Library Progress International *Print version ISSN 0970 1052*
Vol.43, No.2, July-Dec 2023: P. 3360-3363 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

Unit Root Analysis of India's Total Imports and Principal Commodities

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How to cite this paper as: Daisamma Chacko , D. Hylin Reba (2023) Unit Root Analysis of India's Total Imports and Principal Commodities. *Library Progress International, 3360-3363*

ABSTRACT

This study investigates the stationarity properties of India's total imports and its principal imported commodities using unit root tests. Stationarity is a critical prerequisite for econometric modelling, as non-stationary series can lead to spurious regressions. By applying first differences, the study confirms that all variables are integrated of order one I (1). This finding provides a robust foundation for subsequent Vector Auto-Regression (VAR), Granger causality, and variance decomposition analyses, enabling meaningful exploration of short-run and long-run relationships among India's imports.

KEYWORDS: Import, Principal, Commodity, Unit Root

INTRODUCTION

Any country, rich or poor, small or big, cannot be self-sufficient. Irrespective of its position on the power ladder, every nation needs raw materials or finished goods to meet its internal demands. On the other hand, the less developed nations benefit from their cost-effectiveness, making trade a win-win for both. In short, every country is involved in import-export transactions.In today's fiercely competitive market, the key to successful sales lies in offering a superior quality product at the most competitive price and ensuring timely delivery. Access to international-standard quality materials, capital goods, and advanced technology is crucial and necessary. The global market demands constant innovation and improvement, and a country must keep pace with these changes to stay relevant.In today's rapidly globalising and liberalising world, there are other options than survival without imports. The practice of global sourcing at the most competitive costs and the need to enhance domestic industry productivity by importing high-technology products make import liberalisation a vital tool for economic growth.Every country imports goods and services that the domestic country cannot manufacture, maybe because the country cannot produce effectively or cheaply like another exporting country. A few countries sometimes import unavailable commodities and raw materials from their own premises.The major commodities imported by India include bulk imports and non-bulk imports. Within bulk imports are petroleum and crude products, bulk consumption goods, and other items. There are cereals and cereal preparations, edible oils, pulses, and sugar in bulk consumption goods. Under other bulk items, there are fertilisers, crude, sulphur, and unroasted Iron pyrites, manufactured goods, non-ferrous metals, paper, paperboards, manufactures including newsprints, crude rubber including synthetic and reclaimed, pulp and waste paper, metalliferous ores, metal scrap, and iron and steel. Non-bulk imports include capital goods, mainly export-related items, and other goods. Capital goods include manufacturers of metals, machine tools, machinery except electrical and electronic, electric machinery except electronic, electronic goods, computer goods, transport equipment, and project goods. Mainly export-related items include pearls, precious and semiprecious stones, organic and inorganic chemicals, textile yarn, fabrics, made-ups, and cashew nuts. Others include Gold and Silver, artificial resins and plastic materials, professional and scientific controlling instruments, photographic optical goods, coal, coke, briquettes, medicinal and pharmaceutical products, chemicals and products, and non-metallic mineral manufacturers,

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Unit root tests examine the stationarity of time series data, a critical prerequisite for conducting econometric analyses

such as Vector Auto-Regression (VAR) and Granger causality tests. Stationarity ensures that the statistical properties of the series, such as mean and variance, remain constant over time. For this study, the first differences of India's total imports and its principal imported commodities were tested to determine whether they are stationary, thereby allowing reliable modelling of short- and long-run relationships among these variables. The principal commodities are, cotton (raw and waste), vegetable oil, pulses, fruits and vegetables, and pulp and waste paper, textile yarn and related products, fertilizers, sulphur and unroasted iron pyrites, metalliferous ores and minerals, and coal and associated fuels, petroleum (crude and products), wood and wood products, leather and leather products, organic and inorganic chemicals, and dyeing, tanning, and colouring materials, artificial resins and plastic materials, chemical materials and products, newsprint, pearls and precious stones, and iron and steel, non-ferrous metals, machine tools, machinery (both electrical and non-electrical), project goods, professional instruments and optical goods, electronic goods, medical and pharmaceutical products, gold, silver, and other miscellaneous commodities.

Objectives

1. To test the stationarity of India's total imports and major commodity groups using unit root tests.
2. To examine the behaviour and long-run trends of India's total imports and principal imported commodities.

Period of Study

The study covers India's import data over the period 2009-10 to 2023-24.

Methodology

A Unit Root Test is a statistical method used in time series analysis to determine whether a variable is stationary or non-stationary over time. This study focuses on India's total imports and principal imported commodities to examine their behaviour over time and identify long-run trends.

Table

Unit Root Test for India's Total Imports and Principal Imported Commodities

Variable	Coefficient	Std. Error	R-squared	t-Statistic	Prob.
D (India's Total Import (-1))	-1.40	0.34	0.66	-4.13	0.0026
D (Cotton Raw (-1))	-2.33	0.48	0.80	-4.83	0.0009
D (Vegetable Oil (-1))	-1.05	0.35	0.45	-2.98	0.0125
D (Pulses (-1))	-0.90	0.32	0.43	-2.86	0.0157
D (Fruits and Vegetables (-1), 2)	-1.44	0.29	0.72	-5.02	0.0005
D (Pulp and Waste Paper (-1))	-1.81	0.37	0.74	-4.95	0.0008
D (Textile Yarn, Fabrics, and Made-up Articles (-1))	-1.57	0.40	0.66	-3.91	0.0036
D (Fertilisers (Crude & Manufactured) (-1))	-1.81	0.38	0.73	-4.74	0.0011
D (Sulphur and Unroasted Iron Pyrites (-1))	-1.97	0.32	0.82	-6.17	0.0002
D (Metalliferous Ores and Other Minerals (-1))	-1.39	0.38	0.61	-3.64	0.0054
D (Coal, Coke, Briquettes, etc. (-1))	-1.68	0.33	0.75	-5.08	0.0007
D (Petroleum (Crude & Products) (-1))	-1.41	0.39	0.62	-3.63	0.0055
D (Wood and Wood Products (-1))	-1.46	0.34	0.69	-4.31	0.0019
D (Leather and Leather	-1.04	0.30	0.52	-3.48	0.0052

Products (-1))					
D (Organic and Inorganic Chemicals (-1))	-1.81	0.32	0.79	-5.73	0.0003
D (Dyeing, Tanning, and Colouring Materials (-1))	-1.01	0.31	0.50	-3.30	0.0071
D (Artificial Resins, Plastic Materials, etc (-1))	-1.49	0.39	0.63	-3.82	0.0041
D (Chemical Materials and Products (-1))	-1.32	0.36	0.61	-3.66	0.0052
D (Newsprint (-1))	-1.52	0.37	0.67	-4.07	0.0028
D (Pearls, Precious and Semi-Precious Stones (-1))	-1.63	0.38	0.69	-4.32	0.0019
D (Iron and Steel (-1))	-1.78	0.35	0.75	-5.01	0.0007
D (Non-Ferrous Metals (-1))	-1.42	0.36	0.65	-3.94	0.0034
D (Machine Tools (-1))	-0.97	0.29	0.50	-3.35	0.0065
D (Machinery, electrical & non-electrical (-1))	-1.65	0.33	0.75	-5.01	0.0007
D (Transport Equipment (-1))	-1.87	0.38	0.75	-4.95	0.0008
D (Project Goods (-1))	-1.29	0.26	0.74	-4.88	0.0009
D (Professional Instruments, Optical Goods, etc. (-1))	-0.89	0.30	0.45	-3.00	0.0121
D (Electronic Goods (-1))	-1.65	0.39	0.72	-4.29	0.0020
D (Medical and Pharmaceutical Products (-1))	-1.00	0.30	0.50	-3.28	0.0073
D (Gold (-1))	-1.21	0.29	0.61	-4.11	0.0017
D (Silver (-1))	-1.26	0.29	0.64	-4.42	0.0010
D (Other Commodities (-1))	-0.68	0.29	0.34	-2.37	0.0370

The unit root test results for the first-differenced series (denoted D(variable)) indicate that all variables are stationary at the 5 per cent significance level. For example, the first difference of India's total imports has a coefficient of -1.40 and a t-statistic of -4.13 (p = 0.0026), confirming the series' stationarity. Similarly, key commodities such as Cotton Raw (-2.33, t = -4.83, p = 0.0009), Vegetable Oil (-1.05, t = -2.98, p = 0.0125), and Pulses (-0.90, t = -2.86, p = 0.0157) are stationary in their first differences. Other major commodity groups also exhibit stationarity after first differencing. For instance, Fertilisers (Crude and Manufactured) (-1.81, t = -4.74, p = 0.0011), Sulphur and Unroasted Iron Pyrites (-1.97, t = -6.17, p = 0.0002), Machinery, electrical and non-electrical (-1.65, t = -5.01, p = 0.0007), and Medical and Pharmaceutical Products (-1.00, t = -3.28, p = 0.0073) all reject the null hypothesis of a unit root. Even precious metals such as Gold (-1.21, t = -4.11, p = 0.0017) and Silver (-1.26, t = -4.42, p = 0.0010) are stationary after first differencing.

Interpretation

The stationarity of all first-differenced series confirms that the variables are integrated of order one, I (1). This finding justifies the application of VAR modelling and Granger causality tests in subsequent analyses, as these methods require stationary data to avoid spurious regression results. The first differencing has successfully removed trends and other non-stationary components from the series, allowing for a meaningful examination of short-run and long-run relationships between India's total imports and its principal imported commodities. These results provide the

foundation for reliable econometric modelling in the study, ensuring that the subsequent VAR, Granger causality, and variance decomposition analyses are based on stationary data.

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