ARE INDIAN EXPORTS AND IMPORTS COINTEGRATED?
KONYA, Laszlo*  
SINGH, Jai Pal

Abstract
The purpose of this study is to investigate empirically the presence of an equilibrium relationship between the logarithms of Indian exports and imports between 1949/50 and 2004/2005, using the unit-root, cointegration approach. To ascertain robustness, exports and imports measured in current prices but in two currencies, Indian rupee and US dollar have been analyzed. Moreover, since the sample comprises data from both the fixed and freely floating exchange rate periods, the tests have also been performed allowing for a one-time structural break in 1992/93. The results indicate no-cointegration between exports and imports. The lack of cointegration means that Indian macroeconomic policies have been ineffective in bringing exports and imports into long-run equilibrium and India is in violation of her international budget constraint.

JEL Classification: C22, C32, F14, O24
Key Words: Export, Import, Cointegration, India

1. Introduction

In the aftermath of the Asian financial turmoil, policy makers in many countries have been forced to take renewed interest in the overall effect of various macroeconomic policies on the trade balance. Knowledge of whether imports and exports are cointegrated is essential for the design and evaluation of current and future macro policies aimed at achieving trade balance (Arize, 2002). Cointegration between exports and imports implies that trade deficits are only short-term phenomena and thus sustainable in the long-run. This, in turn, means that countries are not in violation of their international budget constraints because their macroeconomic policies have been effective in bringing exports and imports into long-run equilibrium (Herzer and Nowak-Lehman, 2006). According to Bahmani-Oskooee and Rhee (1997), an exchange rate policy is always accompanied by other fiscal and/or monetary policies, so the presence of a long-run relationship among the exports and imports of a country implies that appropriate macroeconomic policies might have been implemented to correct for trade imbalance.

In the footsteps of Hakkio and Rush (1991) and Husted (1992), a growing empirical literature has investigated the existence of long-run convergence between exports and imports for developed, developing and least developed countries alike. However, only Arize (2002) and Upender (2007) considered this issue in relation to India. Using the system approach of Johansen (1995) and the robust single equation approaches of Phillips and Hansen (1990) and Stock and Watson (1993), Arize (2002) found evidence in favor of cointegration over the period 1973-1998 in 35 out of 50 countries, including India. The

* László Kónya, Department of Economics and Finance, La Trobe University, Bundoora, VIC 3086, Australia. Corresponding author. Email: l.konya@latrobe.edu.au, and Jai Pal Singh, College of Management Shri Mata Vaishno Devi University, Kakryal, Katra, J&K -182301, India
results of Upender (2007), based on the augmented Dickey-Fuller (ADF) and the Phillips-
Perron (PP) tests on India’s nominal exports and imports from 1949/50 to 2004/05, and
also on the residuals from the cointegration regressions, indicated that India’s exports and
imports were cointegrated.

India has had trade deficit for long. The aim of this study is to reevaluate the
effectiveness of India’s macroeconomic policies in driving exports and imports towards
long-run equilibrium between 1949/50 and 2004/05 by testing whether Indian exports and
imports, measured in current Indian rupee and US dollar, are cointegrated. Our
contribution to the existing literature is twofold. Firstly, this is only the third attempt in
the literature to investigate the sustainability of Indian trade imbalance by testing for
cointegration. We apply the system approaches of Johansen (1995) and Saikkonen and
Lütkepohl (2000a, 2000b), similarly to Arize (2002), but on an updated an extended
yearly data set, just like Upender (2007). Secondly, in order to incorporate the potential
impact of the March 1993 switch from a fixed exchange rate regime to a freely floating
exchange rate policy, the analyses are also performed allowing for a one-time structural
break in 1992/93. This is an important issue since, as Arize (2002, p. 103) warned, there
is no ground to assume that the behavior of the variables and the relationship between
them are the same during the fixed and flexible exchange rate periods. Most likely for this
reason, contrary to Arize (2002) and Upender (2007), our analyses indicate the lack of
cointegration between India’s exports and imports.

The rest of this paper is organized in four sections. The evolution of India’s Trade
reforms is summarized in Section 2. The methodology used in this paper is briefed in
Section 3 and the data and empirical results are presented in Section 4. Finally, the
conclusion can be read in Section 5.

2. India’s Trade Reforms

The Indian economy is often termed a ‘mixed economy’, referring to a blend of public
control over important areas of industrial development combined with some freedom for
private enterprises. The main characteristic of India’s trade regime is import substitution.
Her import policy was liberalized not long after gaining independence in 1947, and
although the foreign exchange crisis in 1956-57 brought an end to this first wave of
reforms, systematic and deeper reforms were initiated in July 1991 in order to deal with
the consequences of the balance of payments crisis. At the same time, India also started to
open its economy to international trade.

Following Panagariya (2004), in the discussion below we divide the history of India’s
post-independence external-sector reforms into three phases: 1950-75, when the main
trend was toward tighter control and virtual autarky; 1976-91, characterized by some
liberalization, especially during the last 5-7 years of this period; and 1992 onward, when
deeper and more systematic liberalization took place.

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2 Guisan (2004) provides an interesting discussion and econometric modeling of India’s
international trade and development during the last four decades of the 20th century.
First Phase: 1950-75

After 1947 the regulation of the balance of payments became the central concern of the Indian government. In response, explicit restrictions were introduced on the rate at which foreign exchange could be run down. In the following couple of years, until the launch of First Five Year Plan in 1951, India moved to and from between liberalization and control. The period of the First Five Year Plan, however, was one of progressive liberalization as the Tariff Act of 1954 stepped up tariff rates for thirty-two items and cleared the way for liberalization of import quotas through additional licenses over and above normal entitlements. India restored to comprehensive import control after the balance-of-payments crisis in 1956-57.

India introduced an important switch in her economic policy in June 1966 in the form of a major devaluation of the local currency; the Indian rupee was devaluated from 4.7 to 7.5 in comparison to the US dollar. At the same time, India also took steps in the direction of liberalization of import licensing, tariffs, and export subsidies. These measures allowed the imports of raw materials and components to fifty-nine industries, covering 80 percent of the organized sector’s output.

In response to the intense domestic criticisms of the devaluation, the 1966 liberalization measures were partially reversed and the import controls were tightened once again in the late 1960s and early 1970s. As a result, India’s trade regime had become extremely authoritarian and the share of non-oil, non-cereals imports in GDP fell from an already low 7 percent in 1957-58 to 3 percent in 1975-76. Not surprisingly, following this downturn, there was another return to liberalization in the late 1970s, mainly due to the adverse effect of the tight import restrictions on the profitability of local industrialists and to the improved export performance and remittances from the Middle East which improved the balance of payments of India.

Second Phase: 1976-91

In 1976, the reintroduction of the Open General Licensing (OGL) list, which was part of the original wartime regime, marked the beginning of the new phase of liberalization. At this stage, the OGL list of items that no longer required a specific import license from the Ministry of Commerce contained only 79 capital goods items, but it was further extended to cover 1170 capital goods items and 949 intermediate inputs by the April 1988. The government also introduced several export incentives, especially after 1985, which partly neutralized the antitrade bias of import controls. During 1985-90, the Indian rupee was devalued in nominal effective terms by 45 percent, leading to a real depreciation of 30 percent. Additionally, thirty-one sectors had been freed from industrial licensing by 1990. Since this measure freed machinery imports in these sectors from industrial licensing clearance, it had a trade-liberalizing dimension as well. Moreover, improved agricultural performance and the discovery of oil made room for non-food and non-oil imports, mainly machinery and intermediate inputs.
Matched by fiscal policy reforms, trade liberalization raised India’s growth rate from 3.5 percent during 1950-80 to 5.6 percent during 1981-91. However, the external and internal borrowings that supported fiscal expansion were unsustainable and led to the June 1991 balance of payment crisis.

Third Phase: 1992 onward

In July 1991 India switched over toward an outward-oriented, market based economy. The trade liberalization initiation was compressive with occasional hiccups. As regards merchandise trade, the new reforms did away with import licensing on all but a handful of intermediate inputs and capital goods. Consumer goods, however, remained under licensing, though later they were also freed of licensing in 2001. Currently, all goods may be imported without a license or restrictions, except some goods that are disallowed on environmental or health and safety grounds and a few others, such as fertilizer, cereals, edible oils, and petroleum products, which can be imported by the government only.

With the removal of licensing, tariff rates, which had been raised substantially during 1980s, became effective restrictions on imports. Consequently, since 1991 one of the important goals of the reforms has been to lower tariffs. These tariff reductions, however, have been limited to non-agricultural and industrial goods. On some agricultural products, such as skimmed milk powder, rice, corn, wheat, and millet, India traditionally had zero or very low bound rates.

Traditionally, India had also restricted exports of several commodities. With the advent of liberalization policy, India began to reduce the number of products which were otherwise subject to export control. The 1992 Export-Import Policy reduced the number of items subject to controls from 439 to 296 and the number of prohibited items from 185 to 16. Nowadays, export prohibition applies only to a small number of items on health, environmental, or moral grounds, and export restrictions are maintained mainly only on cattle, camel, fertilizers, cereals, groundnut, oil, and pulses.

As part of the liberalization reforms, India devalued her currency from 21.2 rupees to 25.8 rupees to the dollar in 1991. In February 1992, dual exchange rate system was introduced to allow exporters to sell 60 percent of their foreign exchange receipts in the free market while the rest had to be sold to the government at a lower official price. On the other hand, importers were allowed to purchase foreign exchange in the open market at the higher market price. As a further step, the official exchange rate was unified with the market exchange rate within a year. Since February 1994, many current account transactions, including all current business transactions, education, medical expenses, and foreign travel have been also permitted at the market exchange rate. India has accumulated approximately US $ 120 billion worth of foreign exchange reserve and freed up many capital account transactions.

India has also substantially liberalized her trade in services since 1991. While previously the service sector has been subject to heavy government intervention, considerable progress has been made toward opening the door for private sector participation, including foreign investors.
3. Methodology

Following Hakkio and Rush (1991), Husted (1992) presented a simple framework that implies a long-run equilibrium relationship between exports and imports. Suppose that the representative agent of a small open economy, that produces and exports a single composite good and has no government, can borrow and lend in international markets at the world interest rate using one-period financial instruments, and aims to maximize lifetime utility subject to budget constraints.

The agent’s current-period budget constraint in period \( t \) is given by

\[
C_t = Y_t + B_t - I_t - (1 + r_t)B_{t-1}
\]

where \( C_t, Y_t, B_t, I_t \) denote current consumption, output, international borrowing, and investment, respectively; \( r_t \) is the one-period world interest rate, and \((1+r_t)B_{t-1}\) is the debt of the agent from the previous period. This equation must hold in every time period. By iterating forward from some initial period and assuming that the world interest rate is stationary while exports \((X_t)\) and imports \((M_t)\) are integrated of order one, i.e. \(I(1)\), Husted (1992) derived the following testable model:

\[
X_t = \alpha + \beta M_t + \varepsilon_t
\]

Under the above-mentioned conditions, in order to satisfy the intertemporal budget constraint, \( \varepsilon_t \), which includes all short-term dynamics, must be stationary. More precisely, the necessary and sufficient condition for the intertemporal budget constraint is that \( X_t \) and \( M_t \) are cointegrated with the cointegrating vector of \([1, -1]\).

As Irandoust and Ericsson (2004) pointed out, cointegration between exports and imports, or the lack of it, has important bearing on economic policy. Theory implies cointegration granted that the economy is working properly, while the failure to satisfy international budget constraints manifests itself in the lack of cointegration. Technological shocks or some productivity gap might account for diverging time series paths of imports and exports, so if real trade flows are not cointegrated, this might be due to permanent technological shocks to the domestic economy. On the other hand, finding cointegration for the external accounts rejects the assumption of a permanent technological or productivity gap between the economy and the rest of the world (Irandoust and Sjöö, 2000).

We have performed our analyses in two steps. First, we tried to establish whether the logarithms of Indian exports and imports, measured in local and US currencies, are \(I(1)\). Acknowledging the generally low power of unit-root/stationarity tests, we used five different tests: the augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test, the Dickey-Fuller test with GLS detrending (DF-GLS), the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, and the Saikkonen-Lütkepohl unit-root test (SLUR) with a nonlinear gradual level shift starting at the proposed break date 1992/1993. Then, we tested for
cointegration using Johansen’s trace (JT) and the Saikkonen-Lütkepohl cointegration (SLCOIN) tests, both without and with simultaneous structural breaks in levels and trends.\(^3\)

### 4. Data and Empirical Results

Indian exports and imports in Indian rupee and US dollar from 1949/50 through 2004/05 were extracted from Economic Survey 2004-05 (http://indiabudget.nic.in). The natural logarithms of nominal exports and imports in rupee are denoted as LNEXNIR and LNIMNIR, while the corresponding series in dollar are denoted as LNEXNUD and LNIMNUD, respectively.

The unit-root/stationarity tests have been performed both on the levels and on the first-differences of the four data series. The results on the level series are shown in Table 1. The ADF, PP, DF-GLS and KPSS tests unanimously indicate that the levels of exports and imports are non-stationary. For imports and exports in rupees the SLUR test also maintains the unit-root null hypothesis, however, for exports in dollars this test strongly supports stationarity around a linear trend with a structural break in 1992/93.

**Table 1: Unit Root and Stationarity Test Results for the Logarithms of Exports and Imports**

<table>
<thead>
<tr>
<th>Unit-Root / Stationarity Tests</th>
<th>Variables</th>
<th>LNEXNIR</th>
<th>LNEXNUD</th>
<th>LNIMNIR</th>
<th>LNIMNUD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lag</td>
<td>Test stat.</td>
<td>Lag</td>
<td>Test stat.</td>
<td>Lag</td>
</tr>
<tr>
<td>ADF</td>
<td>0</td>
<td>-1.849</td>
<td>1</td>
<td>-2.620</td>
<td>1</td>
</tr>
<tr>
<td>PP</td>
<td>0</td>
<td>-1.849</td>
<td>2</td>
<td>-1.595</td>
<td>5</td>
</tr>
<tr>
<td>DF-GLS</td>
<td>2</td>
<td>-1.375</td>
<td>1</td>
<td>-1.765</td>
<td>1</td>
</tr>
<tr>
<td>KPSS</td>
<td>5</td>
<td>0.238***</td>
<td>5</td>
<td>0.185**</td>
<td>5</td>
</tr>
<tr>
<td>SLUR</td>
<td>0</td>
<td>-2.426</td>
<td>1</td>
<td>-3.363**</td>
<td>0</td>
</tr>
</tbody>
</table>

**Notes:**

a) ADF: Augmented Dickey-Fuller test; PP: Phillips-Perron test; DF-GLS: Dickey-Fuller test with GLS detrending; KPSS: Kwiatkowski-Phillips-Schmidt-Shin test; SLUR: Saikkonen-Lütkepohl test with a nonlinear gradual level shift starting in 1992/93. In all these tests except KPSS, the unit-root null hypothesis is tested against the alternative of stationarity. In the KPSS test the hypotheses are just the opposite. b) In the ADF, PP, DF-GLS and SLUR tests lag refers to lags of the first differences. Allowing for a maximum lag length of 8 years, for ADF, DF-GLS and SLUR the lag lengths are selected by minimizing the Akaike Information Criteria. In the PP and KPSS tests lag denotes the bandwidth selected on the basis of the Newey-West method and Bartlett kernel. c) *, **, and *** indicate significance at the 10, 5, and 1% levels.

d) Each test equation has a deterministic linear trend.

The results on the first differences are displayed in Table 2. The ADF, PP, KPSS and SLUR tests suggest that the first differences of exports and imports are stationary. Three

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\(^3\) About these tests, see e.g. Maddala and Kim (1998, Ch. 4, 6) and Lütkepohl and Krätzig (2004, Ch. 3 and 4). All tests were performed with EViews 5.1 and JMullTi 4.04.
of the KPSS results are sensitive to the presence of a deterministic trend. However, since in these cases the deterministic trend component is statistically significant, the tests with trend are preferred, implying that the first-difference series are stationary.

All things considered, we can reasonably conclude that LNEXNIR, LNIMNIR and LNIMNUD are $I(1)$. Disregarding the possibility of a level shift in 1992/93, LNEXNUD also seems to be $I(1)$, however, it is more likely $I(0)$ around a broken deterministic trend. Hence, the logarithms of Indian exports and imports in rupee might be cointegrated with each other, irrespectively of the possible structural break. However, since cointegration between two variables assumes that they are both integrated of the same positive order, Indian exports and imports measured in dollar can be deemed cointegrated only if the possibility of a structural break in 1992/93 is disregarded.

**Table 2:** Unit Root and Stationarity Test Results for the First-Difference of the Logarithms of Exports and Imports

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\Delta$LNEXNIR</th>
<th>$\Delta$LNEXNUD</th>
<th>$\Delta$LNIMNIR</th>
<th>$\Delta$LNIMNUD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF Lag</td>
<td>Test stat.</td>
<td>Lag Test stat.</td>
<td>Lag Test stat.</td>
<td>Lag Test stat.</td>
</tr>
<tr>
<td>2</td>
<td>-2.893*</td>
<td>0</td>
<td>-4.87***</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-5.42***</td>
<td>1</td>
<td>-4.92***</td>
<td>2</td>
</tr>
<tr>
<td>DF-GLS</td>
<td>-2.95***</td>
<td>3</td>
<td>-3.50***</td>
<td>0</td>
</tr>
<tr>
<td>KPSS</td>
<td>0.599**</td>
<td>2</td>
<td>0.393*</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0.091</td>
<td>2</td>
<td>0.062</td>
<td>5</td>
</tr>
<tr>
<td>SLUR</td>
<td>-4.25***</td>
<td>0</td>
<td>-5.15***</td>
<td>0</td>
</tr>
</tbody>
</table>

*Notes:* See notes a-c, Table 1. d) Each test equation has a constant term. The second KPSS test equations also have a significant deterministic linear trend.

**Table 3:** Cointegration Test Results for the Logarithms of Exports and Imports

<table>
<thead>
<tr>
<th>Cointegration Tests</th>
<th>LNEXNIR</th>
<th>LNEXNUD</th>
<th>LNIMNIR</th>
<th>LNIMNUD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$H_0$</td>
<td>Test stat.</td>
<td>$H_0$</td>
<td>Test stat.</td>
</tr>
<tr>
<td>JT w/o break</td>
<td>1</td>
<td>$r = 0$</td>
<td>27.34**</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$r = 1$</td>
<td>7.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$r = 0$</td>
<td>24.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$r = 1$</td>
<td>7.89</td>
<td></td>
</tr>
<tr>
<td>JT w break</td>
<td>1</td>
<td>$r = 0$</td>
<td>12.05</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$r = 1$</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>SLCOIN w/o break</td>
<td>1</td>
<td>$r = 0$</td>
<td>10.53</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$r = 1$</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>SLCOIN w break</td>
<td>1</td>
<td>$r = 0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$r = 1$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Notes:* a) JT: Johansen’s trace test; SLCOIN: Saikkonen-Lütkepohl cointegration test.b) Lag refers to the number of lags of levels. Allowing for a maximum lag length of 8 years, the lag lengths are selected by minimizing the Akaike Information Criteria. c) *, **, and *** indicate significance at the 10, 5, and 1% levels.d) In each case an unrestricted intercept and linear trend are included in the test equation (Case 2 in JMulTi). The structural break is supposed to occur both in level and trend in 1992/93.
Nonetheless, the cointegration tests have been performed on both pairs of variables, without and with a structural break in levels and trends. The results, reported in Table 3, are mixed.\(^4\) No matter which currency is used; the JT test with structural break and the SLCOINT test fail to reject no-cointegration, while the JT test with no structural break suggests that Indian exports and imports are cointegrated.

To sum up the results, acknowledging the effect of the March 1993 move from fixed to freely floating exchange rate on the time-series properties of the data, we conclude that over the period 1949/50-2004/2005 Indian exports and imports do not exhibit a cointegration relationship and hence India is in violation of her international budget constraint.

5. Conclusion

In this paper we have empirically investigated the possibility of cointegration between the logarithms of exports and imports for India in two currencies, Indian rupee and US dollar. Since we have used long annual time series data from 1949/50 to 2004/05, we have also taken the impact of the exchange rate policy change into consideration.

First we investigated the univariate time-series properties of the data and established that exports in rupee and imports in both currencies behave like \(I(1)\) series, but exports in dollar are likely \(I(0)\) around a broken deterministic trend. Then, we tested for cointegration, both without and with a structural break. Contrary to Arize (2002) and Upender (2007), our analyses indicate that Indian exports and imports are not cointegrated, so macroeconomic policies of India have not been effective to contain the trade imbalance.

References


\(^4\) Allowing for a structural break, LNEXNUD is \(I(0)\) while LNIMNUD is \(I(1)\), so they cannot be cointegrated. Yet, for the sake of completeness, we present all cointegration test results.
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