trade has been benefiting the developing countries by providing them opportunity to trade with developed countries.

Despite its economic and political difficulties, India has taken steps since its previous Review to liberalize its trade and investment regimes, either unilaterally or in the context of commitments made in the WTO, IMF, and the World Bank. Over the past two years, efforts in several crucial areas have seemingly intensified, with the result that India is becoming a more open and secure market for its trading partners.

Notes

1. See Woo S. Jung and Peyton J. Marshall, "Exports, Growth, and Causality in Developing Countries," *Journal of Development Economics* 18 (may-June 1985): 2, table 1.
2. See appendix for the derivation.
3. The study has used the annual observations first because; the impact and adjustment lags of various macroeconomic relations such as M1 and GEXP are too long for monthly or even quarterly observations to reflect the actual correlation between these macroeconomic variables though annual observations yield smaller degrees of freedom, the noisy effects associated with monthly or even quarterly observations tend to average out with annual data which better approximate Mi or money GEXP relationship (See, Masih and Masih 1975 and Spencer 1989). Second, Hakkio and Rush (1991), Van Den Berg and Taynetti (1993) have contended that co-integration is a long run concept and hence requires long span of data to give co-integration much power. The length of time series is far more important than the frequency of observation.

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Appendix-A: (Empirical Results)

Table 1
Unit Root Test

Variables	*Level*		*First Difference*		*Second Difference*	
	Constant	*Constant& Trend*	*Constant*	*Constant& Trend*	*Constant*	*Constant & Trend*
LY*	-0.7207	-0.3814	-2.1130	-2.2445	-7.0472*	-7.0375*
LX	-1.6836	-1.8965	-4.9433*	-4.9560*		
LY	0.7417	-2.6943	-3.5280**	-3.4652***		
LΦ	-0.6133	-2.0834	-4.8138*	-4.7625*		

Note: Critical values are: -3.61, -2.94, -2.61 (significant at 1%, 5%, 10% respectively when 1st difference is constant), and -4.22, -3.53, -3.21 (significant at 1%, 5%, 10% respectively when 1st difference is constant & trend). *, **, ***, Represent significant at 1%, 5% and 10% respectively.

Table 2
Johansen Maximum Likelihood Co-Integration Test Results
For LY_t, LY^*_t and LX_t (lags 1-2)

	Likelihood Ratio	*5 Per cent Critical Value*	*1 Per cent Critical Value*	*Max. Eigenvalue*	*5 Percent Critical Value*	*1 Per cent Critical Value*
R=0	42.95055*	29.68	35.65	23.02908**	20.97	25.52
R<=1	19.92147**	15.41	20.04	16.487312**	14.07	18.63
R<=2	3.434158	3.76	6.65	3.434158	3.76	6.65

Note: * (**) represent significant at 1% (5%). Johansen co-integration test provides two Co-integrating equations at 5% significant level.

Table 3
Johansen Maximum Likelihood Co-Integration Test Results
For $L\Phi_t$, LY^*_t and LX_t (lags 1-5)

	Likelihood Ratio	***5 Per cent Critical Value***	***1 Per cent Critical Value***	***Max. Eigenvalue***	***5 Per cent Critical Value***	***1 Per cent Critical Value***
R=0	30.98144**	29.68	35.65	19.67633	29.68	35.65
R<=1	11.30511	15.41	20.04	5.910847	15.41	20.04
R<=2	5.394263**	3.76	6.65	5.394263	3.76	6.65

Note: * (**) represent significant at 1% (5%). Johansen co-integration test provides one Co-integrating equations at 5% significant level.

Table 4
Granger Causality Based on Error Correction Model

Dependent Variable	*F-statistics for* $\Sigma\Delta LY_{t-i}$	*F-statistics for* $\Sigma\Delta LY^*_{t-j}$	*F-statistics for* $\Sigma\Delta LX_{t-k}$	*t-statistics for* V_{t-1}
ΔLY_t	12.163*	2.043	1.391	-4.319*
ΔLX_t	1.811	1.688	3.289**	-2.494**

Note: *, **, *** represent significant at 1%, 5% and 10% respectively.

Table 5
Granger Causality Based on Error Correction Model

Dependent Variable	*F-statistics for* $\Sigma\Delta L\Phi_{t-i}$	*F-statistics for* $\Sigma\Delta LY^*_{t-j}$	*F-statistics for* $\Sigma\Delta LX_{t-k}$	*t-statistics for* V_{t-1}
$\Delta\ \mathbf{L\Phi_t}$	4.335*	2.555**	6.364*	-3.804*
$\Delta\ \mathbf{LX_t}$	0.312	1.466	1.510	-2.354**

Note: *, **, *** represent significant at 1%, 5% and 10% respectively.

Appendix-B
DERIVATION OF TFP

We generate a capital stock series prior to the generation of TFP series. Series is derived by using the perpetual inventory method. We initialized the capital stock series in the first year for the Penn world table (version 5.6) provide investment data, setting the capital stock equal to the average investment/GDP ratio in the first five years of data, multiplied by the level of GDP in the initializing period, and divided by 0.1, our assumed depreciation rate. This is the capital stock we would expect in the initial year if the initial investment/GDP ratio is representative of previous rates. Each succeeding period's capital is given by current capital minus depreciation at 10%, plus the level of current investment to derive the capital stock series of each preceding years. This series is used for the further calculation of TFP series. We start this estimation of TFP series by first explaining how TFP measure is being derived within the context of neo-classical growth model. Considering a simple Cobb-Douglas production function of the form:

$$Y=AK^{\alpha}L^{1-\alpha} \qquad (1)$$

By dividing the equation (1) by labour input

$$Y = A + \alpha\ K \qquad (2)$$

Where; Y is labour productivity or output per labour, K is capital labour ratio, A is rate of growth of TFP and a is the rate of growth capital output ratio.

From equation 2, TFP growth is being measured. TFP growth is calculated as a residual by subtracting the contribution of growth in the capital labour ratio from labour productivity growth.

$$TFP = LP + \alpha k$$

Here, *LP* is the labour productivity and α is the marginal productivity of capital (under the assumption of perfect competition and constant return to scale this parameter become equal to capital share in output). Variables used in the calculation of TFP are taken from Penn World Table compiled by Summer and Heston (1991).