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Abstract

This study investigates the effect of terms of trade and its volatility on economic growth in India by using the annual time series data from the period 1980 to 2010. Cointegration results suggest the significant positive long run relationship between terms of trade and economic growth. On the other hand, volatility of terms of trade has negative and significant effect on economic growth. Sensitivity analysis confirms that the results are robust. It is concluded that beneficial and less volatile terms of trade is better for economic growth in India. Policy makers should focus on diversifying Indian exports to minimize the volatility in terms of trade to ensure economic growth in the country.

Key words: Terms of Trade, Volatility, Economic Growth,

JEL Classification: F13, D80, F43,

1. Introduction

In India during the last three decades, trend shows that terms of trade has improved. In 1980's the average terms of trade was 84, in 1990's it increase to 105 and in the decade of 2000 the average terms of trade marginally improved and became 107. Similarly, in 1980's the average growth in real GDP was 6 percent, in 1990's it again sustained at 6 percent and in the decade of 2000's in increased to 7.3 percent. The question is that, are the commodity terms of trade and its volatility correlated with economic growth? This study examines this question by using long time series annual data of India covering period from 1980 to 2010.

Most of the empirical studies have been conducted under Prebisch- Singer (PS) hypothesis.¹ Perbisch-Singer hypothesis² argues that the terms of trade of primary product

¹ Lutz (1999), Hadass and Williamson (2001) and Cashin and McDermott (2002).

² See Perbisch (1950) and Singer (1950).

specialization countries will weaken over time as compare to the countries that specialize in manufactured goods. Declining of terms of trade is one of the main reason of income gap between developed and developing countries. Increase in terms of trade would lead to increase in investment and thus economic growth will increase.

Many studies have been conducted to find Herzberger-Laursen-Metzler (HLM) effect.³ HLM effect⁴ argued that the declining in terms of trade will lead to reduce the real income and lower income will lead to lower savings and investment. Consequently, it affects the current account. In most of the empirical studies cross country⁵ has been used to analyze the relationship between terms of trade and it volatility with economic growth, India is mostly not included in these cross country studies. However, some time series are also done on same subject.⁶ The objective of this study is to examine the long run impact of terms of trade and its volatility on economic growth of India.

The rest of the paper is organized as follow: Literature review have been discussed in section 2, methodology presents in section 3, empirical results and estimation are presented in section 4, results of sensitivity analysis are provided in section 5 and final section presents conclusion and policy recommendation.

2. Literature Review

Many studies suggest the positive effect of terms of trade and negative effect of volatility of terms of trade on economic growth. In this section some selected studies are discussed. Arize (1996) use the cointegration technique to empirically examine the long run impact of terms of trade on trade balance by using the data of 16 countries from the period 1973 to 2004. The

³ Arize (1996), Otto (2003), Bouakez and Kano (2008), Hamori (2008) and Misztal (2010).

⁴ See Harberger (1950) and Laursen and Metzler (1950).

⁵ Sea Bleaney and Greenaway (2001) Cashin and Mecdermott (2002a, b).

⁶ See Wong (2004) and Fatima (2010)

results suggest the positive relationship between terms of trade and trade balance in most of the countries.

Mendoza (1997) use the panel estimation method on the data of 40 industrial and developing countries from the period 1971 to 1991 to empirically examine the endogenous growth model. The findings suggest the positive impact of rate of change of terms of trade on economic growth. The negative relationship is found between volatility of terms of trade and economic growth. Sensitivity analysis confirm the robustness of the results.

Kaneko (2000) uses endogenous growth model with two factors, physical and human capital to investigate the relationship between specialization pattern and growth rate of growing economy. Results suggest the positive and significant relationship between terms of trade and economic growth in a country specialize in consumption commodities. Furthermore, if country specialized in capital commodities, the economic growth is not affected by the terms of trade.

Bleaney and Greenaway (2001) use stochastic endogenous growth model to empirically examine the impact of terms of trade, exchange rate and their volatilities on growth and investment. They use panel estimations on the data of 14 Sub-Saharan African countries from the period 1980 to 1995. Volatility of terms of trade and real exchange rate is estimated by using Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. Results show that improvement in terms of trade and less over value exchange rate have significant positive effect on growth and investment while, significant negative relationship is found between volatility of terms of trade and economic growth.

Hadass and Williamson (2001) use the data of 19 countries to empirically investigate the relationship between terms of trade and economic growth from the period of 1870 to 1940. The findings indicate that the positive movement in terms of trade reduces economic growth of

primary product exporters. They concluded that variation in terms of trade explain not more than one fifth of economic growth in pre war period. They did not investigate the impact of volatility of terms of trade on economic growth.

Cashin and Mcdermott (2002b) use the different quarterly time series data of five OECD countries to analyze the relationship between current account balance and terms of trade shocks.⁷ They used Structural vector autoregression (SVAR) model. The results of Canada, United Kingdom and United states shows only small share of volatility in current account balance by the shocks of terms of trade. On the other hand in Australia and New Zealand terms of trade shocks are found significant proportion of variation in current account balance.

Wong (2004) uses the cointegration and error correction technique to analyze the long run and short run relationship between terms of trade and economic growth in Malaysia. Annual time series data has been used from the period 1965 to 2002. The results of cointegration confirms the significant positive long run relationship between terms of trade and economic growth. The results of error correction model also confirm the positive and significant relationship between terms of trade and economic growth of Malaysia in short run.

Cakir (2009) empirically examine the relationship between terms of trade and economic growth by using the panel data of 18 emerging economies over the period of 1990 to 2004. Generalized methods of moments (GMM) has been used. Results indicate the significant positive relationship between terms of trade and economic growth.

Wong (2010) uses the annual time series data of Japan and Korea from 1996 to 2003 and 1971 to 2006 respectively to empirically examine the relationship between terms of trade and economic growth. To find the long run relationship Johansen cointegration technique has

⁷ For Canada (1970:2–1997:4); for Australia from 1970:2–1997:2; for New Zealand (1980:2–1997:2); for the United Kingdom (1970:2–1997:4); and for the United States (1973:2–1997:4).

been used. The results suggest that the real GDP per capita and terms of trade are mutually determined. Results also indicate the significant negative relationship between volatility of terms of trade and GDP per capita in both countries.

Jawaid and Waheed (2011) investigate the impact of terms of trade and its volatility on economic growth by using cross country data of 94 countries over the period 2004 to 2008. Results indicate the significant positive impact of terms of trade and its volatility on economic growth. Sensitivity has been used to check the robustness of initial results. The results were found robust despite the inclusion of additional variables in basic model and use of various proxies for volatility of terms of trade.

3. Empirical Framework

After reviewing the theoretical and empirical work, the model to examine the impact of terms of trade and its volatility on economic growth is derived using the production function framework. The production function in general form as follows:

$$Y = f(A, L, K) \quad (3.1)$$

Where Y is the real gross domestic production, L is the labor force, K is the capital stock and A is the total factor productivity. It has been assumed that effect of terms of trade or volatility in terms of trade on economic growth operates through A .⁸

$$A = g(TOT, VTOT, F) \quad (3.2)$$

Substituting (3.2) in (3.1)

$$Y = f(L, K, TOT, VTOT, F) \quad (3.3)$$

The empirical models for estimations are developed as follows:

$$Y_t = \beta_0 + \beta_1 L_t + \beta_2 K_t + \beta_3 T_t + \beta_3 F_t + \varepsilon_t \quad (3.4)$$

⁸ See, Kohpaiboon (2003) and Jawaid and Waheed (2011).

Where, ε_t is the error term, L is the total labor force and T represents the terms of trade and its volatility. Real gross fixed capital formation has been used as a proxy for capital stock because of unavailability of data of capital stock.⁹ The expected signs for labor and capital stock are positive while, the signs of T are to be determined. Annual time series data have been used from 1980 to 2010. All data are gathered from World Bank's official database.¹⁰ The volatility of terms of trade is measured by Generalized Autoregressive Conditional Heteroscedasticity (GARCH).¹¹ All variables are used in logarithm form.

4. Results and Estimations

Before testing the long run relationship, it is necessary to examine the stationary properties of time series variables. To check the stationary properties we used Augmented Dickey Fuller (*ADF*) and Phillip Perron (*PP*) unit root tests. Table 4.1 represents the results of stationary tests.

Insert table 4.1 here

Results of table 4.1 show that all variables are stationary at first difference this implies that the series of variables may exhibit a long run relationship.

Insert table 4.2 here

Table 4.2 shows the ordinary least square estimations. The results of labor force (L) and capital (K) are having expected positive sign and are highly significant. Results confirm the significant positive relationship between terms of trade and economic growth in India. The findings are consistent with Kaneko (2002), Cakir (2009) and Jawaid and Waheed (2011). Results show the negative and significant impact of volatility of terms of trade on economic growth. Results are

⁹ See Wong (2004).

¹⁰ The web link of data source is <http://data.worldbank.org/indicator>

¹¹ Bleaney and Greenaway (2001) has adopted the same method for measurement of volatility.

consistent with Mendoza (1997), Bleaney and Greenaway (2001) and Wong (2010). It confirms that less volatile terms of trade is necessary for stable economic growth.

Insert table 4.3 here

The unit root stationary results of residuals are analyzed by using the Philip Perron (*PP*) and Augmented Dickey Fuller (*ADF*) tests. Results of table 4.3 show that residuals of both models namely; terms of trade and volatility of terms of trade are stationary at level and variables are at first difference. This confirms the valid long run relationship between the considered variables.

Insert table 4.4 here

The long run relationship between the variables in the empirical model is determined by using the Johansen and Jeuselius (1990) cointegration method. The calculated value of Trace Statistics and Maximum Eigen Values Statistics are presented in table 4.4. Results show the rejection of null hypothesis of no cointegration in both model of terms of trade and its volatility at significant level of 5%, in favor of alternative, that there is one cointegrating vector. Both cointegration test and residual test confirm the existence of long run relationship among variables of equation 3.4 in India.¹²

5. Sensitivity Analysis

In this section two different sensitivity analyses have been performed.

5.1 Additional Variables

The consistency of relationship between dependent and independent variables is tested through sensitivity analysis by adding different additional variables in the basic model [Leven and Renelt (1992)]. If the sign and significance of focus independent variable remains same after

¹² To check the short run relationship we employed error correction model but the result were insignificant.

including additional variables in the basic model then the results said to be robust otherwise the results are refer to fragile. Barro (1996) consider inflation, primary enrollment, fertility rate and life expectancy; Yanikkaya (2003) consider export as percentage of *GDP* and Waheed and Aleem (2008) consider remittances as determinants of economic growth. We used fertility rate (*FER*), life expectancy (*LEX*), export as percentage of GDP (*EXP*), remittances (*REM*), inflation (*INF*) and primary school enrollment (*PSE*) as other determinants of economic growth. Table 5.1 represents the results of sensitivity analysis.

Insert table 5.1 here

It is confirmed from table 5.1 that the coefficient of focus variable [(*TOT*) and (*VTOT*)] remains same sign and significance despite inclusion of other variables in basic model. As a result, the relationship of terms of trade and its volatility found to be robust.

5.2 Different Proxies of Volatility

There are different measures of volatility has been used in empirical studies.¹³ The measures of volatility include, standard deviation, generalized autoregressive conditional heteroscedasticity, 5 years moving averages and 5 years moving standard deviations.¹⁴ To test the robustness of volatility of terms of trade we considered 5 years moving standard deviation (*MSTD*) and 5 years moving average (*MAVG*) as other measures of volatility of terms of trade. Table5.2 represents the results of sensitivity analysis of volatility of terms of trade.

Insert table 5.2 here

Table 5.2 clearly confirms that does not matter what proxy of volatility of terms of trade is considered, the results were shown the negative and significant impact of volatility of terms of trade on economic growth. This shows that our initial results are robust.

¹³ See, Jawaid and Waheed (2011).

¹⁴ See Geol and Ram (2001)

6. Conclusion and Policy Recommendations

This study investigates the effects of terms of trade and its volatility on economic growth in India by using the annual time series data from the period 1980 to 2010. Cointegration results suggest the significant positive long run relationship between terms of trade and economic growth. On the other hand, volatility of terms of trade has negative and significant effect on economic growth. Sensitivity analyses confirm that the results are robust. It is concluded that beneficial and less volatile terms of trade is better for economic growth in India. Policy makers should focus on diversifying Indian exports to minimize the volatility of terms of trade to ensure economic growth in the country.

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Table 4.1: Stationary Test Results

Variables	ADF test				PP test			
	I(0)		I(1)		I(0)		I(1)	
	C	C&T	C	C&T	C	C&T	C	C&T
Y	2.29	0.96	-3.90	-5.02	-1.97	-1.13	-3.90	-5.17
L	-1.83	-1.00	-5.01	-5.35	-1.32	-0.72	-5.01	-5.38
K	-0.84	-2.23	-4.29	-4.20	-0.91	-2.07	-4.29	-4.20
T_{TOT}	-1.10	-1.24	-6.32	-6.25	-1.78	-3.11	-7.93	-8.25
T_{VTOT}	-1.82	-2.58	-6.44	-6.35	-1.51	-2.49	-6.62	-6.56
F	-1.51	-2.87	-4.99	-4.83	-1.51	-2.61	-5.27	-4.94

Note: The critical values for ADF and PP tests with constant (c) and with constant & trend (C&T) 1%, 5% and 10% level of significance are -3.711, -2.981, -2.629 and -4.394, -6.612, -3.243 respectively.

Source: Author's estimations.

Table 4.2: Long Term Determinants of Economic Growth

Variables	Model of Terms of Trade			Model of volatility of Terms of Trade		
	Coeff.	t-stats	Prob.	Coeff.	t-stats	Prob.
C	-8.410	-23.210	0.000	-8.193	-24.570	0.000
L	2.217	24.790	0.000	2.310	24.171	0.000
K	0.440	3.765	0.001	0.336	3.160	0.004
F	0.065	4.537	0.000	0.071	5.138	0.000
T	0.026	1.791	0.086	-0.124	-2.191	0.038
Adj. R²	0.996			0.996		
D.W stats	1.513			1.747		
F-stats (prob.)	1433.785(0.000)			1612.090(0.000)		

Source: Authors' estimation.

Table 4.3: Unit root test for Residuals

Variable	Test	Without Trend	With Trend
TOT	ADF Test	-4.113	-3.988
	PP Test	-4.139	-3.983
VTOT	ADF Test	-4.669	-4.463
	PP Test	-4.659	-4.556

Note: The critical values for ADF and PP tests with constant (c) and with constant & trend (C&T) 1%, 5% and 10% level of significance are -3.711, -2.981, -2.629 and -4.394, -6.612, -3.243 respectively.

Source: Authors' estimation.

Table 4.4: Results of Cointegration Test

Model	Null Hypothesis No. of CS(s)	Trace Statistics	5% critical values	Max. Eigen Value Statistics	5% critical values
T_{TOT}	None *	114.523	88.804	51.981	38.331
	At most 1	62.541	63.876	26.425	32.118
	At most 2	36.116	42.915	15.958	25.823
T_{VTOT}	None *	102.704	88.804	39.212	38.331
	At most 1	63.491	63.876	18.889	32.118
	At most 2	42.915	44.602	17.058	25.823

Source: Authors' estimation.

Table 5.2: Test for Robustness of Volatility of Terms of Trade by Different Proxies

Variables	GARCH			MSDT			MAVG		
	Coeff.	t-stats	Prob.	Coeff.	t-stats	Prob.	Coeff.	t-stats	Prob.
C	-8.193	-24.570	0.000	-9.108	-17.876	0.000	-8.193	-24.570	0.000
L	2.310	24.171	0.000	2.338	23.826	0.000	2.359	24.973	0.000
K	0.336	3.160	0.004	0.400	3.817	0.001	0.395	3.761	0.001
F	0.071	5.138	0.000	0.001	0.318	0.754	0.040	1.200	0.249
T	-0.124	-2.191	0.038	-0.052	-2.906	0.009	-0.131	-2.098	0.053
Adj. R²	0.996			0.996			0.995		
D.W stats	1.747			1.328			1.421		
F-stats (prob.)	1612.090(0.000)			1196.347(0.000)			1278.321(0.000)		

Source: Authors' estimation.

Table 5.1: Results of Sensitivity Analysis

Model	IOI					VIOI				
	Coeff.	t-stats. (prob.)	Adj R ²	D.W	F-stats (prob.)	Coeff.	t-stats. (prob.)	Adj R ²	D.W	F-stats (prob.)
Basic Model	0.026	1.791 (0.085)	0.996	1.513	1433.785 (0.000)	-0.124	-2.191 (0.038)	0.996	1.746	1612.090 (0.000)
REM	0.028	2.216 (0.037)	0.996	1.438	1399.441 (0.000)	-0.082	-2.191 (0.038)	0.998	1.543	3088.376 (0.000)
PSE	0.027	2.155 (0.042)	0.998	1.357	1319.183 (0.000)	-0.089	-2.409 (0.0236)	0.998	1.348	3798.396 (0.000)
REM, EXP	0.018	2.170 (0.042)	0.999	1.584	3873.865 (0.000)	-0.081	-1.971 (0.060)	0.998	1.439	2943.538 (0.000)
PSE, INF	0.026	2.210 (0.039)	0.997	1.373	1292.539 (0.000)	-0.093	-2.177 (0.039)	0.998	1.365	2921.025 (0.000)
LEX, EXP, INF	0.017	2.173 (0.042)	0.999	1.905	3899.670 (0.000)	-0.083	-1.726 (0.097)	0.998	1.434	2351.598 (0.000)
FER, EXP, PSE	0.020	2.304 (0.032)	0.998	1.796	3188.653 (0.000)	-0.076	-1.946 (0.064)	0.998	1.407	2519.983 (0.000)

Note: Authors' estimation.