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**Effects of Terms of Trade and its Volatility on Economic Growth: A Cross Country  
Empirical Investigation**

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## **Abstract**

This study examines the effects of terms of trade and its volatility on economic growth for a sample of 94 developed and developing countries, using five year average annual data from 2004 to 2008. The cross country ordinary least square estimation results indicate significant positive effect of terms of trade on economic growth. Furthermore, volatility of terms of trade has significant positive effect on economic growth. To test the robustness of initial results, sensitivity analysis has been performed using different additional variables, sample size and various proxies of volatility variable. The initial results were found robust despite the inclusion of various variables in the basic model and use of various proxies for volatility of terms of trade.

**Key words:** Terms of trade, Volatility, Economic Growth

**JEL Codes:** F13, D80, F43

## 1. Introduction

Many studies have been conducted to illustrate the effects of terms of trade and its volatility on economic growth. Few of them are time series and some are cross sectional studies.<sup>1</sup> Most of the studies have been conducted under Prebisch-Singer (PS) hypothesis.<sup>2</sup> Prebisch-Singer hypothesis state that primary product specializing country's terms of trade will weaken over time compare to the countries that produce manufactured goods. Lutz (1999), Haddass and Williamson (2001) and Cashin and McDernott (2002a) amongst others have found evidence supporting the hypothesis. In contrast, large number of studies has been done to find Harberger-Laursen-Metzler (HLM) effect.<sup>3</sup> According to HLM effect the unfavorable shock of terms of trade results in a fall in country's real income and aggregate saving, resulting in a deterioration of its current account balance. Arize (1996), Cashin and McDernott (2002b), Otto (2003), Boukez and Kano (2008), Hamori (2008) and Misztal (2010) amongst others have proved both significant and insignificant impact of change in terms of trade on trade balance.

Figure 1.1 shows the relationship between terms of trade and economic growth for a sample of 94 countries. From the scatter diagram there is no clear sign of any relationship between terms of trade and economic growth. On the other hand, figure 1.2 represents the relationship between volatility of terms of trade and economic growth for the same 94 countries. This scatter diagram is also not providing any clear indication about the relationship between volatility of terms of trade and economic growth.

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<sup>1</sup> For time series studies, see Wong (2004, 2010) and Fatima (2010) and for cross sectional studies, see Bleaney and Greenaway (2001) and Cashin and McDermott (2002a).

<sup>2</sup> See Prebisch (1950) and Singer (1950).

<sup>3</sup> See Harberger (1950) and Laursen and Metzler (1950).

*Insert Figures-1.1 and 1.2 here*

From above scatter diagram analysis and the review of previous empirical studies, we are not coming up to a concrete conclusion about the relationship between terms of trade and its volatility on economic growth. However, the international trade theories clearly explain the positive effects of term of trade on economic growth. Thus, this study intend to re-examine the effects of terms of trade and its volatility on economic growth using a new data set on developed and developing countries and applying more rigorous econometric techniques.

The rest of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on the effects of terms of trade and its volatility on economic growth. Section 3 discusses the empirical strategy for examining the relationship. Section 4 shows the model's estimation results. Section 5 performs rigorous sensitivity analysis to check the robustness of the initial findings. Final section concludes the study, provides some policy implications and set directions for further research.

## **2. Literature on Terms of Trade**

The literature on the relationship between terms of trade and economic growth is older and clear than that of volatility of terms of trade. In fact there are well establish theories that can clearly identify the channels through which terms of trade may affect economic growth.

### **2.1 Theoretical Background**

A review of traditional international trade theories (such as the theory of Absolute Advantage, the Law of Comparative Advantage, and the Heckscher-Ohlin Theory)<sup>4</sup> indicates that the differences in terms of trade among nation is a reflection of their comparative cost

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<sup>4</sup> For detail study of such theories, see Salvatore (2004) pp. 33-37 and pp. 115-146.

advantage and from the basis for mutually beneficial trade among nations. Thus the terms of trade is form the basis for mutually beneficial trade. An increase in terms of trade induces a nation to divert resources from inefficient sector to efficient sector, which result in an increase in world output that could be shared by trading nations. Thus, in all these theories, it is the terms of trade that results specialization in production which increases the productivity of resources, because they are used in efficient sector. It is also the fundamental principle of economics that resources should be used efficiently, and in an open economy the terms of trade could be a driving force for such efficiency improvement.

*Insert Figure-2.1here*

Figure 2.1 shows the channels through which terms of trade affect economic growth. An improvement in terms of trade results efficient resource allocation. This efficient resource allocation results in productivity enhancement which leads to higher economic growth. Increase in economic growth permit a country to allocate more resources for research and development. More research activities in the country results in quality improvement which benefit the country in the form of higher export prices resulting further improvement in terms of trade.

The theoretical literature on the effects of volatility of terms of trade on economic growth is not clear. However, from a general perspective we may expect that volatility of terms of trade could have a negative effect on economic growth.

## **2.2 Empirical Studies**

Most of the empirical studies suggest that improvement in terms of trade enhances economic growth. While, volatility of terms of trade has negative effect on economic growth. This section discusses below review of some selected cross country studies.

Arize (1996) investigates the effect of terms of trade on balance of trade for 16 countries over floating exchange rate period between 1973(2) to 1992(4).<sup>5</sup> The cointegration technique has been used to test the long run relationship between terms of trade and trade balance. The results of analysis show that for most of the countries there exist significant positive long run equilibrium relationship between terms of trade and trade balance.

Mendoza (1997) discuss that the volatility of terms of trade affects saving and economic growth. The effect of volatility of terms of trade could be negative or positive depending upon the degree of risk aversion. If risk aversion is low, volatility of terms of trade diminishes welfare and economic growth. Conversely, if risk aversion is high, increase in the volatility of terms of trade sustain economic growth but still reduces social welfare. The author empirically examines a stochastic endogenous growth model using data for 40 industrial and developing countries<sup>6</sup> for the period 1971 to 1991. The empirical results indicate the robust positive relationship between rate of change of terms of trade and economic growth. In contrast, the depressing and robust relationship exists between terms of trade uncertainty and economic growth.

Bleaney and Greenaway (2001) investigate the impact of terms of trade, volatility and real exchange rate on investment and growth for a panel of 14 Sub-Saharan African countries by using annual data from 1980 to 1995. These countries heavily depend on exports of primary commodities. For estimation they use stochastic endogenous growth model developed

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<sup>5</sup> These countries were Canada, France, Germany, Italy, Japan, United Kingdom, USA, Finland, Switzerland, Denmark, Netherland, India, Korea, Malaysia, Mexico and Sri-lanka.

<sup>6</sup> The study uses data of 9 industrial countries and 31 developing countries.

by Mendoza (1997). Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model has also been used to estimate volatility of both terms of trade and real exchange rate. The results indicate that volatility of terms of trade has significant negative impact on growth. Both growth and investment are high when the terms of trade get improved. The findings suggest that trade reforms has been strongly growth enhancing.

Haddass and Williamson (2001) investigate the relationship between terms of trade and economic growth. They considered 19 countries for the period of 1870 to 1940.<sup>7</sup> Results suggest that positive terms of trade movement reduces economic growth of primary product exporters. Findings also confirm the asymmetry in growth impact between core and periphery. In the pre war period, alteration in terms of trade explain not more than one-fifth of economic growth which is observed by the GDP per capita growth rate. However, they cover few developing countries in their sample that remain poor up to the World War II. Furthermore, They did not investigate the effect of volatility.

Cashin and McDernott (2002b) practically examine the relationship between terms of trade shock and current account balance of five OECD countries by using different quarterly time series data for different countries.<sup>8</sup> Structural VAR model has been used for experimental estimations. The outcome suggests that the median terms of trade shock account for only a small share of the inconsistency of current account balance in the United Kingdom, the United States and Canada. On the other hand, shocks in terms of trade are found significant proportion of variation in current account balance in case of New Zealand and Australia.

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<sup>7</sup> They categorize the sample countries according to core and periphery by labor scarcity (measured here by the 1913 real wage rate of unskilled urban male workers (purchasing-power-parity adjusted and relative to Britain) and level of development (development, measured here by 1913 GDP per capita (in 1990 Geary-Khamis dollars) criteria.

<sup>8</sup> For Australia from 1970:2–1997:2; for Canada (1970:2–1997:4); for New Zealand (1980:2–1997:2); for the United Kingdom (1970:2–1997:4); and for the United States (1973:2–1997:4).



Blattman *et al.* (2003) examine the relationship between terms of trade and its volatility with economic performance of 35 countries.<sup>9</sup> Data have been taken of a near century of pre world war II between the periods from 1870 to 1938. The empirical analysis has been done through ordinary least square (OLS) estimation procedure. The results show that term of trade has significant positive impact on economic growth, while, volatility of terms of trade has negative impact on economic growth. These findings are asymmetry between core and periphery.<sup>10</sup> They concluded that terms of trade and their volatility played an important role in explaining growth in the less industrialized periphery than more industrialize core countries.

Otto (2003) examines the responses of the trade balance to terms of trade shocks for 55 small open economies.<sup>11</sup> The study uses structural VAR model. It is found that a positive terms of trade shock results improvement in the trade balance. This outcome is parallel for both small OECD and developing countries. However, Bouakez and Kano (2008) indentifies current account is not significantly affected by the change in terms of trade for three open economies Australia, Canada and the United Kingdom.

Hamori (2008) empirically identifies the relationship between terms of trade and trade balance in G-7 countries by using annual data from 1971 to 2003.<sup>12</sup> The cointegration results show that there is no long run relationship between trade balance and terms of trade. The sub sample analysis supports the robustness of the result. It is concluded that deterioration in the terms of trade will not certainly improves trade balance of a country in the long run.

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<sup>9</sup> 19 core and 16 periphery countries.

<sup>10</sup> The core countries are the industrialized countries had rising terms of trade throughout the seven decades and the periphery had no rise and experience long run decline.

<sup>11</sup> These countries were developing and small OECD economies.

<sup>12</sup> The G-7 countries were Canada, France, Germany, Italy, Japan, United Kingdom and United States

Tsen (2009) empirically examine the long and short run impact of oil prices and terms of trade on trade balance in three Asian Economies Japan, Hong Kong and Singapore. The cointegration and error correction modeling approach has been applied. The cointegration results suggest that terms of trade, domestic demand, foreign demand, oil prices and trade balance are cointegrated of order two. Cointegrating vectors have been normalized by trade balance and terms of trade. For Japan, an increase in foreign demand will cause a decrease in trade balance, even as; increase in domestic demand will initiate an increase in trade balance. Conversely, for Singapore and Hong Kong, an increase in foreign demand will cause an increase in trade balance, at the same time, an increase in domestic demand will lead to a decrease in trade balance. The results also suggest that oil price is an important determinant of terms of trade. Increase in permanent oil prices will cause a decrease in terms of trade for oil importing countries, whereas, impact of an increase in temporary oil prices on terms of trade is ambiguous. In general, terms of trade, domestic demand and oil prices are significant in the determination of trade balance in the short and long run.

### 3. Empirical Strategy

The model to estimate the effect of terms of trade and its volatility on economic growth in parametric form is defined as follows:

$$Y = \alpha_0 + \alpha_1 L + \alpha_2 K + \alpha_3 TOT + \varepsilon \quad (3.1)$$

$$Y = \beta_0 + \beta_1 L + \beta_2 K + \beta_3 VTOT + \psi \quad (3.2)$$

Where  $Y$  is the average annual growth rate of per capita income,  $L$  is the total labor force and  $K$  the gross fixed capital formation as a percentage of  $GDP$ . In the first regression model (3.1)  $TOT$  is the terms of trade and in the second regression model (3.2)  $VTOT$  its volatility of terms of

trade measured by standard deviation of terms of trade index<sup>13</sup> and  $\varepsilon$  and  $\psi$  are the error term. In the above equations the coefficient of labor force and capital are expected to be positive, however the coefficients of terms of trade and volatility of terms of trade are to be determined. The model is estimated by using 5 year annual average data of 94 countries for the period 2004 to 2008. The selection of the countries is based on the availability of data on all variables. The data for this study are acquired from World Bank.<sup>14</sup> Table 3.1 provides the name of 94 countries whose data has been used in empirical analysis.

*Insert Table-3.1 here*

#### **4. Estimation and Results**

To test the existence of a long run relationship between variables of equation (3.1), ordinary least square estimation procedure has been applied. The estimation results are reported in table 4.1.<sup>15</sup>

*Insert Table-4.1 here*

The findings suggest that there exist significant positive relationship between terms of trade and economic growth for a sample of 94 countries. On the other hand, the volatility of terms of trade has also a significant positive effect on economic growth. As the world is moving towards globalization, countries are becoming more liberalize and moving towards specialization. Dependency also increases as country specializes which leads to enhance economic growth. Simultaneously, due to increase in dependency, countries have to face more shocks than before. This means that volatility and growth move together. Conversely, Edward

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<sup>13</sup> Blattman *et al.* (2003) has adopted the same method for measurement of volatility.

<sup>14</sup> The web link of data source is <http://data.worldbank.org/data-catalog/world-development-indicators>

<sup>15</sup> To check the problem of heteroscedasticity, White heteroscedasticity test has been applied. Test results suggest that heteroscedasticity does not exist in both regression models.

(2007) also found the positive but insignificant effect of volatility measured by absolute value of the annual deviation from the long run average of growth on economic growth for all (developed and developing) countries. Furthermore, Stastny and Zagler (2007) confirm the positive and robust impact of volatility measured by the variance of growth rate of *GDP* on economic growth. Therefore, the positive impact of volatility of terms of trade on economic growth is logical.

## 5. Test for Robustness

In this section, sensitivity analyses have been performed to test the robustness of the initial results. The robustness has been checked through adding different variables in the basic model, using different sample size and by using different proxies of volatility.

### 5.1. Additional Variables and Different Sample Size

In the first instance, the robustness of the initial results has been checked through additional variables in the basic model (see Levin and Renelt (1992)). After placing other explanatory variables in the basic model, if coefficient of the focus variable remains significant and of the same sign, then the results are said to be robust. If the coefficient of the focus variable does not stay significant or if the coefficient changes sign with additional variable, then the results are said to be fragile. To perform such sensitivity analyses, we used following model:

$$Y = \alpha_0 + \alpha_1 L + \alpha_2 K + \alpha_3 TOT + \alpha_4 Z + \varepsilon \quad (5.1)$$

$$Y = \beta_0 + \beta_1 L + \beta_2 K + \beta_3 VTOT + \beta_4 Z + \psi \quad (5.2)$$

Where *Y* is the growth rate of per capita income, *L* is the labor force, *K* is the gross fixed capital formation as a percentage of *GDP*, *TOT* is the growth rate of overall terms of trade and *VTOT* is the volatility of terms of trade measured as standard deviation of terms of trade index.

All these variables are considered as major determinants of economic growth in our basic model and  $Z$  is a subset of variables chosen from previous studies and  $\varepsilon$  and  $\psi$  are the error term. For selection of additional variables, following studies have been reviewed which are discussed in the following paragraph.

Barro (1996) concludes about the determinant of economic growth using the panel of around 100 countries from 1960 to 1990. For a given starting level of real per capita GDP, regression results suggest that the growth rate is enhanced by higher initial schooling, lower fertility, better maintenance of rule of law, life expectancy, lower inflation, lower government consumption and improvement in the terms of trade. Adeniyi and Abiodun (2011) use health expenditure and as a determinant of economic growth.

Yanikkaya (2003) examines the relationship between trade liberalization and economic growth using panel data base for over 100 developed and developing countries from 1970 to 1997. The author concluded trade share, export share and import share in GDP have significant impact on economic growth. Additionally, the results are not sensitive to the different statistical method, datasets, outlier problem and specification.

In this study, we use the life expectancy ( $LE$ ), export share in  $GDP$  ( $EXP$ ), fertility rate ( $FR$ ), inflation rate ( $INF$ ), primary enrollment ( $PE$ ) and health expenditure ( $HE$ ) as additional variable for sensitivity analysis. Models of  $LE$  and  $EXP$  have same number of countries as in basic model. Because of unavailability of data, models with inclusion of  $FE$ ,  $INF$ ,  $PE$  and  $HE$  variables have different number of countries.<sup>16</sup> Table 5.1 and 5.2 reports the results of sensitivity analysis.

***Insert Tables-5.1 and 5.2 here***

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<sup>16</sup> Models with the inclusion of  $FE$ ,  $INF$ ,  $PE$  and  $HE$  variables have 88, 71, 81 and 93 countries respectively.

From table 5.1 and 5.2, it is clear that even with the inclusion of other relevant variables, the coefficient of the focus variables (the terms of trade and volatility of terms of trade) remains positive and statistically significant. The coefficient of terms of trade has no difference with the original coefficient; similarly the coefficient of volatility also has no difference in all models with respect to additional variables. Conversely, with respect to different sample sizes the coefficients of terms of trade and volatility of terms of trade has maximum difference of 0.01 with the original coefficient in all models, which is reasonable and acceptable. From these results, it can be concluded that after adding different variables with different sample sizes the initial estimates are robust.

## **5.2. Different Proxies of Volatility**

There are different measures of volatility used in the literature. Standard deviation of considered variable (See Blattman *et al* (2003)), five year moving standard deviation and five year moving average (See Goel and Ram (2001)) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) (See Bleaney M, and D. Greenaway, (2001)) are used as a proxy of volatility. In this section to test the robustness of volatility of terms of trade the standard deviation (*SDT*), five year moving standard deviation (*MSDT*) and five year moving average (*MAT*) of terms of trade are considered.<sup>17</sup> Table 5.3 shows the results of this sensitivity analysis.

### ***Insert Table-5.3here***

Table 5.3 clearly confirms that doesn't matter what proxy of volatility is considered, there is statistically significant positive relationship between volatility of terms of trade and economic

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<sup>17</sup> For five year moving average and 5 year moving standard deviation we used annual terms of trade from 2000 to 2008 .

growth. This confirms that our initial results regarding effect of *VTOT* on economic growth are robust.

## **6. Concluding Remarks and Implications**

In modern literature, the impact of terms of trade and their volatility on economic growth has been extensively argued. Whether reviewing theoretical literature or empirical studies, the terms of trade has significant positive effect on economic growth. However, neither economic theory nor empirical studies provide any connection between volatility of terms of trade and economic growth. This study tries to empirically test the effect terms of trade and its volatility on economic growth using cross country data of 94 developed and developing countries. The study found significant positive relation between terms of trade and economic growth. On the other hand, the volatility of terms of trade has also significant positive effect on economic growth. To test the robustness of initial results a sensitivity analysis has been performed using different additional variables, sample size and various proxies of volatility variable. The initial results were found robust.

At this stage we can set a direction for further research on the relationship between terms of trade and its volatility on economic growth. Since there are well known difficulties with cross country data. Therefore, there is need for more time series studies on the subject using long time series data. This will clear relationship further and may also help policy makers to predict terms of trade and its volatility and its impact on economic growth within a country.

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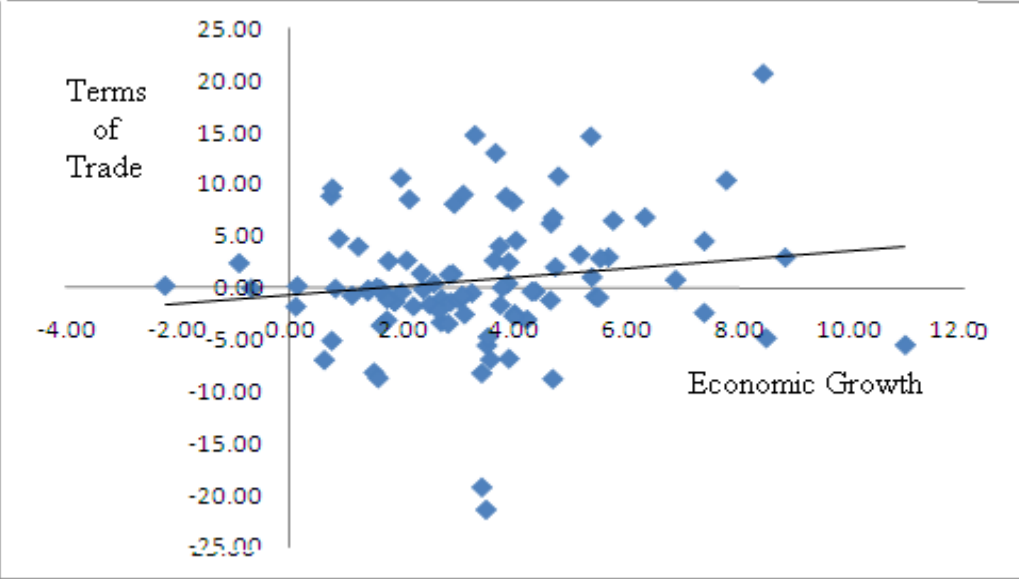
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World Development Indicator (various years).

Web Link: <http://data.worldbank.org/data-catalog/world-development-indicators>

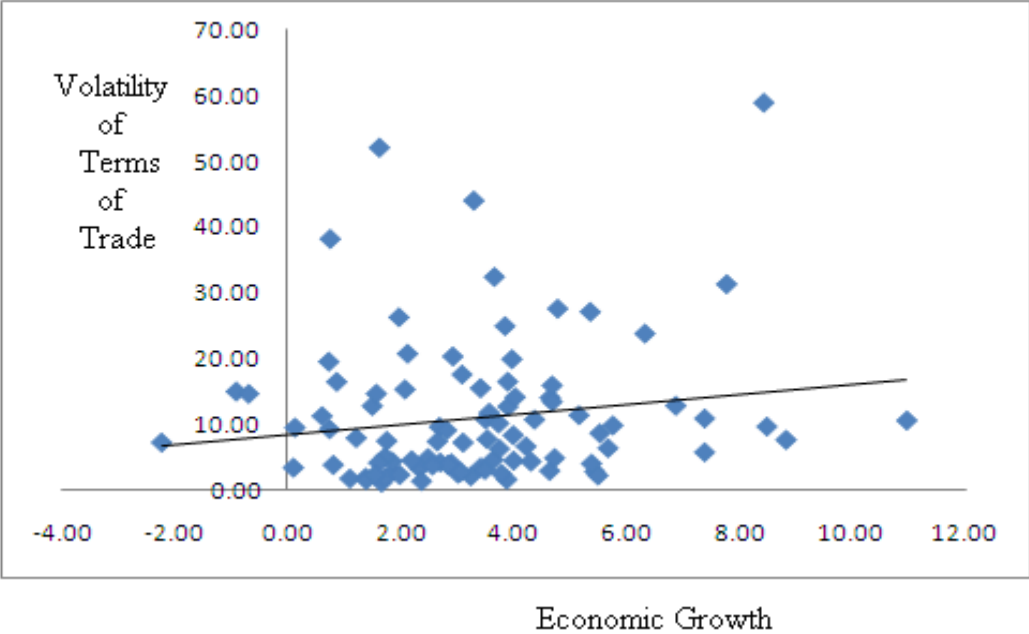
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**Fig 1.1** Terms of Trade and Economic Growth for a Sample of 94 Countries



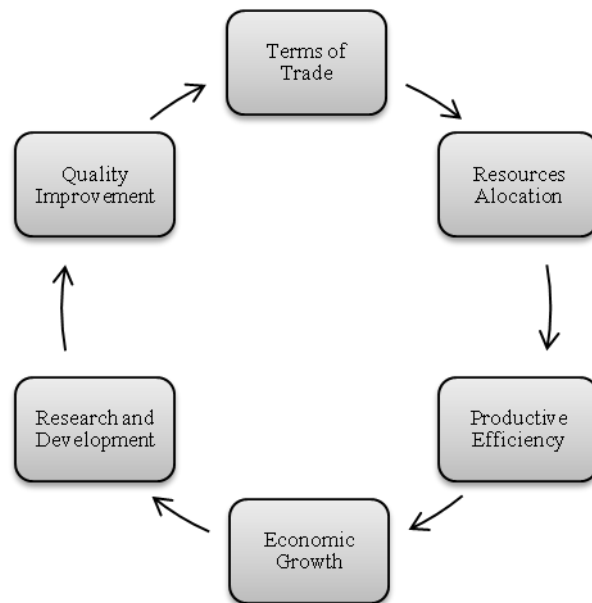
**Source:** Authors' construction

**Fig 1.2** Volatility of Terms of Trade and Economic Growth for Sample of 94 Countries



**Source:** Authors' construction

**Fig 2.1** Theoretical Linkage between Terms of Trade and Economic Growth.



**Source:** Authors' construction

**Table 3.1** Sample of 94 Developing and Developed Countries.

1	<i>Argentina</i>	33	<i>France</i>	65	<i>Mozambique</i>
2	<i>Australia</i>	34	<i>Germany</i>	66	<i>Namibia</i>
3	<i>Bahrain</i>	35	<i>Ghana</i>	67	<i>Netherlands</i>
4	<i>Bangladesh</i>	36	<i>Greece</i>	68	<i>New Zealand</i>
5	<i>Belgium</i>	37	<i>Guatemala</i>	69	<i>Nicaragua</i>
6	<i>Belize</i>	38	<i>Guinea</i>	70	<i>Pakistan</i>
7	<i>Benin</i>	39	<i>Guyana</i>	71	<i>Panama</i>
8	<i>Bolivia</i>	40	<i>Honduras</i>	72	<i>Paraguay</i>
9	<i>Botswana</i>	41	<i>Hong Kong SAR, China</i>	73	<i>Peru</i>
10	<i>Brazil</i>	42	<i>Hungary</i>	74	<i>Philippines</i>
11	<i>Burkina Faso</i>	43	<i>Iceland</i>	75	<i>Rwanda</i>
12	<i>Burundi</i>	44	<i>India</i>	76	<i>Saudi Arabia</i>
13	<i>Cambodia</i>	45	<i>Iran, Islamic Rep.</i>	77	<i>Senegal</i>
14	<i>Cameroon</i>	46	<i>Ireland</i>	78	<i>Solomon Islands</i>
15	<i>Canada</i>	47	<i>Israel</i>	79	<i>South Africa</i>
16	<i>Cape Verde</i>	48	<i>Italy</i>	80	<i>Spain</i>
17	<i>Central African Republic</i>	49	<i>Japan</i>	81	<i>St. Lucia</i>
18	<i>China</i>	50	<i>Jordan</i>	82	<i>St. Vincent and the Grenadines</i>
19	<i>Comoros</i>	51	<i>Kenya</i>	83	<i>Swaziland</i>
20	<i>Congo, Dem. Rep.</i>	52	<i>Korea, Rep.</i>	84	<i>Sweden</i>
21	<i>Costa Rica</i>	53	<i>Kuwait</i>	85	<i>Switzerland</i>
22	<i>Cote d'Ivoire</i>	54	<i>Lao PDR</i>	86	<i>Syrian Arab Republic</i>
23	<i>Denmark</i>	55	<i>Lebanon</i>	87	<i>Thailand</i>
24	<i>Djibouti</i>	56	<i>Lesotho</i>	88	<i>Tunisia</i>
25	<i>Dominican Republic</i>	57	<i>Madagascar</i>	89	<i>Turkey</i>
26	<i>Ecuador</i>	58	<i>Malawi</i>	90	<i>Uganda</i>
27	<i>Egypt, Arab Rep.</i>	59	<i>Malaysia</i>	91	<i>United Arab Emirates</i>
28	<i>El Salvador</i>	60	<i>Mali</i>	92	<i>United Kingdom</i>
29	<i>Eritrea</i>	61	<i>Mauritius</i>	93	<i>Venezuela, RB</i>
30	<i>Ethiopia</i>	62	<i>Mexico</i>	94	<i>Zambia</i>
31	<i>Fiji</i>	63	<i>Mongolia</i>		
32	<i>Finland</i>	64	<i>Morocco</i>		

**Table 4.1** Regression Results of 94 Developed and Developing Countries.

Variables	Model of Terms of Trade (TOT)				Model of Terms of Trade Volatility (VTOT)			
	Constant	L	K	TOT	Constant	L	K	VTOT
<b>Coefficients</b>	0.26	0.01	0.13	0.08	-0.13	0.01	0.13	0.04
<b>t-statistic</b>	0.34	3.2	3.75	2.42	-0.16	2.91	3.76	2.06
<b>Prob.</b>	0.74	0.00	0.00	0.02	0.88	0.01	0.00	0.04
<b>R-Square</b>	0.31				0.29			
<b>F-stat</b>	13.16				12.43			
<b>Prob.</b>	0.00				0.00			

Source: Authors' estimation

**Table 5.1** Test for the Robustness of Terms of Trade by Additional Variables and Different Sample Size.

Variables	No. of Countries	In Basic Model Coeff. of TOT	t-stat. (prob)	Coeff. of TOT with other var.	t-stat. (prob)	R-Square	F-stat. (prob)
<b>Model 1 LE</b>	94	0.08	2.42 (0.02)	0.08	2.45 (0.02)	0.31	9.83 (0.00)
<b>Model 2 EXP</b>	94	0.08	2.42 (0.02)	0.08	2.47 (0.02)	0.33	10.87 (0.00)
<b>Model 3 FR</b>	88	0.08	2.34 (0.03)	0.08	2.33 (0.02)	0.30	9.03 (0.00)
<b>Model 4 INF</b>	71	0.09	2.28 (0.03)	0.09	2.39 (0.02)	0.36	9.39 (0.00)
<b>Model 5 PE</b>	81	0.08	2.57 (0.01)	0.08	2.56 (0.02)	0.35	10.32 (0.00)
<b>Model 6 HE</b>	93	0.08	2.48 (0.02)	0.08	2.46 (0.02)	0.32	10.46 (0.00)

Source: Authors' estimation

**Table 5.2** Test for the Robustness of Volatility of Terms of Trade by Additional Variables and Different Sample Sizes.

Variables	No. of Countries	In Basic Model Coeff. of VTOT	t-stat. (prob)	Coeff. of VTOT with other var.	t-stat. (prob)	R-Square	F-stat. (prob)
<b>Model 1</b> <b>LE</b>	94	0.04	2.06 (0.04)	0.04	2.07 (0.05)	0.29	9.24 (0.00)
<b>Model 2</b> <b>EXP</b>	94	0.04	2.06 (0.04)	0.04	2.29 (0.02)	0.32	10.57 (0.00)
<b>Model 3</b> <b>FR</b>	88	0.05	2.45 (0.02)	0.05	2.40 (0.02)	0.31	9.14 (0.00)
<b>Model 4</b> <b>INF</b>	71	0.05	2.23 (0.03)	0.05	2.32 (0.02)	0.36	9.27 (0.00)
<b>Model 5</b> <b>PE</b>	81	0.05	2.24 (0.03)	0.05	2.24 (0.03)	0.34	9.77 (0.00)
<b>Model 6</b> <b>HE</b>	93	0.04	2.20 (0.03)	0.04	1.95 (0.05)	0.31	9.68 (0.00)

Source: Authors' estimation

**Table 5.3** Test for Robustness of Volatility of Terms of Trade by Different Proxies.

Variables	Model of SDT			Model of MSDT			Model of MAT		
	Coefficient	t-statistic	Prob.	Coefficient	t-statistic	Prob.	Coefficient	t-statistic	Prob.
<b>Constant</b>	0.26	0.34	0.74	-0.03	-0.04	0.97	0.21	0.27	0.79
<b>L</b>	0.01	3.20	0.00	0.01	2.90	0.01	0.01	3.13	0.00
<b>K</b>	0.13	3.75	0.00	0.13	3.68	0.00	0.13	3.72	0.00
<b>VTOT</b>	0.08	2.42	0.02	0.05	1.71	0.09	0.09	2.09	0.04
<b>R-Square</b>	0.31			0.28			0.29		
<b>F-stat (prob.)</b>	13.16 (0.00)			11.83(0.00)			12.49(0.00)		

Source: Authors' estimation