Is the Export-led Growth Hypothesis Valid for India? Another Look at the Evidence

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3 July 2019

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ABSTRACT

The previous studies on the export-led growth hypothesis in India have yielded mixed and inconclusive results. This study explores the dynamic relationship between real exports and real economic growth for India in a multivariate framework by including 'terms of trade' as an additional variable for the period 1980-2017. Unlike most of the previous studies, this study employs the ARDL bounds testing approach and Toda-Yamamoto version of modified Granger causality test to examine this linkage. The results of the bound tests indicate that there is a stable long-run relationship between the variables when economic growth proxied by GDP growth is the dependent variable. Further, the results of the modified Granger causality test suggest that there is unidirectional causal flow from exports to economic growth and from terms of trade to economic growth without any feedback. The study, therefore, provides further evidence that growth in exports stimulate economic growth in India while there is no evidence of growth-driven export.

Keywords
Export-led growth; terms of trade; ARDL bounds test, Toda-Yamamoto; causality; GDP; India.

JEL Codes
C32, C51, F13, F14, F43, F63, O19.

INTRODUCTION

The empirical linkage between exports and economic growth has been the subject of many empirical investigations over the past decades, yet with little consensus. All the investigations are revolved around the question of whether or not an export-led outward-oriented national trade policy is desirable to inward-oriented trade policy in boosting economic growth. In theoretical literature, nevertheless, exports have been described as an engine of growth for the following reasons: (i) export growth may be a catalyst for economic growth directly through a rise in income and employment in the exportable sector (Awokuse, 2008); (ii) export expansion leads to better resource allocation, production efficiency through economies of scale and stimulation of technological enhancement as a result of foreign market competition (Balassa, 1978; Helpman & Krugman, 1985); (iii) export assists in foreign exchange earnings which in turn allows for increased rates of capital and intermediate goods imports (Balassa, 1978). The theoretical consensus of neoclassical economists on export-led growth was also due to the success of outward-oriented policies of Asian Tigers and other free-market economies (World Bank, 1993)

The dynamic relationship between exports and economic growth in India engrossed the attention of many researchers, especially after the economic reforms of 1991. India's post-independence growth stance (since 1947) was one of the most protectionists and highlighted the significance of economic governance. In specific, with exorbitant nominal tariffs and substantial non-tariff barriers, India pursued protectionist trade policies emphasizing the import-substitution industrialization strategy (Topalova, 2007). However, during the 1980s, India set out on market reforms; yet the trade policy stayed restrictive. The acute balance of payments crisis of 1991, forced the Government of India to introduce significant changes in its trade policy and in subsequent years, the Indian economy has considerably shifted towards export promotion strategy.

The speed of India’s export growth has been noticeably high during the post-reform period as compared to the pre-reform period, but the real surge of India’s export was started since 2002. In absolute terms, the value of exports rose from 8484.7 million US$ in 1980-81 to 18537.2 million US$ in 1992-92 and further to 275852.4 million US$ in 2016-17 (Reserve Bank of India, 2018), thereby recording an upsurge of almost 32 times between 1980-81 and 2016-17. Most importantly, India’s share in world exports amplified from a mere 0.6 percent in the early ’90s to 1.9 percent in 2011 and further to 2 percent in 2015 (FICCI, 2016).

Against this backdrop, this paper is an endeavor to investigate the dynamic linkages between real exports, real GDP and terms of trade for India for the time span of 1980-2017. For examining the long-run cointegrating relationship among these variables, the ARDL bound testing approach developed by Pesaran and Shin (1999), and Pesaran, Shin, and Smith (2001) is employed. In addition, this study uses Toda and Yamamoto approach (Toda & Yamamoto, 1995) to Granger causality to check the direction of causality among GDP, exports and terms of trade.

A BRIEF REVIEW OF THE EARLIER STUDIES ON ELG HYPOTHESIS

The empirical linkage between exports and GDP growth has been well documented in the literature with mixed and conflicting results. The earlier empirical investigations, which used cross-section data and adopted either bivariate correlation modelling framework or neo-classical aggregate production function, with export as an additional explanatory variable, had found a significant and positive relationship between export performance and economic growth (Balassa, 1978; Feder, 1981; Kavoussi, 1984; Michaely, 1977; Tyler, 1981) The results of these studies, however, have several shortcomings as they did not take into account the dynamic time-series properties of data. Furthermore, they were unable to deliver any evidence on the direction of causality and assumed with a priori, that it was only export growth which positively influences the GDP growth. Since export is an element of GDP, a correlation between these two factors may also indicate that GDP causes export rather than vice versa. Also, they did not take into account country-specific factors, and implicitly assumed the same production function over different sorts of economies.

With the recent developments in time series modelling techniques, there has been a rise in country-specific studies concentrating on the long-run equilibrium linkage between export and GDP growth. However, the empirical evidence of time series researches regarding the ELG hypothesis has been rather varied and inconclusive. While a wide range of literature utilizing time series methodologies provided evidence in favour of the ELG hypothesis, some other time series evidence cast doubt on the validity of the ELG hypothesis. For instance, studies conducted by Jung and Marshall (1985), Bahmani-Oskooee, Mohtadi and Shabsigh (1991), Ahmed and Harnhirun (2006), Kwan, Cotsomitis and Kwok (1996), Ahmed, Butt and Alam (2000), Abu Qarn and Abu Bader (2004), and Sharma and Panagiotidis (2005) found no evidence or very weak evidence in favour of ELG hypothesis. On the other hand, Nanid and Biswas (1991), Serletis (1992), Henriques and Sadorsky (1996), Bahmani-Oskooee and Alse (1993), Ghatak and Price (1997), Al-Yousif (1997), Islam (1998), and Nidugala (2001) found strong support for export-led growth hypothesis in their studies.

Using recent time series techniques, a few studies have been carried out on the ELG hypothesis for India as well. A brief review of some selected studies is provided below.

Dhawan and Biswal (1999) re-investigated the export-led growth hypothesis for India, using the Johansen cointegration method within a multivariate framework. They had found that there was a robust long-run association between the GDP, real exports and terms of trade and in the long-run causality flowed from terms of trade and GDP to exports. However, the causality from export to GDP was found only in the short-run. Using the same methodology, Asafu-Adjaye and Chakraborty (1999) studied the relationship between exports and economic growth along with one additional variable- 'import' for four developing countries, including India. They did not find any long-run linkages between exports and GDP for India. Love and Chandra (2004), using the Johansen Multivariate approach to cointegration found strong support for the ELG hypothesis for India. The findings of their study indicated a bi-directional causality between real exports and real income. Against this, Shirazi and Manap (2005) tested the relationship between export and GDP growth for five south Asian nations- India, Pakistan, Bangladesh, Sri Lanka, and Nepal using cointegration and multivariate Granger causality test. They also found proof against the ELG proposition for India. Sharma and Panagiotidis (2005) studied the ELG proposition for India, considering GDP growth and GDP growth net of exports, using both Johansen and Breitung's non-parametric cointegration tests. Their study also failed to establish any causal association between exports and GDP towards either direction.

The existing literature on the export-income relationship in the context of India has a number of shortcomings. First, some of the previous studies have conducted causality test without checking the order of integration of the series under study. This is a severe drawback of their studies because econometric theory states that regression analysis involving two or more non-stationary time series lead to the phenomena of spurious or nonsense regression, which yields a misleading and unreliable conclusion. Second, none of the earlier studies included structural breaks undergone by exports, GDP, and other macroeconomic variables of the Indian economy in their analysis. Third, most of the past studies were carried out in the bivariate framework. This might lead to the model specification problem due to the omission of important variable such as labour, capital, terms of trade, etc. Fourth, some of the studies failed to validate ELG hypothesis for India because their study period covered either pre-liberalisation phase when India followed a protectionist trade policy or early years of economic reforms characterized by structural transformation phase. Obviously, exports could not have driven economic growth during these periods. It is only if we include sufficient periods of post-economic reforms when export growth accelerated its pace, the ELG hypothesis might hold.

This study overcomes the shortcomings described above and contributes to the existing literature in the following ways. First, following Dhawan and Biswal (1999) and Love and Chandra (2004), this study examines the link between exports and economic growth with one additional variable 'terms of trade', but makes refinement over their studies in two respects: (i) In contrast to the studies of Dhawan and Biswal (1999) and, Love and Chandra (2004) who applied Johansen multivariate cointegration procedure, the present study uses recently developed ARDL bound testing approach to cointegration, which produces comparatively more efficient results even in the case of small sample size; (ii) this study uses a more comprehensive dataset for a period of 26 years after liberalisation period (post-1991) and 11 years pre-liberalisation period. Second, this is the first study on the ELG hypothesis for India, which uses structural stability test in its model specification. In unit root testing, we have applied Perron and Vogeslang (1998) structural break procedure to detect any unknown breaks. In addition, using Andrew's breakpoint test, we have found one structural break in 1993 and included it in our ARDL, and Toda-Yamamoto augmented VAR model through a break dummy variable(dum_{1993}).

EXPORT PERFORMANCE OF INDIA: AN OVERVIEW

After independence, India's experience of colonial rule and popularity of socialist principles among the then India's political leaders resulted in a vigilant policy atmosphere, in which economic self-sufficiency and the Government regulation of the economy were stressed upon. In specific, India followed a trade policy that was among the most restrictive in Asia with elevated rates of tariffs and other non-tariff barriers. At this juncture, while the world merchandise export recorded an average annual growth of 6.3 percent and 8.77 percent during the 1950s and 1960s respectively, India's export grew at only 0.22 percent per annum and 3.58 percent per annum (Veeramani, 2007). Nevertheless, India's export recorded a healthy growth rate of 8.16 percent during the 1970s. Besides buoyancy of world demand, several other factors namely, the depreciation of real effective exchange rate (REER) of the rupee, provision of export subsidies to compensate the anti-export bias created by import-substitution policy and relatively liberal import policy for export production were responsible for this export boom (Joshi & Little, 1994).

As the growth rate of world export become negative after the 'oil shock' of 1979, India could not maintain its export growth of the 1970s in the early years of 1980s. However, India's export registered a growth rate of 5.75 percent per annum during 1981-1980 because of the strong export growth in the latter half of the 1980s. This growth is primarily attributed to the increased export subsidies, significant depreciation of the real effective exchange rate, and moderate market reforms to facilitate the import of capital goods and industrial licenses (Joshi & Little, 1994). Even though India's export of merchandises and services as a proportion of GDP increased from 5.52 percent a year during the 1970s to 6.08 percent a year during 1980s, India's share in the world merchandise export declined from 0.51 percent to 0.47 percent during the same period (Table 1).

Table 1. Indicators of India's export performance, 1971-2017

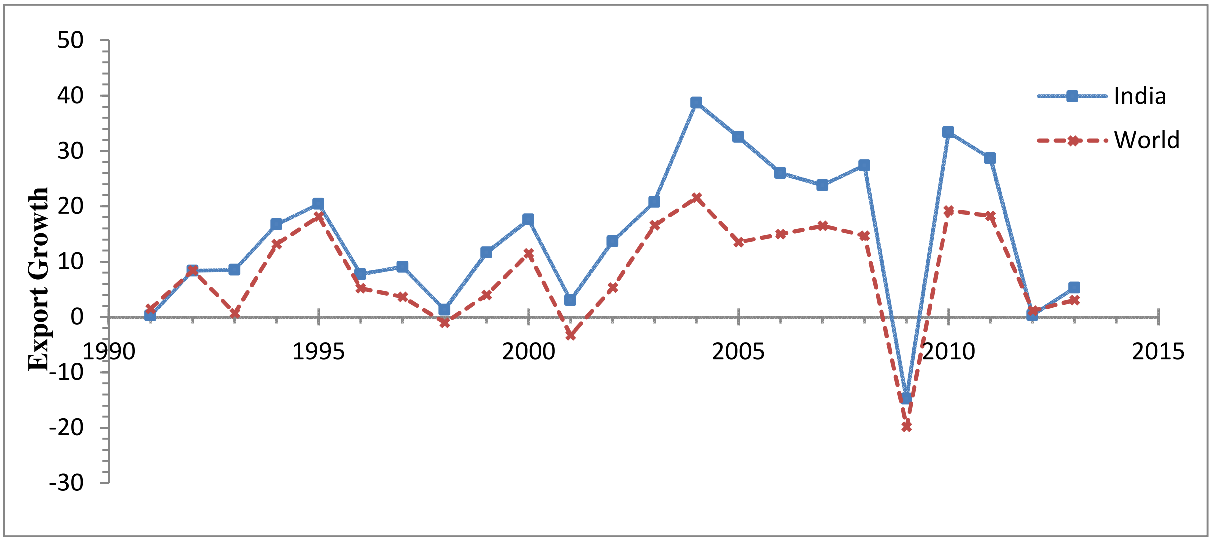
Period	Average Annual Growth Rates of Exports	India's Percentage Share in World Export, Averages		India's Export of Goods and Services (as a percent of GDP), Averages
		Goods	Services	
1971-1980	8.16	0.51	NA	5.52
1981-1990	5.75	0.47	0.71	6.08
1991-2000	11.91	0.58	0.69	10.55
2001-2010	14.04	1.00	2.07	19.02
2011-2017	3.39	1.65	3.25*	22.23

Note: *Separate data for services is available only up to 2013

Source: Data on exports and export as a percent of GDP is from World Development Indicators (World Bank), while separate data for goods and services exports are obtained from the WTO website.

As mentioned earlier, in reaction to the serious balance of payment crisis of 1991, the Government of India initiated a big-bang reform. Since July 1991, a series of changes aiming at macroeconomic stabilization and structural adjustment of the economy was undertaken. Among these reform measures, trade and exchange rate liberalization has been fundamental to the structural adjustment programmes initiated by the Government of India. The post-1991 trade policy of India is characterized by the removal of quantitative restrictions (QRs) on import items, substantial reduction in custom tariff rates, de-canalization of many import items, downward adjustment in the rupee exchange rate against the major international currencies and convertibility of Indian Rupee first on trade account and then for entire current account transaction (Veeramani, 2007). It was expected that these reform measures would scale up the export competitiveness and accelerate economic growth.

The decade-wise analysis of India's export progress in the post-reform era shows that India's export growth was relatively low (11.91 percent) in the first decade of reforms (1991-2000), while the second decade of reforms (2001-2010) was marked by the all-time high growth rate of 14.04 percent (Table 1). In the first decade of reforms, India's export growth started picking up since 1992, and after registering high growth rate in the next five years (1992-1997), the growth of merchandise and services export dropped significantly in 1998 (Figure 1) due to the slowdown in the world demand triggered by the East-Asian crisis. Even the downgrading rupee's exchange rate by more than 6 percent could not avoid the shrinkage in the value of India's export (Veermani, 2007). The real surge of India's export growth began in 2002, and this trend continued until 2009 when India's export growth dipped by 14.76 percent owing to the global financial crisis. Nevertheless, the world economy recovered, and India's export registered a growth rate of 33.36 percent and 28.66 percent in 2010 and 2011, respectively (Figure 1). India's comparative better export performance during 2001-2010 over 1991-2000 is also indicated by the fact that India's percentage share in the world merchandise export was 1 percent during 2001-2010 as against 0.58 percent during 1991-2000. Similarly, India's share of world services exports rose from 0.69 percent in 1991-2000 to 2.07 percent in 2001-2010 (Table 1). In contrast to the pre-reform period, India's export growth, by and large, was larger than the world export growth throughout the post-reform period (Figure 1).



***Source*: Author's calculation based on data from WTO**

Figure 1. Annual growth rates of exports (India and the World)

Recently (since 2012), there has been a steady decline in India's export growth due to the interplay of the global slowdown and some internal factors. Continued global downturn mainly arising from the regions such as China, Japan and EU along with the great commodity crash hindered the revival of international trade, which in turn adversely affected India's export. The percentage share of India's merchandise exports across commodity groups is presented in Table 2.

Table 2. Commodity group-wise India's merchandise exports (percentage share in total exports)

Commodities	1970-71	1980-81	1990-91	2000-01	2010-11	2016-17
1. Agriculture and allied Products	31.70	30.65	19.40	14.19	9.73	12.25
2. Ores and Minerals (excluding coal)	10.68	6.16	4.59	2.05	3.41	1.94
3. Manufactured goods	50.27	55.83	72.91	79.81	68.99	73.57
3.1 Textile fabrics and manufactures	9.45	13.89	20.98	NA	NA	2.22
3.2 Cotton, yarn, fabrics, made-ups etc.	0.83	0.25	0.14	0.10	0.06	0.10
3.3 Jute manufactures	12.40	4.91	0.91	0.46	0.18	0.11
3.3 Leather and leather manufactures	5.21	5.80	7.98	4.42	1.55	1.92
3.4 Gems and Jewellery	2.90	9.21	16.11	16.75	16.13	15.73
3.5 Chemicals and allied products	1.92	3.34	6.48	11.34	11.50	13.94
3.6 Engineering goods	12.85	12.31	11.89	15.82	19.83	23.66
4. Mineral fuels and lubricants (incl.coal)	0.83	0.41	2.91	4.38	16.83	11.75
5. Other commodities	6.49	6.94	0.17	-	1.02	0.46
Total Exports	100	100	100	100	100	100

Source*: *Economic Survey of India, 2017-18

It is evident from Table 2 that there has been a structural shift in India's export basket, from agricultural and traditional items to technology-based manufactured and engineering items. The share of agriculture and related products in India's aggregate merchandise exports declined significantly from 31.7 percent in 1970-71 to 12.75 percent in 2016-17, while the share of manufactured goods increased from 50.27 percent to 73.57 percent during the same period. Among the group of manufactured goods, four major items, namely engineering goods, chemicals and chemical products, gems and jewellery, and textile and readymade garments have maintained their dominance over the years.

The proportion of petroleum products in India's export basket rose dramatically during recent years. Their share expanded from just 0.83 percent in 1970-71 to 11.75 percent in 2016-17. This export surge is mainly driven by India's private sector oil refineries, whose capacity markedly increased since 2001-02.

DATA, DESCRIPTION OF VARIABLES AND METHODOLOGY

Data Sources and Description of Variables

Annual time series data on GDP growth, export, and terms of trade covering the period 1980-2017 have been used in the econometric models of the study. The data pertaining to all the variables have been collected from World Bank's online database 'the World Development Indicators (WDI)'. The brief descriptions of the variables are as follows:

$lgdp =$ real GDP at market prices at constant 2010 US$ is used as a proxy for economic growth.

$lex =$ value of the exports of goods and services at constant 2010 US$.

$ltot =$ terms of trade index (2000=100). It is calculated as the percentage ratio of the export value index to the import value index ($\frac{V_x}{V_M}$.100, where V_x= export value index, and V_M= import value index)

All the variables are converted into their natural log to minimize the problem of heteroscedasticity and to get the growth rate of the relevant variables by their differenced log.

Table 3. Descriptive statistics of the included variables

Variables	Obs. (1980-2017)	Mean	Standard Deviation	Minimum	Maximum	Kurtosis	Skewness
$lgdp$	38	27.38	0.687300	26.32	28.59	1.818	0.19711
lex	38	25.24	1.211831	23.65	26.99	1.508	0.123661
$ltot$	37	4.53	0.138381	4.18	4.77	3.034	-0.3935

Econometric Methodology

Autoregressive Distributed Lag (ARDL) Bound Test

To empirically examine the long-run equilibrium linkages and short-run dynamic interactions among real GDP, real export and terms of trade, this paper employs ARDL bounds testing method of cointegration advanced by Pesaran and Shin (1999) and Pesaran *et al*. (2001). The ARDL modelling approach is a general dynamic specification by combining the lags of the dependent variable and lagged and current values of the explanatory variables, through which the short-run effect may be directly estimated and long-run equilibrium relationship is indirectly determined (Ghosh, 2010). The ARDL cointegration method has many advantages over other conventional cointegration methods like Engle and Granger, Johansen and Johansen and Juselius. First, unlike the Johansen cointegration method, the ARDL method can be used irrespective of the series under consideration are integrated of order zero i.e., I(0), integrated of order one i.e., I(1), or fractionally integrated and so there is no need for unit root pre-testing (Belloumi, 2009). Secondly, in small and finite data sizes, the ARDL procedure is comparatively more efficient. Third, the ARDL model usually offers more unbiased long-run model estimates, even if some regressors are endogenous (Harris & Sollis, 2003). In the first step, without any priori information, the following unrestricted error correction model is estimated in this study:

$$\Delta lgdp = a_{0gdp} + \sum_{i=1}^{p} b_{igdp}\, \Delta lgdp_{t-i} + \sum_{i=0}^{q} c_{igdp}\, \Delta lex_{t-i} + \sum_{i=0}^{q} d_{igdp}\, \Delta ltot_{t-i} + \delta_{1gdp} lgdp_{t-1} + \delta_{2gdp} lex_{t-1} + \delta_{3gdp} ltot_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta lex = a_{0ex} + \sum_{i=1}^{p} b_{iex}\, \Delta lex_{t-i} + \sum_{i=0}^{q} c_{iex}\, \Delta lgdp_{t-i} + \sum_{i=0}^{q} d_{iex}\, \Delta ltot_{t-i} + \phi_{1ex} lgdp_{t-1} + \phi_{2ex} lex_{t-1} + \phi_{3ex} ltot_{t-1} + \varepsilon_{2t} \quad (2)$$

$$\Delta ltot = a_{0tot} + \sum_{i=1}^{p} b_{itot}\, \Delta ltot_{t-i} + \sum_{i=0}^{q} c_{itot}\, \Delta lgdp_{t-i} + \sum_{i=0}^{q} d_{itot}\, \Delta lex_{t-i} + \sigma_{1tot} lgdp_{t-1} + \sigma_{2tot} lex_{t-1} + \sigma_{3tot} ltot_{t-1} + \varepsilon_{3t} \quad (3)$$

Where all the variables are as described previously, Δ is the first difference operator and ε_s are the white noise error terms. The null hypothesis of no-cointegration among the variables in eq. (1) is H_0: $\delta_{1gdp} = \delta_{2gdp} = \delta_{3gdp} = 0$ against the alternative, H_1: $\delta_{1gdp} \neq \delta_{2gdp} \neq \delta_{3gdp} \neq 0$, which is denoted as $F_{lgdp}(gdp|lex, ltot)$. Similarly, for eq. (2), H_0: $\delta_{1gdp} = \delta_{2gdp} = \delta_{3gdp} = 0$, against the alternative of, H_1: $\delta_{1gdp} \neq \delta_{2gdp} \neq \delta_{3gdp} \neq 0$ and so on.

The bound test relies on the joint F-statistic whose asymptotic non-standard distribution depends upon whether variables incorporated in the ARDL model are (i) I(0) or I(1); (ii) whether the ARDL model under consideration contains an intercept and/or a trend; (iii) the number of explanatory variables, and (iv) the sample size. Two sets of critical values (upper bound and lower bound) were reported by Shin and Pesaran (1999) and Pesaran *et al.* (2001), where the lower bound critical values assume that all variables included in the ARDL model are I(0), while the upper bound critical values assume that all variables are I(1).

If the calculated F-statistic is larger than the upper bound value, the null hypothesis of no cointegration is discarded, whereas it is not rejected if the calculated F-statistic is lower than the lower bound value. The decision is unsettled if the F-statistic fall between the lower and upper bounds.

If the first step supports a stable long-run relationship, in the second step the long-run conditional ARDL (p,q_1, q_2) for $lgdp$ can be estimated as under:

$$lgdp = a_0 + \sum_{i=1}^{p} \delta_1\, lgdp_{t-i} + \sum_{i=0}^{q_1} \delta_2\, lex_{t-i} + \sum_{i=0}^{q_2} \delta_3\, ltot_{t-i} + \varepsilon_t \quad (4)$$

The third and final step is to calculate the short-run dynamic coefficient through the following model for error correction:

$$\Delta lgdp = \alpha_0 + \sum_{i=1}^{p} \beta_i\, \Delta lgdp_{t-i} + \sum_{i=0}^{q} \varpi_i\, \Delta lex_{t-i} + \sum_{i=0}^{q} \varphi_i\, \Delta ltot_{t-i} + \lambda ECT_{t-1} + \upsilon_t \quad (5)$$

Where λ is the coefficient of lagged error correction term (ECT) that measures the velocity of adjustment to equilibrium after a shock.

Toda-Yamamoto Approach to Granger Causality

To complement the results of the bound test, we have also conducted Granger non-causality test developed by Toda and Yamamoto (1995), which keeps away from the problems concomitant with the ordinary Granger-causality test by disregarding any possible non-stationarity or cointegration between series (Wolde-Rufael, 2004). The Toda-Yamamoto version of Granger causality test fits a standard VAR model in the levels of the series, thus lessening the likely risk of wrongly identifying the order of the series (Mavrotas & Kelly, 2001). The basic tenet of this approach is to increase the correct VAR order artificially, k, by the maximum order of integration, say d_{max} and then a (k+d_{max})th order of VAR is estimated, while ignoring the coefficients of the last lagged d_{max} vector (Rufael, 2004). To test the Granger causality, Toda and Yamamoto used an adapted Wald test (MWALD) for restriction on the parameters of the VAR (k), where k is the lag length of the system (Lotfalipour, Falahi, & Ashena, 2010). In order to conduct the Toda-Yamamoto approach to Granger non-causality, we represent our GDP-Export-Terms of trade model in the following lag-augmented VAR system:

$$\begin{bmatrix} lgdp_t \\ lex_t \\ ltot_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} lgdp_{t-1} \\ lex_{t-1} \\ ltot_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} lgdp_{t-2} \\ lex_{t-2} \\ ltot_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_{tgdp} \\ \varepsilon_{tex} \\ \varepsilon_{ttot} \end{bmatrix} \quad (6)$$

In the VAR system (6), A_1 and A_2 are the 3×3 matrices of coefficients and A_0 is a 3× 1 matrix of intercepts and ε_s are the white noise disturbance terms with zero mean and constant variance.

RESULTS AND DISCUSSION

In the first step, the order of the integration of the series- $lgdp, lex\ and\ ltot$ is investigated. The ARDL bound test can be used irrespective of the series are I(0) or I(1), but the estimated F-statistic provided by Pesaran *et al.* (2001) are not valid in the presence of any I(2) series (Ghosh, 2010). Therefore, we have used unit root tests to ensure none of the variables is I(2). We applied Perron and Vogeslang version of unit root tests, which takes into account possible unknown structural breaks in the data (Perron & Vogelsang, 1992; Vogelsang & Perron, 1998). Two different methods of trend shifts (structural break) modelling were suggested by Perron (1989), namely, 'the Innovative Outlier' and 'the Additive Outlier'. The Innovative Outlier method assumes that the break occurs more slowly over time, while the Additive Outlier method assumes that the break occurs suddenly. The results of the unit tests with structural break are reported in Table 4.

Table 4. Results of unit root with break test

Variables	**Innovative Outlier**			**Additive Outlier**		
	(Min. ADF) $t_{\hat{\alpha}}$	**TB**	**p-value**	**(Min. ADF) $t_{\hat{\alpha}}$**	**TB**	**p-value**
At Level (constant, no trend)						
$lgdp$	-0.636	2003	>0.99	-0.831146	2001	>0.99
lex	-1.9691	1993	0.9839	-3.270853	1995	0.5224
$ltot$	-3.093336	1997	0.6313	-2.808946	1996	0.7833
At First Difference (constant, no trend)						
$\Delta lgdp$	-6.5153*	2002	< 0.01	-6.68384*	2002	< 0.01
Δlex	-5.2352*	1995	<0.01	-5.396950*	1995	< 0.01
$\Delta ltot$	-6.550*	1996	<0.01	-6.773351*	1993	< 0.01

Notes: Breaks are selected by minimizing Dickey-Fuller t-statistic. The optimal lags for both 'Innovative Outlier' and 'Additive Outlier' are selected using the Schwarz Bayesian Criterion (SBC). * indicates the rejection of the null hypothesis of a unit root at 5% level of significance.

The results of both the 'Innovative Outlier' and the 'Additive Outlier' tests indicate that all the variables are non-stationary at level data as we cannot reject the null hypothesis that the data follow a unit root, possibly with a break. However, all the variables become stationary after taking the first difference at 5 percent critical level, indicating that all the variables are I(1) in nature.

The subsequent step is to apply bound F-test to underlying unrestricted error correction (EREC), eqs. (1)- (3) for the purpose of establishing a long-run relationship. The results of the bound cointegration test along with critical values of F-statistic are presented in Table 5.

The optimal lags for cointegration test are found to be one, using both Schwarz –Bayesian Criterion (SBC) and Akaike Information Criterion (AIC).

Table 5. Bound tests for cointegration

Dependent Variable	AIC Lags		F-Statistic		Decision	
$F_{lgdp}(gdp\|lex, ltot)$	1		5.46		Cointegration	
$F_{lex}(lex\|lgdp, ltot)$	1		1.36		No Cointegration	
$F_{ltot}(ltot\|lgdp, lex)$	1		11.39		Cointegration	
F-Critical Value Bounds	At 5 % level		At 1 % level		At 10 % level	
k=2	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	3.79	4.85	5.15	6.36	3.17	4.14

Notes: Critical values are taken from Narayan (2005).

The bound tests reveal that cointegration exists when the real GDP is the dependent variable as the computed $F_{lgdp}(gdp|lex, ltot)$ is larger than the upper bound critical value at 5 percent level of significance. This outcome is consistent with many previous studies on ELG hypothesis for India such as Love and Chandra (2004), Dash (2009), Trivedi and Pradhan (2010), Ray (2011), Mishra (2011), and Agrawal (2015), and also in line with many other studies which examined the ELG hypothesis like Bahmani-Oskooee and Alse (1993), Henriques and Sadorsky (1996), Awokuse (2008); but this finding is in contrast with the studies of Sharma and Panagiotidis (2005) and Dawson (2005) who did not find any long-run cointegrating linkage between exports and economic growth. Table 5 also indicates that there is no cointegration when export is the regressand as the computed F-statistic is lower than the lower bound critical value at 5 percent significance level. When 'terms of trade' is the dependent variable, the computed $F_{ltot}(ltot|lgdp, lex)$ is larger than the upper bound critical value, suggesting the presence of cointegration relationship. As we are mainly interested in knowing the relationship between economic growth and exports, we have proceeded with the cointegrating link found in eq. (1), i.e., when $lgdp$ is the dependent variable and analyzed the long-run and short-run coefficients at length.

Once we recognized the existence of a long-run equilibrium cointegrating linkage in eq. (1), the long-run and the short-run coefficients are calculated using the associated ARDL and error correction model (ECM). The orders of the ARDL (p, q_1, q_2) are selected using the AIC, and the specified model is ARDL (1,1,1). The long-run coefficients obtained by normalizing GDP are provided in Table 6.

Table 6. Estimated long-Run coefficient using ARDL approach
[Model: ARDL (1, 1, 1) based on AIC, dependent variable:$lgdp$]

Regressor	Coefficient	Std. Error	t-Statistic	Probability
C	8.84	0.7237	12.2237*	0.0000
lex	0.6155	0.01749	35.1873*	0.0000
$ltot$	0.7347	0.10377	7.08023*	0.0000
Dum_{1993}	-0.17870	0.0456	-3.9149*	0.0005

Note: * and ** denote the level of significance at 1% and 5% respectively.

The estimated coefficients of the long-run relationship reveal that real exports and terms of trade have a strong and significant effect on real GDP growth. A one percent increase in exports results in approximately 0.61 percent increase in real GDP, while a one percent increase in real terms of trade leads to 0.73 percent increase in real GDP, other things being equal. The results of the short-run dynamic error correction model are reported in Table 7.

Table 7. Error correction representation of the selected ARDL model
[ARDL (1, 1, 1) based on AIC, the dependent variable is $D(lgdp)$]

Regressor	Coefficient	t-Statistic	Probability
$D(lex)$	0.030204	0.784868	0.4389
$D(ltot)$	0.058968	1.277354	0.2116
$D(Dum_{1993})$	-0.047140	-2.687554**	0.0118
$ECT(-1)$	-0.263780	-3.679807*	0.0009

$$ECT = lgdp - (0.6156 * lnex + 0.7347 * ltot - 0.1787 * Dum_{1993} + 8.8465)$$

R-Squared	0.5005
F-Statistic	7.26 (.000)
DW-Statistic	1.9054

Note: * and ** denote the level of significance at 1% and 5% respectively.

Table 7 shows that the coefficient of the lagged error correction term [ECT (-1)], which shows the velocity of adjustment to the equilibrium level after shock, is negative as expected and statically significant at 1 percent level of significance. A relatively high (negative and significant) error correction term indicates a faster adjustment process. The coefficient on the lagged error correction term (-0.26) suggests that a deviation from the equilibrium of GDP (after shock) in the current period will be corrected by 26 percent in the next year and it takes slightly over 4 years period to restore to the equilibrium.

To check the robustness of our estimated ARDL (1,1,1) model, we conducted a series of diagnostic tests and summary of the results are given in Table 8.

Table 8 Results of diagnostic tests

Test	Statistic	Probability
Serial Correlation	$\chi^2_{BG-Serial}(1)$=0.031407	0.8593
Heteroscedasticity	$\chi^2_{White-Hetro}$=25.950	0.3032
Normality	$\chi^2_{JB-Normal}$=1.4311	0.4889

The Lagrange Multiplier test indicates that the ARDL (1, 1, 1) is free from serial correlation at the selected lag. Similarly, White heteroscedasticity test and Jarque–Bera test suggest that residuals of the estimated model are homoscedastic and normally distributed. Finally, we have employed cumulative sum (CUSUM), and cumulative sum of squares (CUSUMSQ) tests to check the stability of the coefficient of the estimated ECM-ARDL model. The plots of the CUSUM and CUSUMSQ suggest that all coefficients in the estimated model are stable over the sample period as the plot of CUSUM and CUSUMSQ fall inside the 5 % critical bounds.

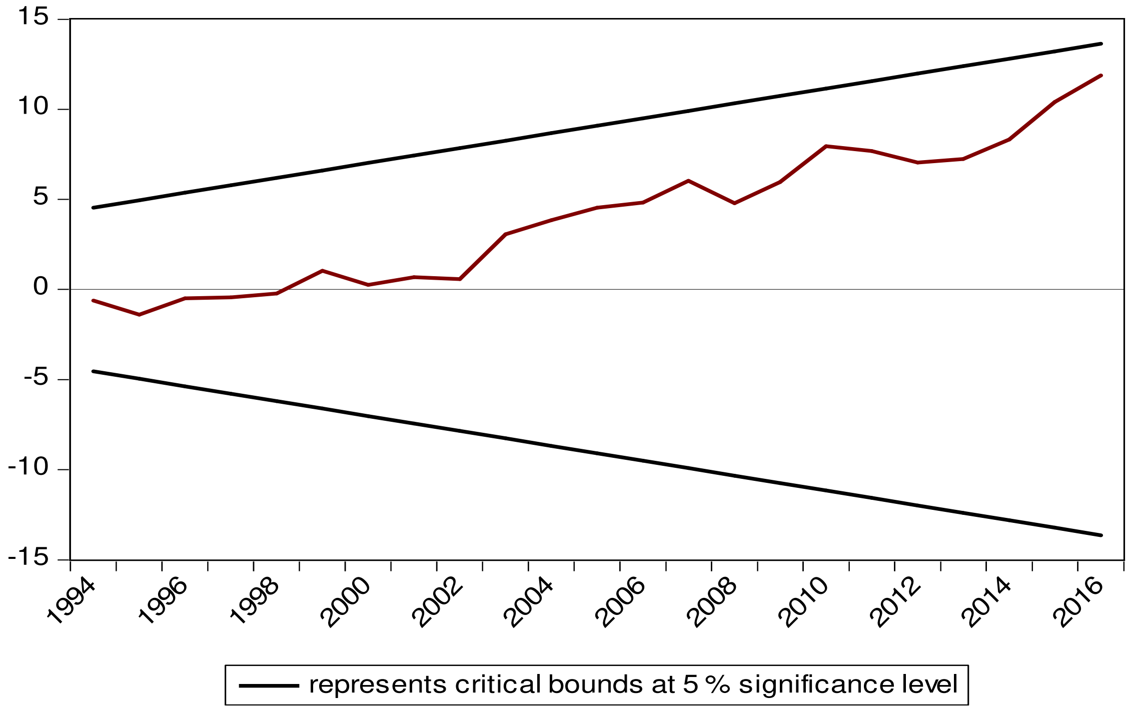


Figure 2 (a). The plot of cumulative sum of recursive residuals [ARDL (1,1,1)]

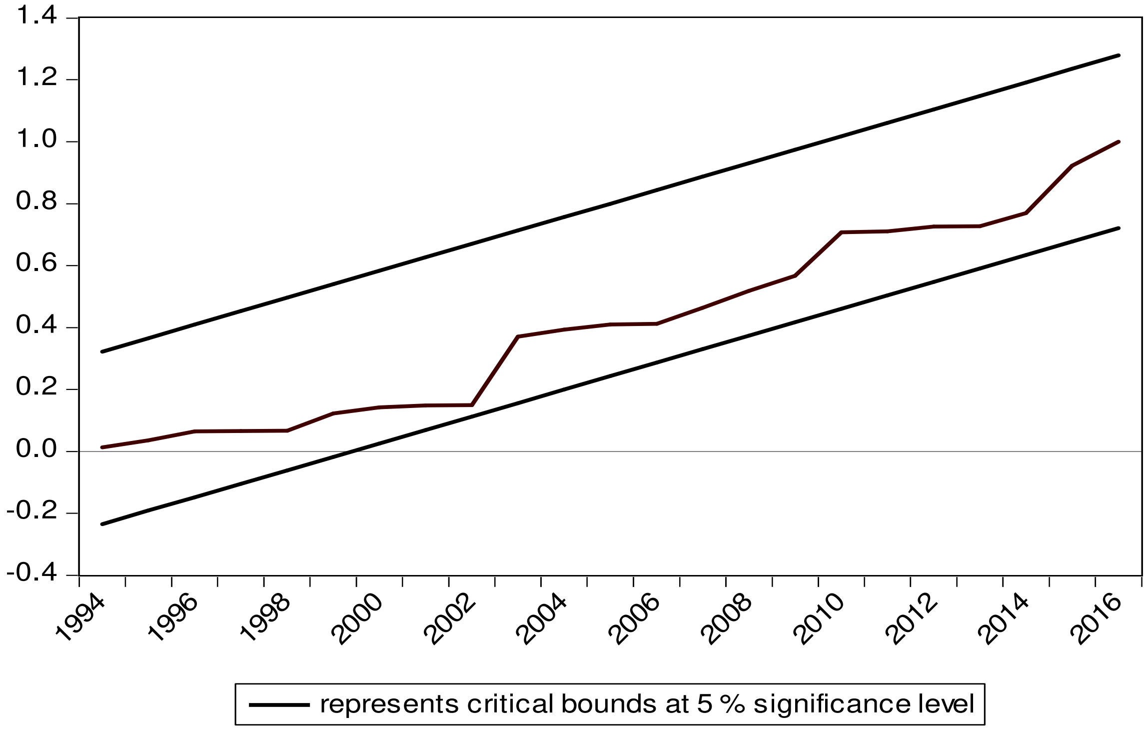


Figure 2(b). Plot of CUSUMSQ of recursive residuals [ARDL (1,1,1)]

As mentioned above, to check the direction of causality, we have employed Toda and Yamamoto (1995) Granger non-causality test. A pre-condition for Toda and Yamamoto procedure is to decide the order of the integration of series (d_{max}) and optimal lag length, k, so as to circumvent spurious causality or spurious non-appearance of causality. As can be seen from Table 4 that all the variables are non-stationary at levels, but the first difference of all the variables are stationary, indicating that the highest order of integration, d_{max}=1. The next step is to decide the optimum lag size. Considering the sensitivity of Granger non-causality test to lag length, we use a combination of SBC, AIC and LR test for selecting the optimal number of lags in each case. All the criteria unanimously suggest that the optimal lag order in each case is 1; this is perhaps due to the reason that we are dealing with annual data. The results of Granger causality with MWALD χ^2 are presented in Table 9.

Table 9 shows that exports Granger causes economic growth as we can reject the null hypothesis 'Granger non-causality from exports to GDP' at 5 percent level of significance. But, we cannot reject the null hypothesis of non-causality from GDP to exports. Therefore, there is solid proof of unidirectional causality running from exports to GDP growth. Table 9 further reveals that there is a unidirectional causality from terms of trade to GDP.

Table 9. Results of Granger Causality based on Toda Yamamoto Procedure

Dependent Variable	source of causation			direction of causality
	lgdp	**lex**	**ltot**	
	Modified Wald χ^2-statistic (p-value)			
$lgdp$	-	4.62(0.0315)**	14.48(0.0001)*	$lex \longrightarrow lgdp$; $ltot \longrightarrow lgdp$
lex	0.39(0.5293)	-	1.78(0.1819)	No causality
$ltot$	0.0019(0.9651)	2.69(0.1008)	-	No causality

Note: * and ** represent significance level at 1% and 5 %.

Our research findings support the export-led growth hypothesis (ELG) for India, while the study does not provide any evidence for growth-led exports (GLE). Our results are consistent with the findings of Dash (2009), Trivedi and Pradhan (2010) and Agrawal (2015) who found evidence of unidirectional causality flowing from export to economic growth for India. Additionally, our results partially support the studies of Dhawan and Biswal (1999), Love and Chandra (2004) and Ray (2011) who found proof of bidirectional causality between exports and economic growth for India. However, these findings are contrary to those of Asafu-Adjaye and Chakraborty (1999), Shirazi and Manap (2005), and Sharman and Panagiotidis (2005) whose studies did not find any causal relationship between exports and economic growth for India.

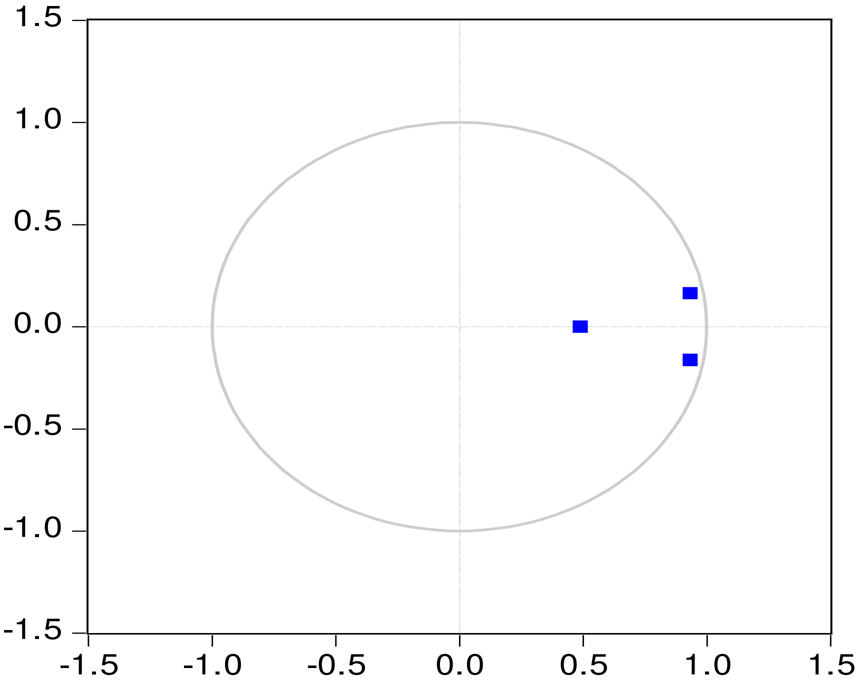


Figure 3. Inverse roots of AR Characteristic polynomial

The estimated Toda-Yamamoto model is dynamically stable as shown by the plot of inverse roots of AR characteristic polynomial (Figure 3). Figure 3 clearly portrays that no root lies outside the circle.

CONCLUSION AND POLICY IMPLICATIONS

This study empirically examines the relationship between exports, economic growth and terms of trade for India and addresses one of the debated issues in the literature whether the export-led growth hypothesis is valid for India. Although many empirical studies have been conducted on the export-output relationship for India, the results are still inconclusive and ambiguous. To draw a more convincing conclusion, the present study has employed the ARDL bounds testing approach to cointegration, followed by Toda-Yamamoto (1995) version of the Granger non-causality test. Unlike the previous studies, this study employs recently developed structural break tests to take into account the trend breaks experienced by the Indian GDP as well as exports during the study period.

Empirical evidence from ARDL model indicates that there exists a long-run equilibrium relationship between exports, economic growth, and terms of trade when GDP growth (proxy for economic growth) is the dependent variable. Exports and terms of trade have a very significant and positive impact on the Indian economic growth in the long-run. Further, the results based on Toda-Yamamoto (1995) Granger causality test reveal that there exists a uni-directional causality that runs from exports to economic growth without any feedback. In summary, the findings of our study strongly support the export-led growth hypothesis (ELGH) for India but provide no evidence for growth-led export (GLE).

It appears that export promotion policies pursued by the government of India in the last two and half decades, have paid off and exports have emerged as an impetus to economic growth in the long-run. This is also evident from the fact that between 2002 and 2012, when Indian economic growth grew at the rate of near about 9 percent per annum, India's manufacturing exports also increase at a rate of 25 percent per annum and the services exports grew by 30-32 percent. Therefore, India should continue its export promotion strategy for sustaining its high growth process; but at the same time, the policy-makers must not go overboard in promoting exports through explicit and implicit subsidies and other unsustainable policies. The policy-makers need to design trade policy in such a way that it maintains a balance between export-led growth (ELG) and domestic demand-led growth (DDLG).

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