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Foreign trade policy and economic growth: Indian evidence

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Abstract. *The present study seeks to examine the impact of foreign trade policy on economic growth and thus, annual data regarding export, import and GDP are collected from the annual report of the Reserve Bank of India (RB) over a period from 1970 to 2018 and crossed checked with the data posted on the official website of the RBI. Johansen co-integration test is applied to measure the long run relationship between the variables and the short run dynamic is examined by VECM. Here, dummy variable is used to examine the impact of new economic policy on economic growth for foreign trade policy and it is evident that adoption of NEP in 1991 has positive impact on Indian economic development and it is influential for foreign trade policy.*

Keywords: GDP, export, import, Dummy, VECM.

JEL Classification: C12, C15, C32.

Introduction

A large number of studies within financial economies have explored the relationship between foreign trade policy (export and import) and economic growth (GDP). Most of the studies have shown a clear connection between them. Much of the established studies have shown on how macroeconomic variables affect GDP but how those variables and economic growth simultaneously affect each other have been less studied in developing as well as economically poor countries. It is assumed that economic growth of a country is largely depends on foreign trade. But, before going to establish this relationship, application of co-integration technique (Johansen, 1988; Johansen and Juselius, 1990) is important to examine the existence of long run economic association among the variables and thereafter short run dynamic relationship is examined among the macro economic variables within VAR framework which is common in literature (Granger, 1981; Engle and Granger, 1987; MacDonald and Power, 1995).

The year 1991 carries a significant milestone in Indian economy. After independence the country plunged into a severe economic crisis triggered by a severe balance of payments situation. This catastrophe was converted into an opportunity after introducing some fundamental changes in the content and move towards to new economic policy. Former Prime Minister Dr. Manmohan Singh felt the urgency of economic reforms in our country and finally launched the new economic policy (NEP) in 1991 by then the former Union Finance Minister Dr. Manmohan Singh (to be considered Father of New Economic Policy) with various changes in Indian economy like introduction of LPG system, bring down the rate of inflation and remove imbalances in payments, move towards higher economic growth and to build sufficient foreign exchange reserves, economic stabilization and to convert the economy into a market economy by removing all kinds of unnecessary restrictions, permit the international flow (goods, services, capital, human resource and technology) without many restrictions and participation of private players in all sectors of the economy and so on. After the introduction of new economic policy, foreign trade has played an important role for Indian economic growth. So, it may be established that introduction of new economic policy in foreign trade policy must have a positive impact on economic growth.

With this nous, dummy variable is incorporated in VAR framework to examine the impact of new economic policy on economic growth. Thereafter, long run equilibrium relationship is established among them and then short run causal relationship is checked and finally, the study is ended with model’s diagnostic checking and stability analysis.

Literature survey

In financial economics, lot of studies has examined the impact of foreign trade policy on economic growth. Some of the studies have shown existence of causality relationship between them. Many of them have observed indecisive results. Although, the research on this issue has got immense importance to the academicians as well as professionals. There are two strands of literatures. One is looking for to establish the long run relationship based on co-integration analysis and the other is to establish the short run dynamics with causality analysis. The following are the important studies which facilitate to develop the present study.

The literature survey starts with the names Roll and Ross (1986) who examine the causal relationship between the macroeconomic variables and their effect on the stock market prices over a period from 1953 to 1983. They observe that impulses or shocks in macroeconomic variables significantly affect the stock market prices (see also Kim 2003).

Bahmani and Soharabian (1992) examine the relationship between stock prices and foreign exchange markets in US over a period from 1973 to 1983. They observes that unidirectional causality running from stock price to exchange rate based on final prediction error (FPE) but when FPE and F-statistic both are used then bidirectional causality between stock price and exchange rate are observed.

Mukherjee and Naka (1995) examine the causal relationship between the Japanese stock exchange (JSE) and the macroeconomic variables by applying VECM approach with a sample spanning from 1971 to 1990. They find that JSE is co-integrated with the macroeconomic variables and presence of long run equilibrium relationship (Naik and Pahdi, 2012).

Another study by Abdalla and Murinde (1997) inspect the causal relationship between the foreign exchange rate and the stock market by considering monthly data from 1985 to 1994 of four developing countries by using co-integration and Granger causality tests. They observe that foreign exchange rate causes stock market in unidirectional way in Pakistan, Korea and India but there is no evidence of causation between exchange rate and stock market in Philippines.

Gjerde and Saettem (1999) examine the causal relationship between the Norwegian market and the macroeconomic variables over a period from 1974 to 1994 by using a multivariate vector autoregressive system. They observe that stock market has a positive reaction towards industrial production but negatively related to the changes in real interest rates. They also observe that stock price react in response accurately towards changes in the oil price.

In 2000 Granger et al apply Granger causality test and impulse response function to examine the relationship between the stock prices and the exchange rate by considering some Asian countries over a period from 1986 to 1997. They divide the whole period in three sub periods. They observe that there is a unidirectional causality running from exchange rate to stock price and stock price to exchange rate in Hong Kong and South Korea respectively in first period. They also find unidirectional causality exists between foreign exchange and stock market in Malayasia and Philippines but opposite relationship presents in Taiwan economy in period two. Finally, unidirectional causality exists between these variables in Taiwan market and opposite in Japan, Thailand, Singapore and Hong Kong economics in the last period. They also observe evidence of bidirectional causality between these variables in Indonesia, South Korea, Malaysia and Philippines markets.

Similarly, Maysami and Koh (2000) inspect the long run equilibrium relationship between the Singapore stock exchange and the selected macroeconomic variables in addition to Japan and US stock indices by considering twenty years of data. They find a significant relationship exist between the Singapore stock market and the macroeconomic variables (interest rate and exchange rate) in the long run and also observe that Singapore stock market is positively co-integrated with the Japanese and American stock markets (Hussainey and Ngoc, 2009).

Fang and Miller (2002) examine the causal relationship between the foreign exchange rate and the stock market performance in Korean market during the market recession and observe that foreign exchange significantly influences stock market at that time (Bhattacharya and Mukherjee, 2003; Muhammad and Rasheed, 2003; Stavarek, 2005).

In 2009, Humpe and Macmillian examine the causal relationship between the stock prices and the macroeconomic variables by considering US data and find existence of long run relationship between the variables which is consistent with the results of Kim (2003).

In 2011, Pal and Mittal examine the causal relationship between the macroeconomic variables and Indian stock markets and observe co-integration relationship between them. The study also reveals that inflation has a significant impact on stock markets.

Masuduzzaman (2012) examines the causal relationship between the macroeconomic variables and the stock markets in UK and Germany by taken into consideration data from 1999 to 2011. It is found that a significant relationship exists between the macroeconomic variables and the stock markets in short run as well long run.

Tangjitprom (2012) also examines the lead-lag effect of the stock market performance in Thailand and finds that the selected macroeconomic variables are statistically significant to explain the stock return.

Saaed in 2015 investigates the impact of import and export on economic growth over a period from 1977 to 2012 in Tunisia. The study shows that economic growth follows Granger causality for exports and imports and also indicates that unidirectional causality observes among imports and exports and between exports and economic growth (see. Elbeydi 2010, Ramos 2000 etc.).

Similarly in 2016, Plihal conducts a study for examining the liaison between the German stock market and the macroeconomic variables and observes unidirectional relationship running from the stock market to the macroeconomic variables. Additionally, bidirectional causality is running from the stock market to money supply and vice versa.

Similarly, Kotha and Sahu (2016) observe that the Indian stock market has a long run relationship with the macroeconomic variables (exchange rate, interest rate, inflation and money supply).

Sampath kumar (2016) examines the relationship between exports and economic growth in India. The study shows that GDP growth causes export growth and the impulse response functions generated also indicate that there are higher reactions of exports over a change in GDP (Kundu 2013, Mehrara, 2011, etc.).

After a comprehensive review of literature it is evident that co-integration relationship exists among the macroeconomic variables and there is an existence of unidirectional or in some cases bi-directional causality. Some of the studies have depicted existence of long run causal relationship between them and vice versa. Many of them have depicted inconclusive results. So, the causal relationship between the foreign trade policy and economic growth are mixed in nature. At this juncture, the present study tries to examine the co-integration and causal relationship between foreign trade policy and economic growth in Indian context by using a dummy variable in VAR framework in a situation when adoption of NEP in foreign trade policy is influential or not for economic development.

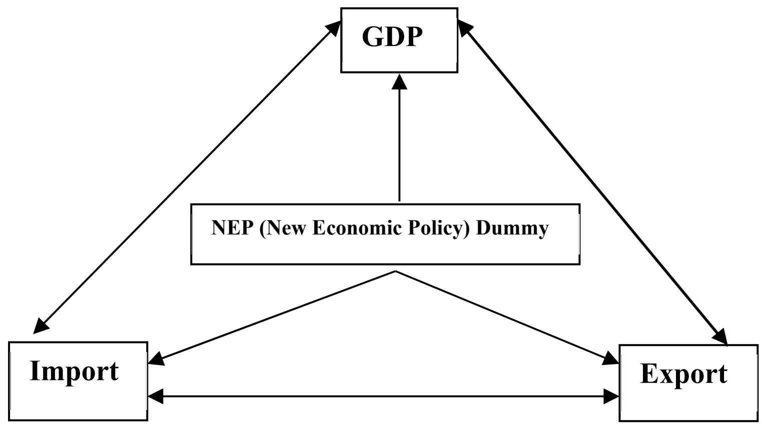
Data and study period

The study uses annual data over a period from 1970 to 2018 to examine the above issues. So, annual GDP, export and import (US $ million) are considered and they are collected from the annual reports of the Reserve Bank of India.

Theoretical framework

After a review of literature the following conceptual model is developed and presented in figure one (Fig.1), which depicts the causal relationships between foreign trade policy and economic growth with dummy variable effect.

Figure 1. *The conceptual framework*



Methodology

The study uses dummy variable in error correction model (ECM) to capture the effect of foreign trade policy on economic growth in a situation when NEP is introduced in India. Here, it is assumed that:

D = 0, when India didn't adopt (NEP) new economic policy on foreign trade policy (from 1970 to 1990).

D = 1, when India adopts new economic policy on foreign trade policy (from 1991 to 2018).

If the coefficient of the dummy variable is found to be positive and statistically significant that means introduction of new economic policy (NEP) on foreign trade policy has positive impact on economic development. So, before going to develop an ECM, the variable must be stationary and integrated with same order. A time series is said to be stationary if its mean and variance are constant over time and the value of the covariance (autocorrelation coefficient) between the periods depends only on the distance or lag between the two time periods, not on the actual time at which the covariance is computed (Gujarati, 2011). So, a time series is said to be stationary if the following conditions are satisfied:

i. Mean: $E(Y_t) = \mu$ (constant for all 't')

ii. Variance: $Var(Y_t) = E(Y_t - \mu)^2 = \sigma^2$ (Constant for all 't')

iii. Covariance: $Cov(Y_t, Y_{t+k}) = \gamma_k = E[(Y_t - \mu)(Y_{t+k} - \mu)]$

Where, γ_k, covariance at lag 'k', is the covariance between the values of Y_t and Y_{t+k}, that is between two Y values 'k' periods apart. If k = 0, then we get γ_0, which is simply the variance of $Y(= \sigma^2)$; if k = 1, γ_1 is the covariance between two adjacent values of Y. Thus, a time series is said to be stationary when it's mean, variance and auto covariance (at various lags) remain same at any measuring point of time, i.e., they are time invariant. According to Gujrati (2003), such time series tends to return its mean (mean reversion) and fluctuates around this mean (variance) will have broadly constant amplitude. It is assumed that in general econometric time series is non stationary but they are become stationary after differencing.

Now start with a random walk model without drift can be defined as follows:

Suppose μ_t is a white noise error term with mean 0 and variance σ^2. The Y_t is said to be a random walk if:

$$Y_t = Y_{t-1} + \mu_t \quad (1)$$

The basic idea of a random walk is that the values of the series today (Y_t) is its value of the yesterday (Y_{t-1}), plus an unpredictable change (u_t). From equation 1 it can be written as:

$$Y_1 = Y_0 + \mu_1$$

$$Y_2 = Y_1 + \mu_2 = Y_0 + \mu_1 + \mu_2$$

$$Y_3 = Y_2 + \mu_3 = Y_0 + \mu_1 + \mu_2 + \mu_3$$

$$Y_t = Y_{t-1} + \mu_t = Y_0 + \mu_1 + ... + \mu_t$$

Generally, if the process starts at some time 0 with a value Y_0, then

$$Y_t = Y_0 + \sum\mu_t \quad (2)$$

Thus, $E(Y_t) = E(Y_0 + \sum\mu_t) = Y_0$

In like fashion, it can be shown that

$Var(Y_t) = E(Y_0 + \sum\mu_t - Y_0)^2 = E(\sum\mu_t)^2 = t\sigma^2$

Hence, the mean of Y_t is equal to its initial value, which is constant, but as 't' increases its variance increases indefinitely thus, violating the condition of stationarity.

Now, it can be rewritten equation 1 as:

$$(Y_t - Y_{t-1}) = \Delta Y_t = \mu_t \qquad (3)$$

Where, ΔY_t is the first difference of Y_t. It is easy to show that, while Y_t is stationary, its first difference will be stationary. This is very significant when working with time series data which is popularly known as difference stationary (stochastic) process (DSP).

Similarly, random walk with drift can be written as:

$$Y_t = \delta + Y_{t-1} + \mu_t \qquad (4)$$

Where, δ is known as the drift parameter. The name drift comes from the fact that if equation 4 can be written as:

$$Y_t - Y_{t-1} = \Delta Y_t = \delta + \mu_t \qquad (5)$$

It shows that Y_t drifts upward or downward, depending on δ being positive or negative. So, random walk with drift violates both conditions of stationarity:

$E(Y_t) = Y_0 + t_\delta$

$Var(Yt) = t\delta^2$

According to Gujrati (2003), the random walk model is an example of a unit root process. The random walk model in equation 1 as:

$$Y_t = \rho Y_{t-1} + \mu_t \quad (-1 \leq \rho \leq 1) \qquad (6)$$

This model resembles the Markov first-order autoregressive model [AR(1)]. Here, ρ is a real number. If $\rho = 1$, equation 6 becomes a random walk without drift meaning that unit root problem, that is a situation of non stationarity. Technically, if $\rho = 1$, equation 6 can be written as $Y_t - Y_{t-1} = \mu_t$. Now, using the lag operator 'L' so that $LY_t = Y_{t-1}$, $L^2Y_t = Y_{t-2}$ and so on. Then equation 6 again can be written as $(1 - L)Y_t = \mu_t$. If it s set $(1- L) = 0$ then $L = 1$, hence the name unit root. Thus, the terms non stationary, random walk and unit root can be treated as synonymous. If, $|\rho| \leq 1$, that is if the absolute value of 'ρ' is less than 1, then the time series Y_t converges to a stationary time series.

There are many techniques to overcome the problem of stationarity such as autocorrelation function and correlogram, Barlett test, Box-Pierce test, Ljung-Box test, Unit root test, D-F test, ADF test and P-P test. The study uses ADF and P-P tests to check stationarity of the time series data.

Now, start with Dickey and Fuller (1979 and 1981) who develops a procedure to formally test for non stationarity (DF test). The key insight of their test is that testing for the existence of unit root. Thus, the obvious test is the following which is based on the following simple AR(1) model:

$Y_t = \rho Y_{t-1} + \mu_t$ (7)

Here, the null hypothesis is as follows:

H_0: $\rho = 1$

H_a: $\rho < 1$

Now, subtracting Y_{t-1} from both sides of equation 7:

$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + \mu_t$

$\Delta Y_t = (\rho - 1)\ Y_{t-1} + \mu_t$

$\Delta Y_t = \delta Y_{t-1} + \mu_t$ (8)

Where, $\delta = (\rho - 1)$. Here the null hypothesis is as follows:

H0: $\delta = 0$

Ha: $\delta < 1$

In this case if $\delta = 0$ then Y_t is non stationary (pure random walk). Dickey and Fuller (1979) also propose two alternative regression equations which can be used for testing stationarity. The first contains a constant in the random walk model which can be written as:

$\Delta Y_t = \alpha + \delta Y_{t-1} + \mu_t$ (9)

According to Asteriou (2007), this is an extremely important case, because such process exhibit a definite in the series when $\delta = 0$, which is often the case of macroeconomic variables.

The second contains a non stationary stochastic time trend in the model:

$\Delta Y_t = \alpha + \gamma T + \delta Y_{t-1} + \mu_t$ (10)

The DF test for stationarity is simply the normal ‘t’ test on the coefficient of the lagged dependent variable Y_{t-1} from one of the three models (equation 8, 9 and 10). This test doesn’t follow conventional ‘t’ distribution and so need to use Dickey-Fuller tau statistic (Gujrati, 2003).

As the error term is unlikely to be white noise, Dickey and Fuller extend their test procedure suggesting an augmented version of the test (ADF) which includes additional lagged terms of the dependent variable in order to eliminate autocorrelation in the test equation. The lag length on these extra terms is either determined by AIC or BIC or SIC. The three possible forms of the ADF test are given by the following equations:

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \mu_t \quad (11)$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \mu_t \quad (12)$$

$$\Delta Y_t = \alpha + \lambda T + \delta Y_{t-1} + \sum_{i=1}^{p} \beta_i Y_{t-i} + \mu_t \quad (13)$$

The difference between the three regressions concerns the presence of the deterministic elements α and γT.

According to Asteriou (2007), there is a question concerning whether it is most appropriate to estimate equation 11, 12 or 13. Daldo, Jenkinson and Sosvill-Rivero (1990) suggest a procedure which starts from estimation of the most general model given by equation 13 and then answering a set of questions regarding the appropriateness of each model and moving to the next model.

In practical studies, researchers mostly use both the ADF and P-P tests because the distribution theory that support the DF tests is based on the assumption of random error terms [iid(0, σ^2)], when using the ADF technique to make sure that the error terms are uncorrelated and the ADF test procedure that follows for fairly mild assumptions concerning the distribution of errors. The regression for the PP test is similar to equation 9 as follows:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + e_t \quad (14)$$

While the ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right hand side of the test equation, the PP test makes a correction to the 't' statistic of the coefficient δ from the AR(1) regression (semi-difference method) to account for the serial correlation i.e., 'e_t'. So, the PP statistic is the modification of the ADF 't' statistic that takes into account the less restrictive nature of the error process. The asymptotic distribution of the PP 't' statistic is the same as the ADF 't' statistic and thus, the Mackinnon (1991 and 1996) critical values are still applicable.

So, at the beginning stationarity of the time series data is checked in level form and if fails to reject the null hypothesis then continues with testing the first difference and so on to make the series stationary.

Order of integration

After testing unit root test it is important to find out the order of integration of the variables which is very much important for co-integration analysis. In general, macroeconomic time series data are usually non stationary (Nelson and Plosser, 1982) and thus, generate spurious results. There are many mechanisms, differencing is one among them to avoid such problem and if differencing makes the series stationary, it is said that the series is integrated of order one, I(1) but some linear combination of them is I(0). Similarly, the series is said to be integrated of order I(d), then differencing the series ‘d’ times are necessary for the series to become stationary.

Var lag order selection

It is also important in the context of co-integration analysis to select optimal lag length which is very much significant in developing error correction model (ECM). If the lag length differs from true lag length then the estimate is inconsistent (Braun and Mittmik 1993). There are many techniques like Akaike Information Criterion (AIC), Schwarz’s Bayesian Information Criteria (SBIC), Hannan-Quinn Information Criteria (HQIC) and Final Prediction Error (FPE) for choosing optimal lag length. Here, AIC, SBIC and HQIC are used to select the VAR lag length. Here, different information criteria may provide different optimal lag length. The lag length that minimizes loss function yields the residuals that are closet to white noise residuals. For a multivariate VAR with ‘k’ variables, ‘T’ observations, a constant term, and lag length p, the information criteria are given below:

$$AIC(p) = \ln\left|\overline{\Sigma}(p)\right| + \frac{2}{T}(k^2 p) \quad (15)$$

$$SBIC(p) = \ln\left|\overline{\Sigma}(p)\right| + \frac{\ln(T)}{T}(K^2 p) \quad (16)$$

$$HQ(p) = \ln = \left|\overline{\Sigma}(p)\right| + \frac{2\ln\ln T}{T}(k^2 p) \quad (17)$$

Where, $\overline{\Sigma}$ is the quasi-maximum likelihood estimate of the innovation covariance matrix (see, Sin and White 1996).The lag order estimate $\hat{p}$ is chosen to minimise the value of the criterion function for $\{p : 1 \le p \le \overline{p}\}$ where $\overline{p} \ge p_0$ (Quinn 1980; Paulsen and TjQstheim, 1985; Quinn, 1988). It can be shown that $\hat{p}^{SIC} \le \hat{p}^{AIC}$ *for* $N \ge 8$, $\hat{p}^{SIC} \le \hat{P}^{HQC}$ for all T, and $\hat{p}^{HQC} \le \hat{p}^{AIC}$ for $T \ge 16$.

Co-integration

The idea of co-integration is first set forth by Ganger (1981 and 1986) and expanded by Engle and Granger (1987) and Johansen (1988). The economic interpretation of co-integration is that if the series is linked to form an equilibrium relationship in the long run then the series is co-integrated. Thus, the concept of co-integration impersonates the existence of long-run equilibrium to which an economic system converges overtime (Harris 1995) and at the same time to observe the short run dynamics within a multivariate framework. The study uses Johansen (1988) and Johansen and Juselius (1990) maximum-likelihood co-integration technique which is a full information maximum likelihood procedure and is expressed through VAR framework with ‘k’ lags.

$$Y_t = \Omega_1 \Delta y_{t-1} + \Omega_2 \Delta y_{t-2} + \ldots + \Omega_k \Delta y_{t-k} + \prod y_{t-k} + e_t \quad (18)$$

In order to use the Johansen con-integration test, the VAR equation 18 needs to be turned into a vector error correction model (VECM) of the form as under:

$$\Delta Y_t = \Pi y_{t-k} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + ...+ \Gamma_{k-1} \Delta y_{t-(k-1)} + e_t \quad (19)$$

Where, $\Pi = (\sum_{i=1}^{k} \Omega_i) - I_n$ and $\Gamma i = (\sum_{j=1}^{i} \Omega_j) - I_n$

This VAR model contains 'n' variables in first differenced form on the left hand side and 'k-1' lags of the dependent variables in differenced form on the right hand side each with a 'Γ' coefficient matrix attached to it. The Johansen test concentrates on examination of the '∏' matrix which is a long run coefficient matrix, since in equilibrium, all the Δy_{t-i} will be zero, and setting the error terms, 'e_t', to their expected value of zero will leave $\prod y_{t-k} = 0$. The test for co-integration between the 'y' variables is computed by looking at the rank of the '∏' matrix through its eigen values. The rank of a matrix is equal to the number of its characteristics roots (eigen values) that are different from zero. The eigenvalues, denoted by λ_i are put in ascending order $\lambda_1 \geq \lambda_2 \geq ... \geq \lambda_n$. If the λs are roots, in this context they must be less than one (1) in absolute value and positive, and λ_1 will be the largest (i.e. the closet to one), while λ_n will be the smallest (i.e. the closet to zero). If the variables are not co-integrated, the rank of '∏' will not be significantly different from zero, so $\lambda_i \approx 0 \forall i$. The test statistic incorporates $\ln(1 - \lambda_i)$, rather than the λ_i itself, but still, when $\lambda_i = 0$, $\ln(1 - \lambda_i) = 0$. Suppose, the rank (∏) = 1, then $\ln(1 - \lambda_1)$ will be negative and $\ln(1 - \lambda_i) = 0 \forall i > 1$. If the eigenvalue 'i' is non-zero, then $\ln(1 - \lambda_i) < 0 \forall i > 1$. That is, for '∏' to have a rank of 1, the largest eigenvalue must be significantly non-zero, while others will not be significantly different from zero.

Generally, there are two test statistics are available for co-integration under the Johansen approach, which are formulated as under:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \quad (20)$$

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (21)$$

Where, 'r' is the number of co-integrating vectors under the null hypothesis and $\hat{\lambda}_i$ is the estimated value for the i^{th} ordered Eigen value from the '∏' matrix. Intuitively, the larger is the $\hat{\lambda}_i$, the more large and negative will be $\ln(1 - \hat{\lambda}_i)$ and hence the larger will be the test statistic. Each eigenvalue will have associated with it a different co-integrating vector, which will be eigenvectors. A significantly non-zero eigenvalue indicates a significant co-integrating vector.

λ_{trace} is a joint test where the null is that the number of co-integrating vectors is less than or equal to 'r' against an unspecified or general alternative that there are more than 'r'. It starts with '*p*' Eigen values, and then successively the larger is removed. $\lambda_{trace} = 0$ when all the $\lambda_i = 0$, for i = 1, ..., n.

Whereas, $\lambda_{\max}$ conducts separate tests on each Eigen value and has as its null hypothesis that the number of co-integrating vectors is ‘r’ against an alternative of ‘r + 1’.

Here, Johansen and Juselius (1990) provide critical values for the two statistics. The distribution of the test statistics is non-standard, and the critical values depend on the value of ‘n – r’, the number of non-stationary components and whether constants are included in each of the equations. Intercepts can be included either in the co-integrating vectors themselves or as additional terms in the VAR. The latter is equivalent to including a trend in the data generating processes for the levels of the series. If the test statistic is greater than the critical value then reject the null hypothesis that there are ‘r’ co-integrating vectors in favour of the alternative that there are ‘r + 1’ (for λ_{trace}) or more than ‘r’ ($\lambda_{\max}$). The test is conducted in a sequence and under the null, r = 0, 1, ..., g – 1 so that the hypotheses for $\lambda_{\max}$ are as follows:

H_0: r = 0 versus H_a: $0 < r \leq n$

H_0: r = 1 versus H_a: $1 < r \leq n$

H_0: r = 2 versus H_a: $2 < r \leq n$

H_0: r = n – 1 versus H_1: r = n

The first test involves a null hypothesis of no co-integrating vectors (corresponding to ‘∏’ having zero rank). If this is not rejected, then there are no co-integrating vectors. However, if H_0: r = 0 is rejected, the null that there is one co-integrating vector (i.e. H_0: r = 1) would be tested and so on. Thus the value of ‘r’ is continually increased until the null is no longer rejected.

But how does this correspond to a test of the rank of the ‘∏’ matrix? ‘r’ is the rank of ‘∏’. ‘∏’ cannot be of full rank (n) since this would correspond to the original y_t being stationary. If ‘∏’ has zero rank, then by analogy to the univariate case, Δy_t depends only on Δy_{t-j} and not on y_{t-1}, so that there is no long-run relationship between the elements of y_{t-1}. Hence there is no co-integration. For 1 < rank (∏) < n, there are ‘r’ co-integrating vectors. ‘∏’ is then defined as the product of two matrices, α and β′, of dimension (n × r) and (r × n), respectively, i.e.

$$\prod = \alpha\beta'$$

The matrix ‘β’ gives the co-integrating vectors, while ‘α’ gives the amount of each co-integrating vector entering each equation of the VECM, also known as the adjustment parameters.

Error Correction Model (ECM)

It is assumed that the variables such as import, export and gross domestic product (GDP) are co-integrated after running Johansen-Juselius test that means they share a common stochastic trend and will grow proportionally (long run relationship). If there is an existence of a co-integrating vector among the variables, then formulation of error correction model (ECM) is required to examine the dynamic relationship (bi-directional and/or a unidirectional) among the variables in the system (Engle and Granger, 1987). Although, the co-integration test fails to show the direction of the causality and for that the estimation of the ECM is vital. The advantage of using VECM technique allows distinguishing between short and long run causality and basically the ECM term refers to the adjustment process between short run disequilibrium and a long run relationship. As GDP, import (imp) and export (exp) are co-integrated then the ECM could have the following from after incorporating NEP dummy variable in VECM particularly in equation 22 is given below:

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^{k} \beta_1 \Delta \ln GDP_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta \ln imp_{t-i} + \sum_{i=1}^{k} \beta_3 \Delta \ln \exp_{t-i} + \delta ECT_{t-1} + \psi NEP_{Dummy} + e_{it} \quad (22)$$

Where, Δ is the difference operator. β_1, β_2 and β_3 are the coefficients to be estimated to examine the short run relationship towards GDP. ECT_{t-1} is the lagged value of the residuals of the error correction term derived from the co-integrating regression of GDP on import and export. The coefficient 'δ' of the error correction term represents the speed of adjustment to the long run equilibrium. 'ψ' is the coefficient of the NEP dummy variable. If it is found positive and significant then introduction of NEP has positive impact on economic growth.

Similarly, the ECM model in VECM framework for other variables can be formulated as under:

$$\Delta \ln imp_t = \alpha_0 + \sum_{i=1}^{k} \beta_1 \Delta \ln imp_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta \ln GDP_{t-i} + \sum_{t-1}^{k} \beta_3 \Delta \ln \exp_{t-i} + \delta ECT_{t-1} + \Psi NEP_{Dummy} + e_{it} \quad (23)$$

$$\Delta \ln \exp_t = \alpha_0 + \sum_{i=1}^{k} \beta_1 \Delta \ln \exp_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta \ln GDP_{t-i} + \sum_{i=1}^{k} \beta_3 \Delta \ln imp_{t-i} + \delta ECT_{t-1} + \psi NEP_{Dummy} + e_{it} \quad (24)$$

After that, diagnostic checking is performed to ensure the goodness of fit of the error correction models. Generally, the desirable model should not have serial correlation, any ARCH effect and non normality in the residuals. The null hypotheses of the above tests are as follows:

H_0: there is no serial correlation.

H_0: there is no ARCH effect.

H_0: the residuals are normally distributed.

Finally, the key assumption of any econometric model is that the parameters are constant throughout the sample period. To check this recursive residuals test (CUSUM) is adopted. It is performed by taking into consideration (Brown et al. 1975) the cumulative sum of recursive residuals. This test plots the cumulative sums together with the ninety five percent (95%) critical line and if the cumulative sum goes outside the area between the two critical lines then parameter instability (structural break) is found up to a particular period. The CUSUM test can be written as follows:

$$W_t = \sum_{j=k+1}^{T} \frac{W_t}{\hat{\sigma}}, \qquad j = k+1, ..., T \tag{25}$$

With, $\hat{\sigma}^2 = \frac{\sum_{j=k+1}^{T} (w_t - \overline{w})^2}{T - K - 1}$ and $\overline{W} = \frac{\sum_{j=k+1}^{T} w_t}{T - k}$.

Where, 'W' is the recursive model; 'σ' is the standard error of the regression fitted to all 'T' sample point; 'k' is the number of coefficient to be estimated. Under the null hypothesis, W_t, the cumulative sum, with constant parameter has a mean of zero, $E(W_t) = 0$, and variance equal to the number of residuals being summed, in fact each term has a variance one and they are independent. But the non-constant parameter W_t will tend to departure from the zero line may be assessed by reference to a pair of straight lines that pass through the points $(k, \pm a\sqrt{t-k})$ and $(t, \pm 3a\sqrt{t-k})$.

Where, "a" is a parameter depending on the significance level 'α' chosen.

Result and analysis

In general, many economic time series are non stationary and have a common tendency of growing over time means they are time invariant. But stationarity of time series data is important for co-integration analysis. Before going to test, the time series data are converted into natural logarithm forms and then ADF and P-P tests are applied in level to check unit root (Table 1). Both the tests are failed to reject the null hypotheses of unit roots at level because the probabilities are higher than five percent meaning that they are non-stationary (unit root) and thus the data are transformed into first differences and performed both the tests again and found that they are stationary at five percent significance levels with integrated at I(1) order which is very much important in VECM analysis.

Table 1. *Unit root test*

Variable	ADF Test				Philips-Perron Test				Order of integration
	Level		Difference		Level		Difference		
	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	
lnGDP	-0.4952	0.9947	-3.4152*	0.0152	-0.5012	0.901	-3.4825*	0.0148	I(1)
lnExport	1.2183	0.9975	-3.1647*	0.0327	1.1239	1.000	-3.6665*	0.0089	I(1)
lnImport	0.8984	0.9947	-4.1275*	0.0032	0.8841	1.000	-4.4069*	0.0031	I(1)

*significant at 5% level.

Source: Author's own calculation.

After testing stationarity it is also important to choose optimal lag length for co-integration analysis. It is also assumed that the model may be mis-specified if the lag length is too small and over parameterized if the number of lags is too large (Wooldridge, 2009, p. 576).

There are many techniques such as likelihood ratio (LR), final prediction error (FPE), Akaike's information criterion (AIC), Schwarz information criterion (SBIC) and Hanna-Quinn information criterion (HQIC). Here, the study applies the last three methods (Table 2).

The symbol '*' is the target or guideline to choose best possible lag for a particular model. It is observed that the position of '*' is at lag length one for GDP and export and also two for import which are identified optimal.

Table 2. *Optimal lag order selection*

Variable	Lags	AIC	SBIC	HQIC
lnGDP	1	28.53806*	28.62603*	28.56876*
lnEXP	1	25.29771*	25.38569*	25.32842*
lnIMP	2	26.15010*	26.26931*	26.19616*

*indicates lag order selected by the criterion.
Source: Author's own calculation.

After satisfying the above mentioned conditions, Johansen co-integration test is applied to find out the number of co-integrating equation/s or vector/s in the model (Table 3). The table provides two types of test statistics namely trace statistic and max Eigen value. Here, both the test statistics confirm the same result and thus reject the null hypotheses at five percent (5%) level of significance because the probability values are less than five percent meaning that there are at most three co-integrating equations in the system. Hence, the GDP, export and import are co-integrated that means the variables have long run relationship and thus vector error correction model (VECM) may be run.

Table 3. *Johansen co-integration test*

Hypothesized no. of CEs	Eigen value	Rank test (Trace statistic)			Rank test (Max Eigen value)		
		Trace statistic	Critical value	Prob.	Max-Eigen value	Critical value	Prob.
None*	0.943230	146.2100	29.79707	0.0001	91.79975	21.13162	0.0000
At most 1*	0.669959	54.41023	15.49471	0.0000	35.47324	14.26460	0.0000
At most 2*	0.446659	18.93698	3.841466	0.0000	18.93698	3.841466	0.0000

Trace test & Max-Eigen value indicate three co-integrating equations at 0.05 levels.
*denotes rejection of null hypothesis at 0.05 level.
Source: Author's own calculation.

The long run association and impact of dummy variable on economic development for foreign trade policy are analysed and the results are presented in Table 4.

Table 4. *Vector error correction estimates (VEC)*

Dependent variable	C_1 (ECT)	C_2	C_3	C_4	C_5 Intercept	C_6 Dummy	R^2 (F-statistic)
GDP	-0.65656* *-4.32648* (0.0001)	-0.21383 *-0.67893* (0.5022)	-0.04011 *-0.017240* (0.9864)	1.168398 *1.05848* (0.2980)	536219.3* *3.235117* (0.0029)	31604.87* *3.214423* (0.0016)	0.851400 35.52274* (0.00000)
Export	0.042958 *1.326039* (0.1945)	-0.04918 *-0.73143* (0.4700)	0.169944 *0.342118* (0.7346)	0.137360 *0.582924* (0.5642)	35609.32 *1.006396* (0.3220)	37023.52 *1.176665* (0.2483)	0.390968 3.980092* (0.006641)
Import	-0.020720 *-0.471108* (0.6409)	0.066641 *0.730045* (0.4708)	0.789108 *1.170122* (0.2509)	0.035133 *0.109822* (0.9133)	-16594.21 *-0.345451* (0.7321)	45735.84 *1.070672* (0.2926)	0.569397 8.198416* (0.000050)

*significance at 0.05 level, value in parenthesis is the probability value.
Source: Author's own calculation.

It is observed from the table that the error correction term of the VECM model 22 where GDP is considered as the dependent variable is negative and statistically significant that means there is a validity of the long run equilibrium among all the variables. But the coefficients of export and import are not significant and thus don't influence GDP. Here the coefficient of the dummy variable is positive and significant that means adoption of new economic policy in 1991 has a positive impact on economic development in foreign trade policy in India. Although, the coefficients of export and import are not individually significant but jointly they are significant because the probability value of F-statistic is less than five percent that means export and import jointly influence the GDP. But in other cases (models 23 and 24) there is absence of long run relationship among the variables and thus the study doesn't consider the above two models mentioned in the parenthesis.

It is discussed above that long run association exists among the variables when GDP is considered as dependent variable. So, it is generally expected that there must be a presence of short run relationship and found that short run uni-directional causality exists between export and GDP and also export and import because the probability values in those cases are less than five percent meaning that the null hypotheses of no short run causal relationship is rejected. But, in other cases short run causal relationship between the variables is absent.

Table 5. *Granger short run causality*

Null Hypothesis (H_0)	F-statistic	Probability	Decision
GDP doesn't Granger cause dummy	0.00227	0.9977	Don't reject H_0
Dummy doesn't Granger cause GDP	0.28048	0.7573	Don't reject H_0
Export doesn't Granger cause dummy	0.00053	0.9995	Don't reject H_0
Dummy doesn't Granger cause export	0.94139	0.4006	Don't reject H_0
Import doesn't Granger cause dummy	0.00067	0.9993	Don't reject H_0
Dummy doesn't Granger cause import	0.72116	0.4939	Don't reject H_0
Export doesn't Granger cause GDP	4.05421*	0.0270	Reject H_0
GDP doesn't Granger cause export	0.74048	0.4849	Don't reject H_0
Import doesn't Granger cause GDP	0.65606	0.5257	Don't reject H_0
GDP doesn't Granger cause import	0.78789	0.4634	Don't reject H_0
Import doesn't Granger cause export	1.01924	0.3723	Don't reject H_0
Export doesn't Granger cause import	4.87602*	0.0142	Reject H_0

*significance of 0.05 level.
Source: Author's own calculation.

It is observed from Table 4 that the R^2 value and F-statistic are significant and satisfactory for VECM model where GDP is considered as the dependent variable which is a good sign for any regression equation. Now, the adequacy of the VECM model depends on some specific tests which are based on residuals. Firstly, Breusch-Godfrey test is carried out to check serial correlation and found that the R^2 value is insignificant and the probability value is higher than five percent that means acceptance of null hypothesis of no serial correlation which is enviable. Secondly, heteroskedasticity test is applied and found that the probability value corresponding to the observed R^2 is not significant meaning that null hypothesis is accepted regarding no heteroskedasticity which is desirable. Finally, J-B test for normality is applied and found that the probability value corresponding to the J-B statistic is insignificant that tells about acceptance of null hypothesis regarding normal distribution of residuals which is good enough. Finally, it may be said that the VECM model is adequate and the results are acceptable in all respects.

Table 6. *VECM test for serial correlation, heteroskedasticity and normality*

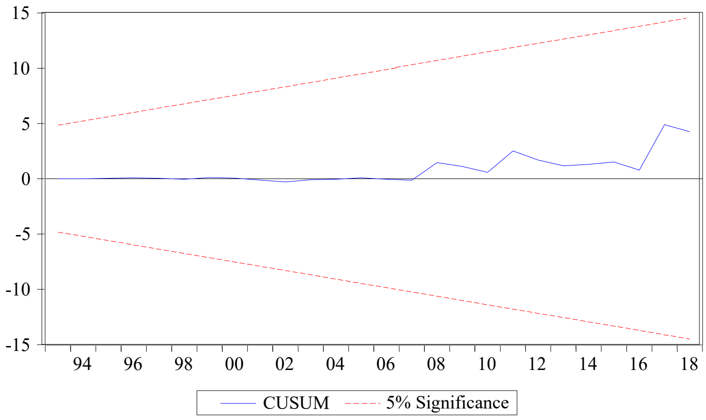
Dependent variable	B-G LM test		B-P-G Het. test		Normality test	
	Obs*R^2	Probability	Obs*R^2	Probability	J-B statistic	Probability
GDP	0.581303	0.7391	14.503733	0.4134	2.23064	0.3215

Source: Author's own calculation.

CUSUM plots for stability diagnostic

At the end, CUSUM test is applied by taking into consideration the residuals to check the stability of the long run coefficient together with the short run dynamics (Pearson and Pearson 1997). It is observed that the CUSUM plot (blue line) lies between the critical bounds (within two red lines) meaning that acceptance of null hypothesis regarding not rejection of coefficients that signifies that the VECM model is stable and there is absence of structural break.

Figure 1



Conclusions

This study examines the impact of economic development in foreign trade policy by using dummy variable by considering two consecutive situations when India doesn't adopt NEP up to 1990 and thereafter and also checks causal relation among the variables within the VAR framework. It is found that long run equilibrium relation exists only when GDP is the dependent variable and the coefficient of dummy variable is positive and significant that certainly tells about that the introduction of NEP in 1991 and onwards has positive impact on economic development for foreign trade policy.

There is an evidence of short run uni-directional causality among the export and GDP and also export and import. The VECM model is appropriate based on various residuals tests and finally the model is stable without any structural break and so the above results are acceptable. Even though, this study is not free from limitation.

There are many important macro economic variables which are kept beyond this study and those must be included for getting a realistic picture. But it is evident that after the adoption of NEP in India the economic growth has positively impacted that finally influenced the foreign trade policy and it creates a more competitive environment in the Indian economy as a means of improving the economic growth.

It may be recommended that the policy makers should take necessary measures by which foreign trade policy would be more competitive in comparison with other economies by innovating and applying more advanced policies and technologies by which Indian economic growth may achieved a stable and sustainable position in near future. Finally, other developing and underdeveloped countries may apply technological innovations on foreign trade policy within a VAR framework to examine the impact on economic growth is the further scope of research.

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