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ABSTRACT

We analyse the role of exports in India's economic growth and examine whether the export-led growth hypothesis (ELGH) applies to India. Our causality analysis provides support for the validity of the ELGH for India for the post- trade liberalisation period (though not for the pre-liberalisation period). Error variance decomposition and other analyses are also undertaken; these corroborate the results of the causality analysis and suggest that the rapid growth of exports has played a substantial role in increasing the growth rate in India following trade liberalisation in 1991.

Keywords: Exports, growth, causality, export-led growth, India

JEL Classification: O24, F13

1 INTRODUCTION

One of the important issues that have dominated the debate in the international growth literature is the role of exports in economic growth. Many economists have argued that more rapid growth of exports can lead to higher economic growth. This is the so-called export-led growth hypothesis (ELGH) (see, for example, Beckerman 1965; Balassa 1978, 1985; Bhagwati 1978, 1988; Edwards 1998; Shirazi and Manap 2005). Several reasons are given to support the ELGH: (1) exporters must sell their products in competitive world markets, which forces them to become more competitive and to adopt or innovate new technology more rapidly; (2) domestic competition then stimulates even non-exporters to try to be more competitive and adopt or innovate new technology more rapidly, leading to faster productivity gains throughout the economy and thus faster economic growth; (3) trade liberalization or export promotion policies allocate scarce resources throughout the economy better; (4) exporters can exploit economies of scale given their access to large world markets; (5) increasing exports facilitate improved access to international capital and intermediate goods for domestic firms, again leading to productivity gains and expansion of the production frontier; and (6) with their access to much larger world markets, successful exporters can increase output and employment more rapidly.

In this way, greater exports lead to a more competitive, technologically mature, productive and rapidly growing economy. The analysis based on 'endogenous' growth theories (in a framework characterised by increasing returns to scale) also emphasises the benefits stemming from a dynamic export sector (see Romer 1986, 1992) and argues that more open economies can better absorb technological advances (Barro and Sala-i-Martin 1995, chap. 8; Edwards 1998).

Many developing countries have also undertaken import substitution industrialisation (ISI) policies. In the early years of political independence in the 1950s and 1960s, countries undertook ISI policies because of various political and economic reasons—they were afraid of re-inviting foreign domination, and wanted to encourage domestic (infant) industries and avoid importing economic shocks. Developing countries were also concerned about the likelihood that the terms of trade for their commodity exports would decline over time (the Singer-Prebisch hypothesis). However, small domestic markets (and resulting diseconomies of scale) constrained industrial growth under ISI, and the protection of domestic industries with high tariffs for long periods (and the resulting diseconomies of scale) constrained industrial growth under ISI, and the protection of domestic industries with high tariffs for long periods (and the resulting overvalued exchange rates) led to the creation of inefficient and non-competitive industries that could not export, grow rapidly, or contribute to rapid employment generation. This often led countries that followed ISI policies into economic stagnation with low growth of output and exports (see e.g., Balassa 1978; Bhagwati 1978,

88). Under ISI policies, exports were reduced to a minimum and certainly could not fuel growth in the rest of the economy.

Many empirical studies examine the validity of the ELGH (see Section 2); some support the ELGH and others reject it. Several studies find no causal relation between exports and growth. These empirical results are surprising in view of the strong analytical arguments in favor of the ELGH. However, there are two problems with most previous empirical studies.

1. The attempt to examine the export–growth relation did not separate the trade liberalisation phase of the economy (when the ELGH is analytically expected to be valid) from its import substitution phase (when the ELGH is not expected to be valid).
2. Some analyses of the exports–growth relation in a bi-variety framework that concluded that no co integration or causal relation exists between them may be using mis-specified models that lack important additional variables.

After eliminating these problems, this study re-examines the empirical evidence regarding the ELGH in India, as its GDP growth has accelerated considerably following economic reforms in 1991, averaging about 7 per cent per annum since 1995.

The rest of the paper is organised thus: Section 2 reviews the existing literature and presents the motivation for further work. Section 3 explains the methodology, econometric procedures, and data sources used. Section 4 discusses the results of our empirical analysis. Section 5 carries out forecast error variance decomposition (FEVD) analysis to further examine the role of exports in India's economic growth. Section 6 summarises the main conclusions.

2 REVIEW OF EXISTING LITERATURE AND MOTIVATION FOR THE STUDY

To examine the empirical validity of the ELGH for India, we analyse the direction of causality between exports and output. Therefore, it is worth considering the possibilities regarding the direction of causality between exports and output (or their growth rates).

As mentioned in the introduction, the ELGH argues that higher exports lead to higher economic growth because they facilitate more competition, faster technological progress and economies of scale, etc. Some economists have also suggested that causality would run from economic growth to exports in economies where factors like technological innovation cause growth. Increased growth helps to increase output and exports in such cases (by lowering the price of goods, for example). For example, Vernon (1966) focused on the opposite causality channel, in which the self-propelled growth of the domestic economy leads to improved competitiveness and eventually to the expansion of exports. Balassa (1985) and Bhagwati (1988) developed some of Vernon's ideas further and suggested bi-directional

causation between exports and growth. They argued that export expansion leads to efficiency and allocation effects, which create the initial growth impetus to output. This impetus enhances international competitiveness in many industries through scale economies. The enhanced competitiveness fosters a new round of export expansion. The expansion starts a virtuous cycle—exports lead to growth, which in turn leads to increase in exports. Finally, some studies have also claimed that there is no relation between exports and GDP or their growth rates. In particular, during the ISI regimes, it can be expected that exports do not lead to growth; rather, economic growth (whether due to technological innovation, fiscal or monetary stimulus or other reasons) could lead to exports or the two may not be related (see, for example, Bhagwati 1978, 1988). Thus, we see that, analytically, all four results are possible:

a. export growth causes output (or GDP) growth;
b. output growth causes export growth;
c. there is a bi-directional causality between export growth and output growth; and
d. there is no long-run relation or causality between exports growth and output growth.

Of these, (a) would unequivocally support the ELGH; (c) would partially support it; and (b) or (d) would negate it. In fact, (b) or (d) may be the relation likely to exist during a country's ISI phase. As per Vernon's arguments, (b) may also hold in developed countries where technological innovations may play a substantial part but it is more likely to be a consequence of ISI policies in developing economies.

The previous empirical findings on the direction of causality are equally ambiguous. The early cross-section studies of Michealy (1977), Balassa (1978, 1985); Bhagwati (1988), Feder (1982) and others support the ELGH, usually by showing that exports had a positive correlation with output or growth. However, they assume—rather than demonstrate—that export growth has a positive causal effect on GDP growth, ignoring that a positive correlation between these two variables can also be compatible with causality running from output growth to export growth. Further, country-specific factors may cause apparent differences in the effect of exports on growth across countries, but these factors cannot be controlled for in cross-country regressions.

In response to these criticisms, several country-specific time series causality analyses have come up recently to examine the validity of ELGH. For example, Abdulai and Jaquet (2002), Federici and Marconi (2002), Awokuse (2003), Kaushik et al. (2008) and Chigusiwa (2011) support the ELGH and suggest that export is an integral factor in determining economic growth. On the other hand, studies such as Greenway and Sapsford (1994), Richards (2001), Panas and Vamvoukas (2002), Love and Chandra (2005), and Reppas and Christopoulos (2005) found the opposite direction of causality or else rejected the ELGH.

Several studies also support bi-directional causality between exports and economic growth (Sampath and Anwar 2000; Chandra 2003; Mah 2005; Husein 2009). Finally, many studies even fail to find any long-term relation (or co integration) between exports and economic output, such as those of Sharma and Panagiotidis (2004), Oskooee and Economidou (2009), and Waithe et al. (2011).

The existing empirical literature on India also reveals the same mixed results (see, for example, Mallick (1994), Sampath, and Anwar 2000; Nidugala 2001; Love and Chandra 2004; Sharma and Panagiotidis 2004; Kaushik et al. 2008; Ray 2011).

Thus, neither analytical nor empirical studies have been able to resolve the issue satisfactorily and leave readers confused about the validity of the ELGH. We believe that some problems in testing cause this confusion in empirical results.

1. Mixing up the ISI and trade liberalisation or export promotion phases of a country's history. This problem is acute in the case of India, where ISI policies were followed for long periods. India followed mostly ISI-type policies for most of the period from independence in 1947 until the economic reforms in June 1991. During this period (the 'pre-liberalisation phase'), high tariffs and an overvalued exchange rate (Figure 1) reduced exports to a minimum, and indeed exports could not have fueled economic growth during this period—nor does the ELGH claim so. It is only during the 'post-liberalisation phase' (June 1991 onwards) when liberal trade policies were followed that exports could grow rapidly and ELGH might hold. Thus, if data from different phases of the economy are mixed, testing for ELGH or causality will be unlikely to yield clear results, as is the case with most empirical studies mentioned earlier.

2. Testing for causality between export and output in a bi-variety framework without being sure that co-integration exists between the variables. Granger (1988) shows that when two variables co-integrate, causality must exist between them in at least one direction. Thus, when there is no co-integration, causality is not likely to exist in either direction, as has been found by some studies such as Sharma and Panagiotidis (2004). In such cases, it is important to consider whether some additional variable(s) important to the relation between exports and GDP are missing whose inclusion may lead to co-integration between all concerned variables. For example, we found that including the real effective exchange rate (REER) as an additional variable (in an a-theoretical vector auto-regression (VAR) framework) led to co-integration between exports, GDP and REER, probably because REER explained some of the movement in exports not fully explained by variations in GDP. Once a co-integrating or long-term relation had been found, the causality was indeed also found to exist in at least one direction.

3. Another issue raised in a few studies (Greenaway and Sapsford 1994; Ghatak 1997; Islam 1998) is that since exports is a component of GDP, a test between them would be biased

in favour of finding co-integration and causality from export to growth (since an increase in exports must increase GDP, other things being constant). This bias can be avoided if we carry out the test of co-integration and causality between real exports (X) and real domestic output or GDP net of exports (GDP_{nx}).

In this paper, we avoid these errors and re-investigate the empirical evidence on the ELGH hypothesis for India. We use time series data from India and carry out causality analysis. We ensure that the analysis includes sufficient variables to ensure a stable long-term (or co integrating) relation among them. We undertake separate tests for cointegration and causality for the pre-liberalisation phase dominated by ISI policies (1960 to 1991: Q2) and the post-liberalisation period (1991: Q3 to 2012: Q2).Finally, instead of GDP, we use GDP net of exports, GDP_{nx}. The ELGH would be considered valid if it holds during the post-liberalisation phase. We also carry out the FEVD analysis of economic growth and export growth using the vector error correction model (VECM) to examine the causality result and the role of exports in India's economic growth.

3 METHODOLOGY AND DATA

We econometrically examine co integration and direction of causality between exports (X) and GDP net of export, or GDP_{nx} (to avoid bias in the tests resulting from exports being a component of GDP). As commonly used in the literature (see Nidugala 2001; Sharma and Panagiotidis 2004; Love and Chandra 2005; Husein 2010), we use a log-linear relation between exports and output (GDP_{nx}). This specification has the advantage of minimising heteroscedasticity and first differences of the variables having the interpretation of being their growth rates. Thus, the relation between exports and output can be written as:

$$\text{Log } X = a + b \text{ Log } LGDP_{nx} \qquad (1)$$

As discussed in Section 2, cointegration may not be obtained between exports and output if an important variable is missing. Therefore, we repeat the co-integration test by including the REER as an additional variable in the analysis, i.e,

$$\text{Log } X = a + b \text{ Log } LGDP_{nx} + c \text{ Log REER} \qquad (2)$$

Since the REER affects the price foreigners pay for Indian exports, it might have caused variations in exports that movements in GDP_{nx} alone could not explain (or variations in GDP_{nx} that exports alone could not explain). Indeed, a depreciation of the REER could lead to increased real exports as they become cheaper for foreigners or to increased domestic output (GDP_{nx}) as foreign imports become more expensive. Previously, Rodrik (2008) and Hua (2012) and others have argued that real exchange rates can significantly affect economic

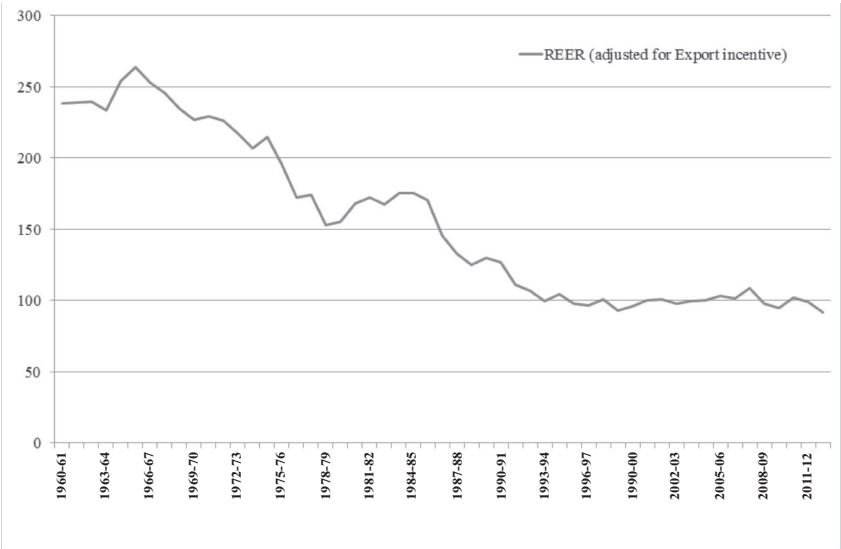
growth. The FEVD analysis in Section 5 proves this—it shows that changes in REER explained as much as 35 per cent of the error variance in export growth and 11 per cent in the growth of real domestic output, GDP_{nx}, during the post-liberalisation period (Table 8). The numbers are lower but still significant even in the pre-liberalisation period. This might explain the lack of co integration between GDP_{nx} and exports when the REER is not included.

Previously, some studies have also used terms of trade (see, for example, Love and Chandra 2005; Hussein 2010) or imports (Shirazi and Manap 2005) instead of the REER. In our case, data on terms of trade was not available for the full period of the study. We did not use imports as it is strongly correlated with exports, which can lead to misleading judgment about the true role of exports. Some other authors have also used many explanatory variables. We avoided this to focus on the relation between output and exports and because the limited observations available did not permit a meaningful econometric analysis with a large number of variables.

3.1 Data Sources

The period of study is from 1960 to 2012. Trade liberalisation policies were initiated in India in June 1991 (1991:Q2, where Q2 denotes second quarter of calendar year). We break up this period into the pre-liberalisation or ISI phase (1960 to 1991) and a post-liberalisation or EP phase (1996:1 to 2012:2). Starting from 1991:3 was not possible as quarterly GDP was available only from 1996 and using yearly data would have left us with a very small data set. All data are taken from the Reserve Bank of India's Handbook of Statistics. We have used GDP net of exports (GDP_{nx}) at factor cost at constant (1999-2000) prices. Real exports (X) are obtained by taking exports in current domestic currency and dividing by the wholesale price index (WPI) as a price deflator only for exports was not available. For REER, the 36-currency export-weighted REER are available from the RBI website. However, from 1960s to the 1980s, various incentive schemes were common to promote exports in view of the overvalued rupee. This affects the REER actually faced by the exporters. Joshi and Little (1994) provide a series of REER adjusted for export incentives for 1960-88 (base: 1978 = 100). Applying the ratio of their incentive-adjusted REER to unadjusted REER, we converted the unadjusted series (taken from RBI) to incentive-adjusted REER. The ratio of incentive-adjusted REER to the unadjusted REER in 1988 was 0.95. Srinivasan and Wallack (2003) assumed a constant level of export incentives until reform began in 1991 and then reduced the weighting factor linearly (by 1 per cent each year) until it became the same as the official REER in 1995. We followed the same procedure to construct the REER series. The final REER series used in the regression analysis is this incentive-adjusted REER series, which starts from 1960 (Figure 1).

Figure 1 The Real Effective Exchange Rate for India 1960–2012



Source: The Handbook of Indian Economy 2012-13, Reserve Bank of India & Srinivasan and Wallack (2003)

3.2 Econometric Issues

The econometric methodology to be used depends on whether the concerned variables are stationary or integrated; therefore, we began by examining the order of integration of each variable. This was tested by using the augmented Dickey-Fuller (ADF) test (see Dickey and Fuller 1976), the Phillips Perron test (Phillips and Peron 1988) and the Generalised Least Square based Dickey Fuller (DF-GLS) test of Elliott et al. (1996, 2001). The results are shown in Table 1. For each variable of interest (in logarithmic form), each test rejects the null of stationarity in level but not in first difference for the full period. Identical results are obtained for the pre and post-liberalisation sub-periods. This implies that all variables are integrated of order one (denoted I(1)) for the full period as well as the two sub-periods. The Granger representation theorem (Engle and Granger 1987) shows that a causal relation can exist between variables only of the same order of integration. Thus, henceforth, we only consider a long-term and/or causal relation between exports and output (GDP_{nx}) rather than exports and growth.

Since all the variables are integrated of order 1, the cointegration methodology is appropriate. We use Johansen's multivariate cointegration test, considered among the most reliable tests of cointegration. We then examine the causality testing between the concerned variables using the VECM, which is briefly explained below.

Table 1 Unit Root Tests

Variables	ADF		PP		ERS DF-GLS	
	Levels	1ST Diff.	Levels	1ST Diff.	Levels	1ST Diff.
Whole Period: 1960 to 2012						
$LGDP_{nx}$	-0.26	-6.53**	-2.28	-6.62**	-2.10	-4.58**
LX	-0.76	-10.25**	-0.68	-10.42**	-2.6	-2.60**
LREER	-1.00	-5.49**	-1.12	-5.47**	-1.87	-3.38**
Pre-Liberalisation Period: 1960 to 1991						
$LGDP_{nx}$	-0.78	-6.82**	-2.03	-6.78**	-2.05	-3.90**
LX	-2.84	-7.11**	-2.72	-6.78**	-1.24	-2.97**
LREER	-0.95	-3.23*	-0.95	-3.18**	-1.33	-3.15**
Post-Liberalisation Period: 1996:Q1 to 2012:Q2						
$LGDP_{nx}$	-1.83	-3.11**	-0.66	-15.0**	-2.12	-2.42*
LX	-2.38	-8.23**	-2.59	-8.23**	-1.31	-3.65**
LREER	-2.03	-5.11**	-3.12	-6.32**	-2.56	-5.81**

Notes: For all unit root tests at levels, an intercept and trend is included, whereas for the first difference, only an intercept is included. **and* indicate rejection of the null of no unit root at 1% and 5% significance levels respectively.

3.2.1 Testing the Direction of Causality using VECM

Angel and Granger (1987) point out that if there is a cointegrating vector among variables, there must be causality among these variables in at least one direction. They also provide a test of the direction of causality, which considers information provided by the cointegrated properties of variables. To test whether Y_t is caused by X_t, we estimate the following VECM relation:

$$\Delta Y_t = \eta + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{p} \beta_j \Delta X_{t-j} + \Theta(Y - \kappa X)_{t-1} + U_t \qquad (3)$$

where the lagged ECM term $(Y\text{-}X)_{t-1}$ is the lagged residual from the cointegrating relation between Y and X and more generally, X can be a vector of variables. There are two sources of causation of Y_t by X_t, the long-run causation through the lagged ECM term if is non-zero and short-run causation through the lagged dynamic terms X_t if $_i$ are not all equal to zero. Similarly, to test whether X_t is caused by Y_t, we estimate:

$$\Delta X_t = \eta' + \sum_{i=1}^{p} \gamma_i \Delta Y_{t-i} + \sum_{j=1}^{p} \delta_j \Delta X_{t-j} + \Phi(X - \kappa' Y)_{t-1} + U_t' \qquad (4)$$

Long-run causation from Y to X exists if is non-zero and short-run causation exists if $_i$ are not all equal to zero.

4 EMPIRICAL RESULTS

We begin with a test of cointegration between log of real exports (LX) and log of real GDP net of exports ($LGDP_{nx}$) using the Johansen cointegration procedure. Results for the full sample (1960-2012) are shown in Table 2, part A. The Johanson cointegration tests of trace and max-eigenvalue statistics suggest no cointegration relation between $LGDP_{nx}$ and real exports, LX (null hypothesis of no cointegrating vectors is not rejected). Sharma and Panagiotidis (2004) obtained similar results. But an important missing variable can easily cause the lack of cointegration between these variables (Section 2). Thus, we re-test the cointegrating relation between $LGDP_{nx}$ and LX by including the log of the real effective exchange rate (LREER), as an additional variable. With the inclusion of LREER, the Johansen cointegration test implies cointegration between the variables (see Table 2, part B: the null hypothesis of zero cointegrating vectors is rejected at 1 per cent significance level by both the trace and eigenvalue test statistics, while the null of one cointegrating vector is not rejected).

Table 2 Johansen Co-integration Test for the Whole Period (1960–2012)

Null hypotheses	Trace Statistic	Max–Eigen Statistic
A. Co-integration test between Output ($LGDP_{nx}$), and exports (LX)		
r = 0	13.83	11.82
r < 1	2.02	2.02
B. Co-integration test between $LGDP_{nx}$, LX and LREER		
r = 0	23.99**	20.30**
r < 1	3.69	3.69

Note: ** and * indicates rejection of the null hypothesis at 1% and 5% significance level.

If a set of variables is cointegrated, there exists valid error correction representation of the data, and causation must exist in at least one direction (Engle and Granger 1988). Thus, we proceed to test for causality between exports and output using the VECM procedure (Section 3). The results (Table 3) show that the null hypothesis that exports do not cause GDP_{nx} is not rejected by either the long or the short run tests. However, the null of output not causing exports is rejected by the long run test at 5 per cent significance level. This implies that GDP_{nx} caused exports during this period, which does not support the export led growth hypothesis.

However, as discussed earlier, India went through a major regime change in June 1991 when it switched from mostly ISI policies to trade liberalisation policies; therefore, it should

Table 3 Causality Test between Output and Exports for the Whole Period (1960–2012)

Null Hypothesis	Causality test	Test Value	p-value
Export (LX) does not cause Output ($LGDP_{nx}$)	Long run: $\Theta = 0$	-0.076 (coefficient)	0.406
	Short run: $\sum \beta_i = 0$	1.204 (Chi sq.)	0.321
Output ($LGDP_{nx}$) does not cause Export (LX)	Long run: $\Phi = 0$	-0.272 (coefficient)	0.002**
	Short run: $\sum \delta_i = 0$	2.021 (Chi sq.)	0.145

Notes: See equations (3) and (4) in Section 3. ** and * indicates rejection of the null hypothesis at 1% and 5% significance level.

be interesting and instructive to carry out the cointegration and causality tests separately for the pre-liberalisation phase (up to 1991:2) and for the post-liberalisation phase (1991:3 to 2012:2). All the variables remain integrated of order 1 for the pre- and post-liberalisation sub-periods (Table 1).Thus, we undertake Johansen cointegration tests for the pre-liberalisation period between log of real GDP_{nx} and log of real exports (Table4, part A). The table shows that the null hypothesis of zero cointegrating vectors is not rejected, implying that no cointegration exists between exports and GDP_{nx}. We then re-ran the test by including the log of REER as an additional explanatory variable in the model. The results are shown in Table4,part B: both trace and max-Eigen value statistics reject the null hypothesis of zero cointegrating vectors but do not reject the null of at least one cointegrating vector, thus confirming the presence of one cointegration vector between $LGDP_{nx}$, LX and LREER. This confirms the effect of LREER as an influencing factor in ensuring cointegration between GDP_{nx} and exports during the pre-liberalisation period.

Table 4 Johansen Co-integration Test for Pre-Liberalisation Period (1960–1991)

Null hypotheses	Trace Statistic	Max–Eigen Statistic
A. Cointegration test between Output ($LGDP_{nx}$), and exports (LX)		
r = 0	7.22	6.62
r < 1	0.59	0.59
B. Cointegration test between $LGDP_{nx}$, LX and LREER		
r = 0	14.11*	13.36*
r < 1	0.75	0.75

Note: ** and * indicates rejection of the null hypothesis at 1% and 5% significance level.

Next, we test the direction of causality using the VECM procedure (Section 3). The results (Table 5) show that the null hypothesis that exports do not cause GDP_{nx} is not rejected

by either the long or the short run tests. However, the null of output not causing exports is rejected by the long run test. This implies that there was long run causality from GDP_{nx} to exports during the pre-liberalisation period, which again does not support the export led growth hypothesis. As explained earlier in the introduction, this is what we expected during the pre-liberalisation phase. IS policies dominated that phase, in which high tariffs, overvalued exchange rates and other anti-export policy biases reduce exports to a minimum and they cannot possibly become an engine of growth. Thus, this result seems quite appropriate and should not be interpreted as negating the validity of the ELGH; to test it properly, we need to test it for the post-liberalisation period (only).

Table 5 Causality Test between Output and Exports for Pre-Liberalisation Period

Null Hypothesis	Causality test	Test Value	p-value
Export (LX) does not cause Output ($LGDP_{nx}$)	Long run: $\Theta = 0$	-0.023 (coefficient)	0.824
	Short run: $\sum \beta_i = 0$	1.298 (Chi sq.)	0.274
Output ($LGDP_{nx}$) does not cause Export (LX)	Long run: $\Phi = 0$	-0.299 (coefficient)	0.045*
	Short run: $\sum \delta_i = 0$	2.111 (Chi sq.)	0.158

Notes: See equations (3) and (4) in Section 3. ** and * indicates rejection of the null hypothesis at 1% and 5% significance level.

Table 6 Johansen Co-integration Test for Post-Liberalisation Period (1996:1–2012:2)

Null hypotheses	Trace Statistic	Max–Eigen Statistic
A. Cointegration test between Output ($LGDP_{nx}$), and exports (LX)		
r = 0	6.68	6.62
r < 1	0.09	0.59
B. Cointegration test between $LGDP_{nx}$, LX and LREER		
r = 0	36.87*	29.454*
r < 1	7.415	7.307

Note: * indicates rejection of the null hypothesis at 5% significance level.

Therefore, next we consider the results of cointegration and causality tests for the post-liberalisation period, which is dominated by trade liberalisation policies. While liberalisation began in June 1991, for this exercise we use data from 1996:1 to 2012:2, because quarterly data on GDP is available only from 1996 (and annual data would have provided only 20 observations, which are too few for statistical analysis). Like the previous exercise, we ran cointegration test between exports and GDP_{nx} with and without REER in the models (Table 6). Interestingly, even during the post-liberalisation period, there is no cointegration when the

test is run between the logs of GDP_{nx} and exports only (Table 6, part A) as the null of zero cointegrating vectors is not rejected. However, the variables cointegrate when the log of REER is included in the model (Table 6, part B) as the null of zero cointegrating vectors is now rejected at the 5 per cent significance level. This again confirms the relevance of the REER in ensuring cointegration and a proper understanding of the long-run relation between exports and GDP.

Finally, we carry out the causality test between output and exports for the post-liberalisation period (using the tri-variate VECM model with $LGDP_{nx}$, LX and LREER) (Table 7).The results show that the null hypothesis that exports do not cause GDP_{nx} is rejected by both the long or the short run tests. However, the null of GDP_{nx} not causing exports is also rejected by both the long run and short run tests at 5 per cent significance level. This implies that there exists bi-directional causality between exports and GDP_{nx} during the post-liberalisation period implying that there is feedback between exports and GDP_{nx}. This evidence provides support for the weaker form of the export led growth hypothesis during the post-liberalisation period.

Table 7 Causality Test between Output and Exports for Post-Liberalisation Period

Null Hypothesis	Causality test	Test Value	p-value
Export (LX) does not cause Output ($LGDP_{nx}$)	Long run: $\Theta = 0$	-0.132 (coefficient)	0.824
	Short run: $\sum \beta_i = 0$	9.048 (Chi sq.)	0.274
Output ($LGDP_{nx}$) does not cause Export (LX)	Long run: $\Phi = 0$	-0.194 (coefficient)	0.045*
	Short run: $\sum \delta_i = 0$	6.159 (Chi sq.)	0.158

Notes: See equations (3) and (4) in Section 3. ** and * indicates rejection of the null hypothesis at 1% and 5% significance level

Thus, dividing the period of analysis into ISI and trade liberalisation phases shows that causality ran primarily from GDP_{nx} to exports during the pre-liberalisation period dominated by ISI policies, but became bi-directional between exports and GDP_{nx} during the post-liberalisation period dominated by trade liberalisation policies. The bi-directional causality is consistent with the weaker form of the ELGH. Thus, the separate analysis for the pre- and post-liberalisation periods brings out the difference in the response of the economy to exports. It shows that exports fuelled growth during the post-liberalisation period, although not during the pre-liberalisation period. This evidence supports the arguments in favour of trade liberalisation and the ELGH for India during the post-liberalisation period.

5 ROLE OF EXPORTS IN ECONOMIC GROWTH: FEVD ANALYSIS

The causality tests based on VECM and VAR can be interpreted as within sample tests. They can indicate the Granger exogeneity or endogeneity of the dependent variable within the sample period only. They provide no information about the dynamic properties of the system or the relative strength of the Granger-causal chain or extent of exogeneity of the variables beyond the sample period. The FEVD analysis separates the variation in an endogenous variable into the component shocks to the VAR/VECM and thus, provides information on the relative importance of each variable's random innovations (including its own) in affecting the endogenous variables in the VAR/VECM. It can also be used to infer the (out-of-sample) direction of causality: if the error variance of a variable is mainly explained by shocks to itself, it is likely to be self-caused or exogenous, while if a significant part of its error variance is explained by shocks to other variable(s), these latter variable(s) are said to determine or 'cause' it.

To see how real exports (LX) and real output ($LGDP_{nx}$) respond to various shocks to the system, we perform the FEVD analysis characterising the dynamic behaviour of the VECM involving first differences (i.e., growth rates) of LX, $LGDP_{nx}$ and LREER with the lagged ECM or error correction term included as an exogenous variable. The analysis is carried out separately for the pre- and post-liberalisation periods (Table 8). For the pre-liberalisation period (1970–1991), Table 8 shows that in the long-run (about 10 years)after the shock, GDP growth ($LGDP_{nx}$) explains over 93 per cent of its own shock and export growth explains only 0.62 per cent (LX), while GDP growth ($LGDP_{nx}$)explains 16 per cent of the exports growth. Therefore, GDP growth ($LGDP_{nx}$) was determined largely by its own shock during the pre-liberalisation period while its impact on export growth was significant. This implies that shocks to the growth of GDP_{nx} significantly influenced export growth in the pre-liberalisation period, which corroborates the findings from the causality analysis of this period that output caused exports.

The lower part of Table 8 shows the quarterly variance decomposition for the post-liberalisation period using quarterly data for 1996:1 to 2012:2 for growth of exports (LX) and GDP ($LGDP_{nx}$). The results show that growth of exports significantly explains the growth of GDP_{nx} during this period. While 67 percent of the forecast error variance of $LGDP_{nx}$is explained by itself after 60 quarters (15 years –the period after which the results stabilise), around 21 per cent is explained by the growth of exports, LX. At the same time, for the growth of exports, LX, around 15 per cent of the variance is explained by LGDPnx at the end of 15 years. These results suggest bi-directional causality between exports and $GDP_{nx,}$ and again corroborate the results of the causality tests of Section 4, although we now see that the feedback is stronger from exports to GDP (21 per cent) than in the reverse direction (15 per cent). The role of GDP growth ($LGDP_{nx}$) in explaining the role of export growth (LX) has remained constant (about 15 per cent at the end of 15 years) in the pre and post-liberalisation periods. However, the role of growth of exports (LX) in explaining the growth of GDP ($LGDP_{nx}$) has increased considerably from 0.62 per cent in the pre-liberalisation period to about 21 per

cent in the post-liberalisation period. This, trade liberalisation appears to have contributed an additional 20 per cent to the growth of GDP_{nx} during the post liberalisation period.

Table 8 Forecast Error Variance Decomposition Analysis for Growth of Output and Exports

Time horizon (years)	% of Forecast Error Variance in growth of real output ($\Delta LGDP_{nx}$) explained by		% of Forecast Error Variance in growth of real Export (ΔLX) explained by	
	Export growth (ΔLX)	Output growth ($\Delta LGDPnx$)	Export growth (ΔLX)	Output growth ($\Delta LGDP_{nx}$)
Pre Liberalization (Yearly Analysis)				
1	0.00	100.00	79.18	20.81
2	1.61	98.38	61.00	38.99
3	1.40	98.59	50.64	49.35
4	3.11	96.88	42.19	57.80
5	5.56	94.43	37.86	62.13
6	5.66	94.33	36.48	63.51
7	6.01	93.98	36.60	63.39
8	5.38	94.61	36.91	63.08
9	4.93	95.06	36.45	63.54
10	5.55	94.45	35.54	64.45
Post Liberalization (Quarterly Analysis) (Quarters)				
5	8.28	91.71	67.66	32.33
10	11.76	88.24	69.20	30.79
15	15.96	84.04	69.17	30.82
20	28.36	71.63	68.93	31.06
25	39.01	60.99	68.37	31.62
30	43.96	56.04	67.73	32.26
35	47.25	52.74	67.16	32.83
40	49.76	50.24	66.74	33.25
48	51.18	48.82	66.35	33.64
52	51.76	48.24	65.94	34.05
56	52.37	47.62	65.59	34.40
60	53.07	46.93	65.32	34.67

These findings are supported by the results on compounded annual growth rates (CAGR) of exports, GDP and GDP_{nx} during the pre and post-liberalisation phases (Table 9).The table shows that the exports, which only grew at 4.1 per cent during the pre-liberalisation or ISI phase, grew at 12.45 per cent during the post-liberalisation phase. The average CAGR of

GDP—which was 3.87 percent during the ISI phase—increased to 6.2 percent during the EP phase, while even the average CAGR of GDP net of exports (GDP_{nx}) went up from 3.8 percent during the IS phase to 5.2 percent during the post-liberalisation phase. Since we saw earlier that about 21 per cent of the growth of GDP_{nx} during the post-liberalisation phase was explained by exports (as compared to only 0.62 per cent during the pre-liberalisation phase), these results imply that exports contributed about 1 per cent additional growth of output (GDP_{nx}) during the post-liberalisation phase.

Table 9 Annual Compound Growth Rates of Export, GDP and GDP net of Export

Period of Exports (GDP_{nx})	Real Exports	Real GDP	Real GDP net
Import Substitution Period: 1960-1991	4.10	3.87	3.8
Export Promotion Period: 1992-2006	12.45	6.2	5.2

Clearly, therefore, the rapid growth of exports has played a substantial role in increasing the growth rate in India following economic liberalisation in 1991.

6 CONCLUSIONS

In this paper, we have undertaken an empirical analysis to examine the role of trade in India's exports and evaluate whether the ELGH is valid for India. Despite several earlier studies, clear results were not available on this issue. Our empirical analysis explains the reasons for these unclear results. We show that while exports and GDP do not cointegrate by themselves for the case of India, they do cointegrate when an additional variable (REER)—which explains some of the variation in exports not explained by variations in output—is included in the analysis. Then, all variables cointegrate and hence causality must exist in at least one direction.

We further noted that India had a long phase of ISI policies, when exports are reduced to a minimum due to high tariffs, an overvalued exchange rate, and other anti-export biases. Certainly, exports could not be an engine of growth during this phase. Thus, we analysed the direction of causality separately for the pre-liberalisation (1960 to 1991:2) and post-liberalisation (1991:3 to 2012:2) phases. We found that export growth did not cause output growth during the ISI phase (rather, output growth determined export growth during this phase). However, we also found that during the post-liberalisation phase there existed a bi-directional causality between exports and GDP with export growth explaining about 21 per cent of the growth in GDP net of exports or GDP_{nx}. By contrast, exports growth explained only 0.6 per cent of GDP_{nx} growth during the pre-liberalisation phase.

Thus, this evidence supports the view that ELGH is valid for India, at least in the weak form, and that exports contributed about 1 per cent additional growth to GDP during the post-

liberalisation phase than they did earlier. These findings explain why the previous studies—which mixed up the ISI and trade-liberalisation phases—often found ambiguous results and failed to provide a proper understanding of the important role that trade liberalisation and the growth of exports has played in increasing the growth rate of India's GDP.

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