ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

THE IMPACT OF CHINA AND INDIA ON AFRICAN MANUFACTURING EXPORTS ON THE THIRD MARKET:

GRAVITY APPROACH AND A TEST OF FLYING - GEESE THEORY FOR AFRICA

BY
ATNAFU G/MESKEL

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN ECONOMICS (INTERNATIONAL ECONOMICS)

JULY, 2007
ADDIS ABABA

ACKNOWLEDGEMENT

My best gratitude goes to Dr. Alemayehu Geda, my thesis advisor who has been with me from the very inception of the topic of this thesis. Dr. Alemayehu has devoted his valuable time in directing and suggesting substantial ideas, correcting and critically commenting on this manuscript. He has always encouraged me to look in to frontier academic matters. Apart from this, Dr. Alemayehu has been generous to dedicate resources for my thesis.

The department of Economics of AAU in collaboration with the African Economic Research Consortium (AERC) has offered me a home scholarship for my MSc study. AERC has also provided me thesis fund. I record my appreciation here.

My brothers Ato Fantahun Belew and Ato Alem Haileselassie with their respective families have always been with me and my family even when I was in the most difficult situations. They have encouraged me a lot to peruse my MSc study.

I would like to thank Dr Abi Mamo who thought me Econometrics at JFE in Nairobi. Dr Abi has been generous to provide me latest information and materials in econometrics and international trade.

Finally, I owe my deepest thanks to my wife W/ro Abaynesh Zeleke who has taken care of me all the time. Thank you, Abay.

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ACRONYMS

AEAN-4	Thailand, Malaysia, Indonesia, and the Philippines
AGOA	African Growth and Opportunity Act
AP	Asia Pacific
AR(1)	Auto Correlation of Order 1
CES	Constant Elasticity of Substitution
CPI	Consumer Price Index
CS	Cross-Section
DOTS	Direction of Trade Statistics
ECA	Economic Commission for Africa
EIR	Export Import Ratio
ESA	East and Southern Africa
FDI	Foreign Direct Investment
FG	Flying-Geese theory
G2SLS	Generalized Two Stage Least Square
GDP	Gross Domestic Product
GLS	Generalized Least Square
GTAP	Global Trade Analysis Project
H-O	Heckscher-Ohlin
HS1996	Harmonized System 1996
HS2002	Harmonized System 2002
ICRG	International Country Risk Guideline
M-P-E	Import- production - export
IMF	International Monetary Fund
IV	Instrument Variable

JB	Jarque and Bera
LM	Lagrange Multiplier
NA	North Africa
NIEs (NICs)	Newly Industrializing Economies (Countries) Hong Kong, Singapore, Taiwan, and South Korea
OECD	Organization for Economic Development and Cooperation
OLS	Ordinary Least Square
PCS	pooled- Cross-Section
RCA	Revealed Comparative Advantage
RCAI	Revealed Comparative Advantage Index
RTAs	Regional Trading Arrangements
SITC	Standard International Trade Classification
SITC Rev.1	Standard International trade Classification Revision 1
SITC Rev.2	Standard International trade Classification Revision 2
SITC Rev.3	Standard International trade Classification Revision 3
SRC	Spearman's Rank Correlation
UN Comtrade	United Nations Commodity Trade Statistics
UNIDO	United Nations Industrial Development Organization
US	United States Dollar
USA	United States of America
WCA	West and Central Africa
WDI	World Development Indicator
WES	World Export Share
WTO	World Trade Organization

ABSTRACT

In this paper, we address two major questions. First, the question of whether China and India displace the African manufacturing export from the third market and, secondly, the question of whether there is an evidence for shifting comparative advantage from China and India to Africa as predicted by the flying-geese theory of industrial development.

The commodity is disaggregated down to three-digit SITC Rev.3 according to the UN Comtrade classification. We employed the gravity equation to test whether China and India are crowding out the African manufacturing exports from the third market. In contrast to most of the researches which estimate gravity model on averages of bilateral trade flows from cross-section data, we estimated the gravity model on panel data of imports of six third market countries from thirteen African exporter countries for the period 1995-2005. To test whether there is an evidence of shifting of comparative advantage from China and or India to Africa as predicted by flying-geese theory, we estimated Spearman's rank correlation coefficients on indices of the revealed comparative advantage vectors of the African exporters and China and India for the period 1995-2004.

Both the gravity and flying-geese models predicted same outcome. The major finding of this paper is that there is strong evidence that China has been displacing African manufacturing from the third market but India has been complementing in the early years. However, the overall third market impact of China and India has been that of complementarity in the later years of the sample period. Furthermore, we found an evidence for shifting comparative advantage from China and India to Africa as the flying-geese theory predicts, South Africa being the leading goose. South Africa gained comparative advantage earlier than other African countries and moved to the higher stage of industrialization followed by Kenya.

*The major implication of this study is that, in the world where China and India are reshaping the global economic order dynamically, the outcomes of the traditionally received wisdom of trade liberalization and industrialization policies in the spirit of export promotion may be uncer*tain.

Key words and phrases: *China; India; third market; African manufacturing exports; Gravity model; flying geese- theory*

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Globalization has altered the competitive dynamics of nations, firms, and industries (Gereffi, 1999). Chen *et al* (2005) argue that many African economies are prominently linked to the world economy as important producers of raw materials and soft commodities. Alemayehu (2002:20) noted that there existed a reasonable degree of trade linkage with Europe in the pre-colonial period. Leaving aside the slave trade, the main feature of this trade was the export of primary commodities by African nations to Europe (Alemayehu, 2002:20).

Following their accession to the World Trade Organization (WTO), China and India are gaining attention in the world economy in general and African trade pattern in particular. In line to this, Jenkins and Edwards (2005) argue that “In recent years accelerated growth and greater openness of their economies have led to China and India becoming increasingly important players in the global economy”. Economic links with China and India is not new but both countries' trade with Africa has increased significantly in recent years (Jenkins and Edwards, 2005). Growth of trade between Africa and the Asian drivers[1] since 1990 is significant. Since 2000, China has overtaken as trading partner in Africa. According to these authors, where as Africa has always had a trade surplus with India, it has run deficit with China, although this has narrowed considerably since 1998 as a result of the rapid growth of exports to China.

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[1] **Asian drivers in this study refers to China and India**

As Alden (2003) puts it, “at a time when the world seems preoccupied by events in the middle east and the ‘global war on terror’, China’s growing engagement in Africa has gone little noticed in the west” (Alden, 2003:147). Yet in a span of less than a decade trade between the regions has increased from US$10 billion in 2000 to US$28 billion in 2005. The author emphasized the Chinese concern in Africa as “China expended significant resources in foreign assistance towards African states, has started negotiations towards a regional economic free trade with the Southern African Customs Union, and has embarked on an unprecedented peacekeeping mission in Liberia” (Alden, 2003:147).

Over the last 20 years, China has grown at the rate of nearly 10 per cent per annum, driven primarily by an expansion of the modern, industrial export oriented sector. With some 20 million Chinese workers moving from rural underemployment to the modern sector annually, the impact is akin to adding another middle sized-industrial economy to the world economy each year (Eichengreen *et al*, 2004). According to these authors, with between 200 million and 300 million workers still to be reallocated from rural underemployment, this is not simply a one-time shock, but an ongoing process that should continue for a decade and more.

About 40% of the world population today lives in China and India. Since 1990, the Chinese economy has grown at almost 10 per cent per annum and India's at almost 6 percent. Between 1990 and 2002 trade as a share of GDP almost doubled in India and increased by more than two-thirds for China (Eichengreen *et al*, 2004). Although their share of output and trade still lag behind their share of world population, these (the former ones) have increased significantly.

China and India's emergence over the last decade as key net importers of commodities from Africa means that global commodity markets are likely to be the main channels through which the impact of China and India's ascendancy has been (and will be) felt on the African continent (Eichengreen *et al*, 2004).

1.2 STATEMENT OF THE PROBLEM

The Chinese and Indian interaction in the African economy is becoming stronger than ever. Their interaction with the African economies has both opportunities and challenges. Countries which export labor-intensive manufactures face competition in the third market[2]. There are also opportunities for some countries to increase exports to China and India as incomes in China and India increase (Jenkins *et al*, 2005:ii). Emphasizing on China, Alden (2003) pointed out that there are points of tension, however. One of them is trade. The balance of trade favors China and has, in the case of South Africa, been a topic of contention in ministerial meetings between the two countries for a number of years (Alden, 2003:156). Local industries (especially manufacturing and textiles) and merchants have been hit hard by the flood of cheap imports from China, particularly when these are linked to the new Chinese wholesale and retail shops that use established networks to access goods. Across the continent from northern Namibia to central Kenya, traditional products and retailers have been edged out by Chinese

[2] In this study, the third market is defined as a common destination place for the exports of Africa and the Asian drivers.

businesses (Alden, 2003:156). Even in Angola's war-torn region of Huambo, five Chinese retailers have, since their arrival in 2000, managed to curve out position that has effectively closed down established suppliers (Alden, 2003:156). The use of Chinese contract labor, rather than local workers, in Chinese-sponsored projects in Ethiopia, Sudan and Namibia has been criticized locally (Alden, 2003:157). Also, the available stock of knowledge on the impact of the emerging Asian drivers on the rest of the world is full of controversy and non-conclusive.

The rise of the Asian drivers on the global scene has led to concerns in both developed and developing countries. In the case of the later, the importance of China, particularly on the countries in Asia and more recently on Latin America has been a focus of attention, but so far there has been very little work on the impact on Africa. Most of the researches that have been carried out focused on impacts on macroeconomic performance and industrial competitiveness and do not explore implications for dynamics of industrial development.

Most of the studies undertaken on the impact of the Asian drivers are on Latin America and Asia. In the case of Africa, on the other hand, the existing literature on the impact of the Asian drivers is much thinner (Chen *et al*, 2005). By emphasizing on global macroeconomics, raw commodity markets, trade links and policies, foreign direct investment by Chinese and Indian multinationals, and governance standards, the authors contend that "with the integration of China and India the "Asian Drivers" in the world economy gaining momentum, it is ever more manifest that economy and policy in poor countries will be affected in various complex ways. The sheer size of the

Asian drivers, their phenomenal rate of growth and their growing economic and political power ensure that they will re-shape the world economy and change the rules of the game" (Chen *et al*, 2005:4). The authors argue that their growing presence is likely to transform past relationships in a number of key respects, providing both competition and opportunities not just for the major trading partners in OECD countries, but also for developing countries and other emerging economies. Policy response to the drivers cannot rely on conventional policy prescriptions. And they will be needed for the long term, as the giants' rise is unlikely to be only temporary (Chen *et al*, 2005:1).

According to these authors, the only available study are Jenkins and Edwards (2005) and Kennan and Stevens (2005). The former combines a disaggregated trade analysis with a framework to assess trade-poverty linkages where as later estimates the impact of China on African countries' trade balance and draws a tentative list of African "losers" and "winners" (emphasis original) from China's rise in the international trade arena Chen *et al* (2005:4). The study by Kaplinsky *et al* (2006) is also inconclusive. They summarized the trade, production & FDI and Aid against direct (both complementary and competitive) and indirect (both complementary and competitive) impacts and asserted that it is difficult to conclude across countries and sectors (Kaplinsky *et al*, 2006). The availability of literature on situation is even worse in the case of India (Alemayehu, 2006).

On the methodological front, the empirical test of the FG theory of industrial development through shift in comparative advantage is also inconclusive; see for example Rana (1990) and Lutz (1987). Rana examined the changes in the pattern of revealed comparative advantage of 14 Asian and pacific countries from 1965 to 1984 and found that in the NIEs[3] and ASEAN-4[4] countries, the pattern changed significantly and that the changes were "beneficial" (emphasis original) in the sense that the gains occurred in commodities in which world demand was growing relatively fast (Rana, 1990:243). Lutz's analysis of changes in exports of selected three-digit product categories for manufactures for sixteen countries from 1968 to 1976 and from 1976 to 1982 however indicated that such shifts have not occurred. Many of the other developing countries that have expanded such exports have done so in the same product categories as the NICs[5], not different ones (Lutz, 1987:339). According to the review by Dowling and Cheang (2000) however, such consistency is not evident from studies of shifting comparative advantage from the NIEs to other less developed Asian economies. Dowling and Cheang (2000) further noted that; Watanbe and Kojiwara (1983), Rana (1990), Yamazawa *et al* (1991), and Fukasaku (1992) found evidence of shifts in comparative advantage from the NIEs to other less developed economies in the Asia Pacific region; whereas Cline (1984), Lutz (1987), Lutz and Kihl (1990), and Chow and Kellman (1993) did not (Dowling and Cheang, 2000:445).

At this juncture, in-depth analysis of specific group of countries would be essential because different regions or group of countries are going to be affected differently by the emergence of China and India. Therefore, due to dynamic nature of the society in general and fast emerging China and India in particular, studies conducted at regional or continent level cannot hold for

3 Hong Kong, Singapore, Taiwan, and south Korea
4 Thailand, Malaysia, Indonesia, and the Philippines
5 Same as 2

a specific group of countries or individual country. The study by Jenkins and Edwards (2005) pointed out that there is ample scope for further research in this field and extended that priority areas would be:

1. identification of labor-intensive products which are likely to have a pro-poor impact;
2. studies of individual value chains; and
3. more in-depth studies of specific countries (Jenkins and Edwards, 2005:iii)

Therefore, one could pose a question as to what would be the impact of the emerging China and India on the African manufacturing, i.e., whether the growing China and India would crowd out African manufacturing export from the third market. Can the emergence of China and India speed up the African industrial development process?

1.3 OBJECTIVES OF THE STUDY

1.3.1 GENERAL OBJECTIVE

The overall objective of this study is to examine the impact of China and India on selected African countries manufacturing export on the third market and asses the possibility of shifting comparative advantage from the Asian drivers to Africa as predicted by the flying-geese model.

1.3.2 SPECIFIC OBJECTIVES

The specific objectives of the study are to:

1. examine whether Chinese and Indian exports are competing or complementing African manufacturing exports on the third market;

2. assess if there is dynamics of shifting comparative advantage from the Asian drivers to African manufacturing as predicted by the flying-geese theory of industrial development.

1.4 HYPOTHESIS OF THE STUDY

In this study, we hypothesize that:

1. the direct impact of China and India on the African manufacturing export is competitive, more specifically we hypothesize that China and India's exports crowd out the African labor-intensive manufactured exports from the third market;
2. there is a shift in comparative advantage towards manufacturing sector, enhancing industrial development as consistently predicted by the FG theory of industrial development.

1.5 METHOD AND DATA

1.5.1 METHOD

The available literature on the methodology of evaluating the impact of the integration of China, and, by extension India in to the world economy can generally be classified in to two strands. The general equilibrium model derived from the Global Trade Analysis Project (GTAP) which is widely used for international trade policy analysis (see for example, Valerie, *et al*, 2005, Ianchovichina and Martin, 2006) and the gravity model which has been labeled by Eichengreen *et al* (2004) as familiar workhorse of empirical international trade literature. The former strand rested on the fundamental assumption of perfect competition and constant elasticity of substitution (CES) technology and a system of demand and supply ensuring market clearing mechanism (see for example Cerra *et al*, 2005; Alemayehu, 2002:76).

In this study, the gravity model will be employed as a framework of analysis to examine the impact of China and India on the African manufacturing export on the third market. The reason for selecting the gravity model is that it has performed remarkably well over a long period in explaining bilateral trade flows (see for example, Greenway *et al*, 2002). According to these authors, at the heart of the model is an emphasis on the countries' GDP being a positive determinant of trade and the distance between the countries a negative determinant. Hence, the impact of the growth of the Asian drivers (their GDP and per capita income) on Africa can easily be captured.

The use of the gravity model has enjoyed something of resurgence in recent years, partly because of more systematic efforts to reinforce its theoretical underpinnings (see for example Deardorff, 1995; Evenett and Keller, 2002) and partly because of the availability of a growing number of "natural experiments" in the form of RTAs[6] (Greenway *et al*, 2002).

Furthermore, the potential for using the framework for *ex post* as well as *ex ante* analysis (i.e., to predict trade potentials and therefore comment on potential adjustment problems) was also seen as useful (Greenway *et al*, 2002:3).

Someone may question the appropriateness of the gravity model in the African context. Such researchers argue that Africa is trading more with developed countries than within itself as the gravity model would predict,

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[6] Regional Trading Arrangements

thus, the gravity model may not explain determinants of trade within Africa. However, since it is a question of how African manufacturing export is being affected by China's and India's export on third market, say USA; but not trade within Africa, I argue that by applying the model to examine Chinese and India's impact on the third market (which is in most cases outside Africa) is in line with the current trading pattern.

The question of whether there would be a dynamics of changing comparative advantage in African manufacturing sector consistent with the flying-geese theory of industrial development will be evaluated by non-parametric Spearman's rank correlation coefficient test on the revealed comparative advantage (RCA) vectors for the 13 African exporting countries under the study period. To find out if the changes are beneficial in the sense that the world demand in the selected commodity is rising relatively fast, the growth rate of world import in the commodity under discussion will be compared to the directions of changes of the RCA.

Despite its weak theoretical foundation, this approach has been extensively used in empirical analysis (Balassa (1965, 1977); Donges and Riedel, 1977; Yeats, 1985; and UNIDO, 1885; as cited in Rana, 1990).

The value added of this study is the attempt that, first, the gravity model is employed to evaluate the impact of the Asian drivers on the African exports of clothing and accessories on the third market and second, the FG theory is used to evaluate whether there is an evidence for shifting comparative advantage and hence a multiple catch-up process of industrial development in Africa through China-India-led-macroclustering as predicted by the flying-geese theory.

1.5.2 DATA SOURCE

The sample size, i.e., the number of African countries to be included in this study is determined based on the principle that, the smaller the population, the bigger the sampling ratio has to be for an accurate sample (i.e. one with a high probability of yielding the same results as the entire population) is applied. The commonly accepted approach is that for a small population (under 1000), a researcher needs a large sampling ratio (about 30%). Alemayehu (2002:332-333) on the basis of the ECA definition has classified the African countries in to three regions as East and Southern Africa (ESA), North Africa (NA) and West and Central Africa (WCA). Hence, 13 countries will be selected from 52 countries proportionately (at random) from each group. The third market is taken as the main trading partner countries[7] to the selected 13 African countries.

The main source of trade data will be the United Nations Commodity Trade Statistics Database (UN comtrade). Data for some relevant variables will be obtained from IMF Directions of Trade statistics and World Development Indicators CD-ROM. The study will cover the period 1995 to 2005; the rationale for selecting this period is that clothing and accessories which is the commodity under this study was put under SITC Rev.3 classification by the UN comtrade since 1995. The rational for selecting clothing and

[7] They are defined by the United Nations Commodity Trade Statistics Database as the top five trading partner (in this context importer) countries

accessories is because of the fact that Africa is facing severe competition in the third market of this commodity from China and India.

1.6 JUSTIFICATIONS AND SIGNIFICANCE OF THE STUDY

This study is relevant to regional and national governments in designing trade and industrial policies. The expected gain from this study is Knowledge of locating Africa in the world of the emerging Asian drivers. Academic and research institutions, professional associations, and regional and multinational organizations can benefit from this study in acquiring preliminary information. The information obtained from this study can be disseminated through professional journals, conference proceedings or as university reference material.

1.7 LIMITATIONS OF THE STUDY

The first and foremost problem this study faces comes from data. Missing values for some countries/or commodities are common in trade data. Reports for some countries are not up-to-date. Trade data for some countries are not reported consistently and in a uniform unit of account.

1.8 ORGANIZATION OF THE STUDY

The remainder of the paper is organized as follows. Chapter 2 is devoted to theoretical and empirical literature and develops econometric specification of gravity model. Chapter three will deal with model specification and estimation issues. Finally, chapter four will complete the study by concluding remarks.

CHAPTER 2: THEORETICAL FRAMEWORK AND EMPIRICAL LITERATURE

This chapter is devoted to review of the theoretical frameworks and empirical literatures on both the gravity model and the flying-geese theory of industrial development. The gravity and flying-geese frameworks will be dealt with in section 2.1 and 2.2 respectively. Under the respective sections, first I will provide review of the formal theory developed on the subjects and, then, turn to empirical studies in these areas. Following the evaluation of the literature, I will present the model I am intending to use in this study.

2.1 THEORETICAL FRAMEWORK

2.1.1 GRAVITY MODEL

The gravity model has been instrumental in analyzing the determinants of bilateral trade flows. The model was first used in applied econometric work by Tinbergen (1962) and Pöyhönen (1963). The literature on gravity model has been growing very vast (see for example, Anderson, 1979; Oguledo and MacPhee, 1994; Deardorff, 1995; Cyrus, 2002; Egger, 2002; Frankel and Wei, 1995; Màtyàs, 1997, 1998; Greenway and Milner, 2002; Anderson and Wincoop, 2003; Cheng and Wall, 2005; Baldwin and Taglioni, 2006**;** Bussière and Schnatz, 2006; Greenway *et al,* 2006, Linders and Groot, 2006; Subramanian and Wei, 2007) and literatures cited therein. Thus, we will not pretend to cover all but the main ones relevant for our purpose.

The model is formed on the central idea that income and distance between countries are respectively positive and negative determinants of bilateral trade. Anderson (1979) has offered the functional form of gravity equation as:

$$M_{ijk} = \alpha_k Y_i^{\beta k} Y_j^{\gamma k} N_i^{\xi k} N_j^{\epsilon k} d_{ij}^{\mu k} U_{ijk} \qquad (2.1)$$

Where;

M_{ijk} = the dollar flow of good or factor k from country or region i to country or region j

Y_i = Incomes in country i

Y_j = Incomes in country j

N_i = Population in country i

N_j = Population in country j

d_{ij} = the distance between countries (regions) i and j

U_{ij} = the lognormally distributed error term with $E(lnU_{ij}) = 0$

Until recently, there were two lines of researches in the use of gravity equation. One strand of literature claims that, though the gravity model performed well empirically, it has no theoretical foundations. This strand of literature includes, for example, Frankel and Wei (1995), Rose (2004); Eichengreen *et al* (2004), Greenway *et al* (2006). The other strand in the literature–attempts to underpin the empirical relationships which are found to be strong with sound theoretical basis and challenges those views which assert the gravity model as having no theoretical foundations. This strand of researches includes the works of Anderson (1979); Oguledo and MacPhee 1994; Deardorff (1995); Baldwin and Taglioni (2006).

2.1.1.1 RESEARCHES ON THEORETICAL FOUNDATION OF GRAVITY EQUATION

Anderson (1979) puts the gravity model as probably the most successful empirical trade device of the last 25 years. According to this author, applied to a wide variety of goods and factors moving over regional and national borders under differing circumstances, it usually provides a good fit.

Anderson (1979) notes that while other interpretations are possible, the one advanced in his work under discussion has four advantages. First, it explains the multiplicative form of the equation. Second, it permits an interpretation of distance in the equation. Third, the vague underlying assumption of identical "structures" across regions or countries is straight forwardly interpreted as identical expenditure function. Finally, following the logic of the present interpretation implies that the usual estimator of the gravity equation may be biased requiring change in the method of estimation (Anderson, 1979:107).

Though the author laid down the theoretical foundation of the model, his formulation is meant for cross-sectional analysis. Thus, many authors who used gravity model as framework of analysis employed a cross-sectional (CS) units and pooled-cross-section (PCS) units. Regarding the estimation issues, Anderson acknowledged the dependency of incomes with the error term. However, he argues that the relative stability of the equation over time in some applications may suggest that the bias is not serious, but this is conjectural (Anderson, 1979:111). He offers several alternatives to reduce this bias and in Anderson (1979), he provided two: first, use of instrument variable and, second, dealing with simultaneity directly.

Oguledo and MacPhee (1994) have derived the gravity equation from a linear expenditure system. They noted "this new approach is another attempt to answer recent criticism that the theoretical foundation of the gravity model is weak (Oguledo and MacPhee, 1994:112). First, using simplified set of assumptions, they derived the simplest form of gravity equation given in equation (2.2). Then, they argued that because of the simplifying assumption, the equation is too simple for applicability in the real world. In an attempt to avoid these weaknesses, the authors relaxed the original set of assumptions and formulated the full blown gravity equation given by equation (2.2)[8].

$$M_{ij} = \frac{\gamma}{k} Y_i^{\alpha 1} N_i^{\alpha 2} P_i^{\alpha 3} Y_j^{\beta 1} N_j^{\beta 2} P_j^{\beta 3} (T\hat{\ }C_{ij}^{\epsilon 1}) t_j^{\epsilon 2} U_{ij} \tag{2.2}$$

Accordingly, Oguledo and MacPhee (1994) noted that "the economic interpretation of equation (2.2) is that functional form of the gravity equation and a major portion of its explanatory power is encompassed by the expenditure system of the trading partners.-

The log-linearized form of equation (2.3) is given in equation (2.3)

$$\begin{aligned} \log M_{ij} = {} & \log \gamma' + \alpha_1 \log Y_i + \alpha_2 \log N_i + \alpha_3 \log P_i + \beta_1 \log Y_j \beta_2 \log N_j + \beta_3 \log P_j \\ & + \epsilon_1 \log T\hat{\ }C_{ij} + \epsilon_2 \log t_j + \log U_{ij} \end{aligned} \tag{2.3}$$

8 *The derivation and description of the variables is shown in Appendix A1*

Where, $\gamma' = \frac{\gamma}{k}$

Deardorff (1995) questions whether the gravity model works in neoclassical world and notes that "bilateral trade patterns are well described empirically by the so-called gravity equation, which relates trade between two countries positively to both of their incomes and negatively to the distance between them, usually with a functional form that is reminiscent of the law of gravity in physics".

Deardorff (1995) examined the issue from two key angles, one with frictionless trade and one with out. For the frictionless trade case, Deardorff (1995) rigorously derived the gravity equation and obtained the values of bilateral trade on average and concludes: if expenditure fractions differ across countries because preferences are not identical/or not homothetic, then individual bilateral trade flows will vary around this frictionless gravity value. If one country tends to overproduce what another over consumes, then exports of the former to the latter will be above that value, and if one tends to under produce what other over consumes, these exports will be below that value (Deardorff, 1995:15).

With the impeded trade case the results of his derivation are read as: if importing country, j's, relative distance from exporting country i is the same as the average of all demanders' relative distances from i, then exports from i to j will be the same as in the Cobb-Douglas case. That is c.i.f exports will be given by the simple frictionless gravity equation, while fob exports will be reduced below that equation by the transport factor from i to j, much as in the standard gravity equation with transport factor (one plus transport cost) measuring distance Deardorff (1995:23).

Finally, the following conclusions were made by Deardorff (1995). First, it is not all that difficult to justify even simple forms of the gravity equation from the standard trade theories. Second, because the gravity equation appears to characterize a large class of models, its use for empirical test of any of them is suspect (Deardorff, 1995:26).

The work by Cyrus (2002) was primarily aimed at examining the role of income in gravity model. He took the theoretical foundation of gravity equation as given in the most frequently cited works of Tinbergen (1962), Pöyhönen (1963) and Linnemann (1966). According to Cyrus (2002), trade between two countries is analogous to gravitational force between two objects where income enters positively and multiplicatively in the gravity equation implying that trade between two medium-sized countries should exceed trade between a small and large country (Cyrus, 2002:164). He further contended that "Such an outcome would result from Helpman and Krugman-type (1985) model of monopolistic competition, but Deardorff (1998) has shown that a standard Heckscher-Ohlin framework can produce the same outcome. So, the empirical success of gravity specification cannot be used as evidence to support a particular theory of trade (Cyrus, 2002:164).

Baldwin and Taglioni (2006) extended Anderson and Wincoop (2003) to allow for panel data (Anderson and Wincoop, 2003 fitted the model with cross-section data). Baldwin and Taglioni (2006) reviewed the basic theory behind the gravity equations and used this to explain why several of the standard choices are incorrect and why they typically bias the results. They started by putting the gravity model as a workhorse tool in a wider range of empirical fields which is regularly used to estimate the impact of trade agreements, exchange rate volatility, currency unions the 'border effect' (emphasis original), common or related language usage and it even has a range of more exotic applications such as the impact of religion on trade and the impact of trade on the likelihood of war. Baldwin and Taglioni (2006) argue that its popularity rests on three pillars: First, international trade flows are key elements in all manner of economic relationships, so there is a demand for knowing what normal trade flow should be. Second, the data necessary to estimate it are now easily accessible to all researchers. Third, a number of high profile papers have established the gravity model respectability (see for example, McCuallum, 1995; Frankel, 1997 and Rose, 2000) and establish a set of standard practices that are used to address *ad hoc* empirical choices that face any empirical researchers.

The authors' review of the Leamer and Stern's famous 1970 book provided three distinct sets of foundations out of which the best is based on what could be called the 'potluck assumption' (Baldwin and Taglioni, 2006:1). According to this assumption, nations produce their goods and throw them all in to a pot: then each nation draws its consumption out of the pot in proportion to its income. The expected values of nation-i's consumption produced by nation j will equal the product of nation-i's share of world GDP and nation j's share of world GDP. In this way, bilateral trade is proportional to the product of the GDP shares.

Baldwin and Taglioni (2006), after a step by step derivation of gravity model, have shown that its estimation suffers from basic econometric biases, the 'medals' in their–terminology. A gold medal of classic gravity model mistake arises due to omitted variable biases and a small problem. What they called the bronze medal mistake arises due to the inappropriate deflation of nominal trade values by the US aggregate price index. Since there are global trends in inflation rates, inclusion of this term probably creates biases via spurious correlations. However, Baldwin *et al* (2006) note that Rose (2000) and other papers offset this error by including time dummies since every bilateral trade flow is divided by the same price index, a time dummy corrects the mistaken deflation procedure (Baldwin and Taglioni, 2006:7). The silver medal is due to the fact that most researchers mistake the log of the average for the average of the logs. In line with this, Baldwin and Taglioni (2006) contend that "the basic theory tells us that the gravity equation is a modified expenditure function; it explains the value of spending by nation on the goods produced by another nation. That is to say, the gravity equation explains uni-directional bilateral trade. Most gravity models however are not estimated on uni-directional trade, for example, French exports to Germany. Rather, they work with the average of the two-way exports, for example the average of exports of French exports to Germany and German exports to France". Baldwin and Taglioni (2006) assert that there is nothing intrinsically wrong with this, but since it was done without reference to theory, most researchers mistake the log of the average for the average of the logs[9].

[9] ***The formal derivation is shown in Appendix A2***

2.1.1.2 RESEARCHES ON EMPIRICAL SUCCESS OF GRAVITY EQUATION

This strand of literature argues that gravity model has no strong theoretical foundation. However, it fits data well (see for example, Rose 2004; Eichengreen *et al* 2004, Frankel and Wei 1995).

Rose (2004) noted that the gravity equation is only conventionally a successful model. For those unfamiliar with the gravity model, it is a completely conventional device used to estimate the effects of variety of phenomenon in international trade. Unusually for economics, it is also a successful model in two senses. First the estimated effect of distance and output (the traditional gravity effects) are sensible economically and statistically significant, and reasonably consistent across studies. Second, the gravity model explains most of the variations in international trade. That is, the model seems reliable and fits the data well (Rose, 2004). As a result, Rose (2004) relied on the standard gravity model of bilateral trade to estimate the effect of multilateral trade agreements.

More recently, Eichengreen *et al* (2004), Greenway *et al* (2006) noted that the gravity model fits data well and they used it to study the impact of China on the exports of other Asian countries. Subramanian and Wei (2003) noted that the gravity model has “enjoyed empirical success in terms of its ability to explain a relatively large fraction of variations in the observed volume of trade” Subramanian and Wei (2003:6).

Greenway and Milner (2002) however noted that though the gravity model has been remarkably successful in explaining actual bilateral trade flows, until fairly recently the theoretical underpinnings for the standard gravity equation were, at best, loose. The same can be said of extensions to the standard gravity equation, designed to evaluate the impacts of Regional Trading Arrangements (RTAs). Most applications of gravity model therefore search for evidence of actual or potential effects by adding dummy variable for membership of a particular RTA, rather than trying to estimate particular trade effects, such as trade creation and trade diversion (Greenway and Milner, 2002).

2.1.2 EMPIRICAL EVIDENCES

Gravity model has been employed to examine (i) the effects of trading blocks on trade (see for example, Frankel *et al,* 1995; Alemayehu and Haile, 2002; Greenway and Milner, 2002), (ii) the effects of currency unions and exchange rate volatility on trade (see for example, Rose, 2000), (iii) the effect of WTO on trade (see for example Rose, 2004; Subramanian and Wei, 2007) and (iv) border effects (see for example, Helliwell, 1996 and Anderson and Wincoop, 2003). Recently, it is becoming instrumental in evaluating the impact of China and by extension India's integration in the global economy (see for instance, Eichengreen *et al,* 2004; Bussière and Schnatz, 2006; Greenway *et al,* 2006 etc., and literatures cited therein) among others.

However, the review in this subsection will focus on those works which employed gravity model as a framework of analysis to evaluate the impact of China and by extension India's emergence on the trade pattern of other countries as that is the main thrust of this thesis.

Eichengreen *et al* (2004) used the gravity model to evaluate the impact of the rise of China on the exports of other Asian countries using data on bilateral trade flows from IMF's Direction of Trade Statistics for 180 countries for the period 1990 through 2002. They considered bilateral flows between 13 Asian exporting countries and all 180 importing countries. They regressed the log imports of country i from country j on the log GDPs of the two countries, the log per capita GDPs of the two countries, the distance between them and other standard gravity variables. They claim that their innovation is to include a measure of China's exports to the same market (we understand the market to mean the third market, i.e., importing country). The authors recognized and controlled for endogeneity of China's exports and unobserved factors by standard treatment for this type of problem, i.e., in this context, the gravity model suggests distance between china and the third market is both plausibly exogenous and strongly correlated with Chinese exports. In addition they used China's GDP as an instrument in the first stage regression (Eichengreen *et al,* 2004). The main conclusions derived from this study are: (a) the use of gravity model enabled them to disaggregate among commodity types; (b) there is a tendency for China's exports to crowed out the exports of its Asian neighbors in the consumers good market, but, (c) there is a strong tendency for China to suck up imports from its Asian neighbors, offsetting the third-market effect in the capital goods market. Hence, more and less developed Asian countries are being affected very differently by China's rise (Eichengreen *et al*, 2004).

Greenway *et al* (2006) use gravity mode to explore whether and how the growth of China's export is displacing exports of other Asian countries to third markets over the period 1990-2003.

They used bilateral imports and exports from the IMF Direction of Trade Statistics (DOTS), deflated by US CPI for all urban consumers (1982-1984 =100), real GDP and GDP per capita (in constant 2000 US dollars) extracted from World Development Indicators, country specific variables from Rose (2002), corruption indices from the International Country Risk Guide (ICRG) which range between 0 (for high corruption) and 6 (for low corruption). The panel data consists for 170 importing countries and 13 Asian exporting countries. They used panel estimation as it has the advantage of capturing relationships whilst disentangling the invariant country specific effects (Greenway *et al*, 2006).

Greenway *et al* (2006) assert as "we use imports of country i from country j as a dependent variable rather than average bilateral trade (imports and exports), which has been in some studies e.g. Rose (2002), Engelbrecht and Pearce (2004) and Tomz *et al* (2005)". The authors adopted formulation suggested by Subramanian and Wei (2003). Subramanian and Wei (2003, 2007) suggest that specification with imports are more closely grounded in theory as most theoretical underpinnings generate predictions for unilateral trade. They further argue that the inclusion of importer's and exporter's log GDP as separate explanatory variables allows one to distinguish between importer and exporter characteristics. They claim that, to ensure the "displacement effect" (emphasis original) of China, they included China's exports to the same destination market of the Asian countries' exports as an additional variable (Greenway *et al,* 2006:12).

Summary of their major findings shows that (i) the gravity model estimates show clear evidence of displacement effect over the period 1990-2003, this effect being intensified in the later half of the period and in particular, in developed country market (ii) they acknowledge as "our findings, however, do not occur with the common perception of greater competitive treat for low and middle income Asian countries given their similar relative factor endowments", (iii) by contrast, they found a strong evidence for high-income exporters losing ground in third market (Greenway *et al,* 2006:20).

Bussière and Schnatz (2006) also used gravity model based benchmarking to evaluate China's integration in world trade. Their study analyses the rapid trade integration that took place in the past decade between China and the rest of the world. They argue that they used gravity model, which captures well the evolution of trade flows over time and across countries to develop and quantify a new benchmark of trade intensity. They further note that, the approach which they followed helps to identify whether for instance, small open economies, which are commonly found to have a high trade to GDP ratio, are indeed well integrated in to the world economy (Bussière and Schnatz, 2006:26). Their finding shows that the comparison of actual and predicted trade flows shows that for most country-pairs, the model successfully captures the evolution of bilateral trade over time (Bussière and Schnatz, 2006:26).

2.1.3 EVALUATION OF THE LITERATURE ON GRAVITY MODEL

First, all studies which establish theoretical foundation for gravity equation follow the analogy of Newton's universal law of gravity which states that the force of attraction between two bodies (say the earth and the sun) is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. In Newtonian (classical) physics, this force of attraction is directed towards the centre of the mass of the respective bodies, i.e., the forces act in opposite direction. Therefore, the bodies are always in equilibrium (the earth with less mass relative to the sun rotating around the sun with larger mass relative to the earth) at a given distance.

However, Anderson (1979); Oguledo and MacPhee (1994); Deardorff (1995); Baldwin and Taglioni (2006) establish theoretical foundation for gravity equation by cases with balanced trade conceptually similar to the equation in classical physics of the earth and the sun and then, they derived gravity equation from expenditure function.

In the Newtonian framework, the equilibrium is established because of the gravitational force. But balanced trade (equilibrium) comes first in establishing the theoretical foundation of gravity model. However, in the real world context, trade is not balanced. In formulating gravity model, probably the best way could be to model it for disequilibrium and then explain adjustment mechanism towards equilibrium so that the analogy becomes more compatible to the Newtonian physics. However, owing to the scope of this study, we will not deal with this here.

Second, most of the theoretical underpinnings of gravity models of bilateral trade are subjected to estimation biases, the "medals". This is because in Newton's law of gravity, the two forces are not averaged; rather, their interaction in opposite direction establishes equilibrium. But in gravity model of bilateral trade, imports and exports are averaged without theoretical justification, hence the "silver medal mistake" (see Appendix 2).

Subramanian and Wei (2007) suggest that specification with imports is more closely aligned to theory as most theoretical underpinnings generate predictions for unilateral trade. I agree with this suggestion in specifying my model. Concerning the "gold medal mistake", the problem of omitted variable bias is a general problem in econometrics and not exceptional to gravity model. Thus, it will be treated econometrically. The bronze medal mistake, which is associated to deflation by US price index, will be offset by inclusion of time dummies, see for instance Rose (2000).

Third, on the empirical front, most of the researchers follow Anderson (1979), which is a cross-sectional version. However, the traditional cross-section approach is affected by a severe problem of misspecification. Màtyàs (1997) notes that the most natural representation of bilateral trade flows is three-way specification, with exporter (local) country effect, importer (target) country effect, and time (business cycle) effect. Then, eliminating one of the three dimensions (time) implies that the natural representation of time-averaged gravity model is a two-way panel with (fixed or random) exporter and importer effects. Since these are the most important dimensions of variations, OLS are very likely to result in inconsistent estimate (Egger, 2002).

Finally, on the estimation issues, most of the empirical researches (see for example, Eichengreen *et al*, 2004; Greenway *et al,* 2006; Bussière and Schnatz, 2006) which examine the impact of the Asian drivers on the exports of Asian counties using gravity model, assume positive value of trade flow between pairs of countries. However, in practice missing values of trade flows between pairs of countries is a common phenomenon. Ignoring or dropping missing values will mean loss of information on the causes missing trade flows. Under this situation, the gravity model will underestimate potential imports and exports between trading partners.

Therefore, the model which I am going to estimate will be specified so that the shortcomings of the earlier researches will be minimized. Regarding the missing values, I will employ the recent multiple imputation technique for missing data proposed by King *et al* (2001). This algorithm is theoretically well sound and superior to other approaches King *et al* (2001).

2.1.4 MODEL SPECIFICATION

We have reviewed theoretical and empirical researches on the application of the gravity equation. Methodologically, the use of gravity equation in evaluating the impact of the Asian drivers on the exports of other countries is found to be appropriate. Following our evaluation of existing researches and recent developments in econometric estimation techniques, the gravity model to be estimated will be based on the following.

Following Baldwin and Taglioni (2006), Greenway *et al* (2006), Subramanian and Wie (2007), we use imports of country i (third market in this study) as the dependent variable rather than average bilateral trade, which has been used in some studies (see for example Rose, 2002). This avoids “the silver medal mistake”.

(i) We adopt a version of gravity model suggested by Màtyàs (1987, 1998), Egger (2002), Egger and Pfaffermayr (2003), the more general and proper panel econometric specification of the gravity equation will be a two-way error component model with exporter and business cycle interaction effects.

(ii) To ensure the displacement effect of China and India, we include China and/or India’s exports to the same destination market of the African countries' exports as an additional explanatory variable.

Therefore, the gravity model with three fundamental determinants of bilateral trade volume: (a) export supply, captured by income and income per capita of the exporting country; (b) import demand captured by income and income per capita of the importing country; and (c) resistance or attraction captured by geographical distance and well known gravity dummies. The fundamental determinants of bilateral trade in gravity equation, augmented with the local (exporter) country effect, and the time (business cycle effect). More precisely, the benchmark specification is of the following form:

$$\begin{aligned} lnM_{ijt} = {} & \beta_o + \beta_1 lnChEXP_{it} + \beta_2 lnINDEXPit + \beta_3 lnGDPM_{it} + \beta_4 lnCAPM_{it} \\ & + \beta_5 lnGDPX_{jt} + \beta_6 lnCAPX_{jt} + \beta_7 lnDIST_{ijt} + \beta_8 lnAreap_{ijt} + \beta_9 Border_{ijt} \\ & + \beta_{10} Comlang_{ijt} + \beta_{11} Comclo_{ijt} + \beta_{12} Colony_{ijt} + \beta_{13} ImpCorrup_{it} \\ & + \alpha_i + \lambda_t + \varepsilon_{ijt} \end{aligned} \tag{2.4}$$

Where,

M_{ijt} = Imports of country i from the African country j at time t

$ChEXP_{it}$ = Exports of China to third market i at time t

$INDEX_{it}$ = Exports of India to third market i at time t

$GDPM_{it}$ = Real GDP of the importing country i at time t

$CAPM_{it}$ = Real per capita GDP of the importing country i at time t

$GDPX_{jt}$ = Real GDP of the exporting country j at time t

$CAPX_{jt}$ = Real per capita GDP of exporting country j at time t

$DIST_{ijt}$ = Distance between i and j at time t

$Areap_{ijt}$ = Product of country areas of country pairs i and j a time t

$Border_{ijt}$ = Binary dummy which is unity if i and j share a land border, zero otherwise at time t

$Comlang_{itj}$ = Binary dummy which is unity if i and j share common language zero otherwise at time t

$Comclo_{ijt}$ = Binary dummy which is unity if i and j were ever colonies of post 1945 with same colonizer, zero otherwise at time t

$Colony_{ijt}$ = Binary dummy which is unity if i ever colonized j or vice-versa, zero otherwise

$ImpCorrup_{it}$ = Importer's corruption index at time t

α_i = the exporter country effect

λ_t = the time (business cycle effect)

ε_{ijt} = white noise disturbance term

The value added of this study is the use of the model specified in equation (2.4) which is theoretically sound specification of the gravity model in evaluating the impact of the Asian drivers on the African manufacturing sector.

2.2 THE FLYING GEESE MODEL

2.2.1 THEORETICAL EXCURSION: THE FG THEORY

The phrase "flying-geese pattern of development" was coined originally by Kaname Akamatsu in the 1930's (Akamatsu, 1935, 1937, ci: Kojima 2000) in Japanese. It is presented to world academia after the war in 1961 and 1962 in articles written in English (see for example, Kojima 2000; Ozawa 2001, Cutler *et al* 2003 and literatures cited therein).

Akamatsu's FG theorem has been theoretically expanded and empirically tested by his followers, as detailed in Kojima (2000). Kojima (2000) offers a comprehensive review of the FG model, which recently has been employed to explain the rapid economic growth in East Asia.

Rana (1990) noted that the FG theory or 'multiple catch-up processes' explains recent increase in economic interdependence among the Asian and Pacific (AP) countries as well as their emergence as important actors in the international economy. Rana (1990) pointed further that "according to this process, late comers successfully adopt a strategy of entering into sectors in which they have a rising comparative advantage and import technology from a more mature economy whose advantage in that industry is declining". The later in turn invest in newer industrial projects using more advanced technology and know-how in which they have an innovative edge (Rana, 1990:244).

As Rana (1990) puts it, both the factor endowment and the newer theories of international trade including the product life-cycle theory support this pattern of development. According to the former theory, shifts take place as endowments change and impact on relative price, while in the later theories production facilities for standardized products shift to late comers at the last stage of the product cycle. Such relocation occurs to take advantage of lower wages since production of standardized goods requires less skilled labour. Shifts in comparative advantage are, however, not smooth and could involve considerable frictions in adjustment. Prospects for the world trading environment, trends in intra-industry trade, and domestic policy measures could also influence the timing of the shifts (Rana, 1990:244).

According to Kojima (2000), the FG pattern of development is a theory to explain a sequential development of manufacturing industries in developing economies. Kojima (2000) pointed out that The FG model intends to explain the catching-up process of industrialization in late comer economies of which: (i) a basic pattern, i.e., a simple industry grows tracing out the three successive curves of import, production, and export; and (ii) a variant pattern in which industries are diversified and upgraded from consumer goods to capital goods and/or from single to more sophisticated products (Kojima 200:376). Akamatsu discovered these two patterns, which looked like a flying geese formation, through statistical analysis of industrial development in the prewar Japanese economy. Kojima introduced a theoretical model in which the accumulation of physical and human capitals cause the economy to diversify first to a more capital-intensive key industries and then to rationalize them so as to adopt more efficient production methods. Such diversification/rationalization paths are repeated in moving the economy towards the higher stages of production and export.

Kojima (2000) notes that the regional transmission of FG industrialization has been facilitated by the "pro-trade-oriented FDI" mechanism through which an investing country's comparatively disadvantageous production is transmitted onto a host country in such a way as to strengthen the latter's comparative advantage. This type of comparative advantage augmentation via FDI brings about an expansion of production and trade and results in "FDI-led growth" in the regional economies involved (Kojima, 2000:376).

The wild-geese-flying pattern of industrial development denotes the development after the less-advanced country's economy enters into international economic relationships with the advanced countries" (Akamatsu, 1962:11, ci: Kojima, 2000). This means that the FG model aims at addressing the catching–up process of industrialization in developing open economies.

Kojima (2000) directly cited Akamatsu (1961:208) as "Although reference is made here simply to consumer goods and capital goods, there are many kinds and qualities of consumer goods and capital goods. Accordingly, the sequential phenomenon of import-domestic production-export (M-P-E) occurs not only in connection with capital goods following consumer goods, but also in the progression from crude and simple goods to complex and refined goods"

Kojima (2000) further quotes Akamatsu (1962:17) "the less-advanced 'wild-geese' are chasing those ahead of them, some gradually and others rapidly, following the course of industrial development in a wild-geese-flying pattern. The advanced "wild geese," which are in the lead flying onward, increasingly achieving technological innovations and trying to maintain a certain distance of heterogeneous (or dissimilar) difference from less-advanced 'wild geese'.

Ozawa (2001) pointed out the following three points about FG: (i) that the FG model of catch-up growth, though instrumental in depicting the essential features of latecomers' (notably Japan's) industrial upgrading and Asia's export-led growth, has so far neglected its financial and/or institutional dimensions; (ii) that the success of Japan's FG growth derives critically from a special set of institutional arrangement that was created in the early post war period; and (iii) that Japan's present financial mess is paradoxically the very vicissitudinary outcome of such an FG-specific regime.

Ozawa (2001) noted Akamatsu as among the very first to recognize the economic significance of FG paradigm. Ozawa (2001) quotes Akamatsu (1962:1) as writing "the alignment from advanced nations to backward nations according to their stages of growth" (Ozawa, 2001:472). It is impossible to study the economic growth of developing countries in modern times without considering the *mutual interactions* (emphasis original) between these economies and those of the advanced countries". Ozawa (2001) pointed out that Akamatsu did not leave any formalized theoretical model to explain his ideas. According to Ozawa (2001), the FG analogy came from Akamatsu's empirical findings of the "import →domestic production→export (M-P-E)" pattern of sequential growth in some pre-war Japanese industries such as textile, which Akamatsu identified as the basic FG pattern. Furthermore, Ozawa (2001) noted that in essence, what Akamatsu had in mind was an evolutionary model of sequential catch-up through teacher-learner relations among nations in the stages of industrial upgrading. It was a model of derived economic development via-cumulative learning in a late comer nation (Ozawa, 2001:472).

Cutler *et al* (2003:36) note that the flying-geese (FG) theory of sequential economic development in a group of interactive economies led by a lead-goose nation has been referred to in both academic and the news media.

Dowling and Cheang (2000) argue that the flying-geese theory of general principle of development is similar to that of the "product cycle" theory, developed by Vernon (1966). They further pointed out that key difference between the two theories is the perspective taken. "Product cycle" theory takes the perspective of the developed countries. It describes how a new product is invented and developed from its infant stage to exporting stage and finally to declining stage (Dowling and Cheang, 2000:446). On the other hand, the "flying geese" model takes the perspective of developing country. It describes how a new product is introduced to the less developed countries via imports (this stage should correspond to the exporting stage of the "product cycle" theory), and how the less developed countries acquire the necessary production techniques and become exporters (this stage should correspond to the declining stage of the "product cycle" theory).

One of the issues to be addressed in this study is, therefore, the implication of the FG theory for Africa. More specifically, the FG theory will be employed as framework to assess if there can be a Pax China and India-led macro-clustering in FG-style catch-up in Africa as Pax Americana-led macro-clustering has resulted in FG-style catch-up in East Asia.

2.2.2 COMPARATIVE ADVANTAGE, THE RCA INDEX AND SPEARMAN'S RANK CORRELATION

Comparative advantage is a concept defined in term of relative autarkic prices. As pre-trade data are not observable in the real world, the test of comparative advantage thus will have to be conducted indirectly by using proxies such as the revealed comparative advantage indices (Dowling and Cheang, 2000:450).

As Mahmood (2001), puts it, comparative advantage in a particular commodity by a country is in the true sense difficult if not impossible to measure due to factor as well as product market distortions. Balassa (1965) as cited by Mahmood (2001) approximated the comparative advantage concept in an indirect way by using post-trade data that manifests both post-trade relative prices and prevailing factor as well as product market distortions (Mahmood, 2001).

According to Balassa (1965, ci: Mahmood, 2001) and Balassa (1979), comparative advantage is revealed in relatively high shares of export markets (Mahmood, 2001). However, to evaluate what is low, Balassa (1965, ci: Mahmood, 2001) and Balassa (1979) called for these shares to be compared to some average. In other words the data has to be normalized for comparison purposes. Defined as such, the RCA index compares a country's world export share of total world exports (Mahmood, 2001). If a country's share of world export of a particular commodity is greater than the country's share of world exports of all commodities, the RCAI will be greater than one (see for example, Lutz 1987; Rana 1990; Dowling and Cheang 2000;

Mahmood 2001). The RCAI of country i in industry a, developed by Balassa (1965, ci: Rana 1990; Mahmood 2001) and literatures cited therein as:

$$RCAI_a^i = \frac{X_a^i / X_a^w}{X_t^i / X_t^w} \qquad (2.5)$$

Where,

$RCAI_a^i$	=	Revealed comparative advantage index of country i in commodity a
X_a^i	=	value of exports of commodity a by country i
X_t^i	=	value of total exports by country i
X_a^w	=	value of world exports of commodity a
X_t^w	=	value of total world exports

According to equation (2.5), country i exhibits revealed comparative advantage or has greater specialization in the export of commodity a, than the world as a whole if $RCAI_a^i > 1$. In other words, a country has revealed comparative advantage only in those products for which its market share of world exports is above its average share of world exports (Mahmood, 2001).

In the present climate of trade liberalization, and in the context of this study, an important question is what would be the extent of competition or complementarity in world export market between Africa on the hand and China and India on the other? The degree and nature of export specialization association between Africa and the Asian drivers is thus evaluated by estimating the Spearman's Rank Correlation (SRC) coefficients of RCAI between the Asian drivers and Africa in the world market of manufacturing products. The SRC coefficient is widely used to analyze the degree of association between two variables. The SRC is given by (see for example, Dowling and Cheang 2000; Mahmood 2001):

$$SRC = 1 - \frac{6}{N(N^2 - 1)} \sum_{i=1}^{N} D_{RCAIi} \qquad (2.6)$$

Where,

SRC = the Spearman's Rank Correlation Coefficient

N = the number of observations or product group categories

D_{RCAIi} = the difference between any pair of RCAI ranking of two countries

In the present context, the SRC compares the ranking of two sets of RCAI by taking the differences of ranks, squaring these differences and then adding, and finally manipulating the measure so that its value will be +1 whenever there is a perfect positive association between two series of RCAI (see for example, Lutz 1987; Rana 1990; Dowling and Cheang 2000; Mahmood 2000).

2.2.3 EMPIRICAL TESTS AND EVIDENCES OF THE FG THEORY

The well known formal tests of the flying-geese theory are due to Lutz (1987); Rana (1990); Dowling and Cheang (2000); Cutler *et al* (2003).

Lutz (1987) analysed whether there actually were shits in comparative advantage from the NICs to other developing states for selected manufactures between 1968 and 1982. The manufacturers included in the analysis were selected from the three-digit SITC system used by the United Nations (1974; 1978; 1980; 1983) and SITC 65 (textiles).

Lutz (1987) concluded that, overall, the analysis provided very little evidence that there actually had been shifts in comparative advantage from the NICs to the other developing countries. The findings of Lutz (1987) was that in exports for selected three-digit product categories for manufacturers of sixteen countries from 1968 to 1976 and from 1976 to 1982, however, indicated that such shifts have not occurred. However, there was evidence that such shift were occurring between developed states and the NICs. One possible exception of this pattern might have been Mexico (Lutz, 1987:351).

Rana (1990) questions whether the evolving trade patterns of the Asian and Pacific (AP) countries during the 1965-1984 support the shifting comparative advantage hypothesis. Rana (1990) analyzes the changes in the pattern of comparative advantage for the entire group of 14 AP countries by estimating the spearman's rank correlation coefficient between the RCA vectors for various time periods. The finding is that, the World Export Share (WES) measure, the Spearman's rank correlation is lower (0.295) in the case of Singapore and higher (0.779) in the case of Western Samoa. This suggests that in the period 1965-1984, the pattern of comparative advantage changed most significantly in the case of Singapore and the least in the case of Western Samoa. The Export Import Ratio (EIR) measure also indicates a similar ranking (Rana, 1990:247).

Rana (1990) summarizes his four major findings as follows:

1. The pattern of revealed comparative advantage of the NIEs (except Hong Kong) and the ASEAN-4 countries (except Indonesia) changed significantly during the period 1965-1984. Because these countries gained comparative advantage in exporting several labour intensive and moderately capital- and skill-intensive items. Such changes, however, did not generally occur in the case of South Asian and South Pacific countries.
2. In the case of the NIEs and many of the ASEAN-4 countries, the changes in comparative advantages were "beneficial" in the sense that the gains occurred in commodities for which world demand was growing relatively fast. In the cases of most of the South Asian and South Pacific countries, however, the changes were not "beneficial."
3. Contrary to the findings of Lutz (1987), relatively strong evidence consistent with the FG pattern of development could be obtained during the post-1973 period among the countries comprising the East Asian Industrial Belt (that is, comparative advantage in certain types of manufactured goods had shifted from Japan to the NIEs and from both Japan and NIEs to the ASEAN-4 countries).
4. In addition, by using the composition of manufactured exports of the NIEs as a benchmark, several findings relating to the industrialization levels of other AP developing countries were obtained.

Dowling and Cheang (2000) examined whether the evolving trade and FDI patterns of the Asian economies support the FG pattern of development. The authors utilized the export data prepared by the Centre for Strategic

Economic Studies, Technology University of Victoria, Australia. The study period covers 1970-1995. Dowling and Cheang (2000) identified shifts in comparative advantage in different technological groups instead of in individual industries. This will be more convincing test of the RCA according to Dowling and Cheang (2000). By analysing spearman's rank correlation between RCA vectors, the authors concluded that

1. The pattern of RCA for the NIEs and ASEAN-4 suggested that theses economies have undergone substantial structural change during the period 1970 to 1995.
2. There was support for the FG paradigm for the period 1970 to 1995. Economic development did in deed trickle down from Japan to the NIEs and ASEAN-4. Comparative advantages also shifted from the NIEs to ASEAN-4 in 1985 to 1995.

2.2.4 EVALUATION OF THE LITERATURE ON FG THEORY AND ITS IMPLICATION FOR AFRICA

Researches on the FG model of industrial development do not provide or at least remain silent on different issues listed below. One could raise following issues on the theory.

(i) The impact of imported goods on local manufacturers:

The model does not provide any explanation on the effect of imported goods on local manufacturers. Suppose local consumers turn to imported goods due to preference changes. This may end up with a displacement of local firms from the market. If imported goods monopolize the local market, then it is not clear how the local firms can move to the next technology ladder.

(i) Expansion of production chain is common rather than relocation:

In the real world, firms in the developed nations expand their production to exploit economies of scale and scope rather than relocating the production and marketing activities. Commodities are created through integration of production processes performed in a multiplicity of national territories. Whether any given territory is included in global production networks or excluded from them depends up on the decision of private actors. States can try to make their territories attractive, but they cannot dictate the structure of goods production network (Kasahara, 2004).

(iii) Linear hierarchy and Stability of the model:

In market based competition, the stability of the regional hierarchy may have much to do with competition among firms. Between domestic producers and foreign investors, the relations are often in the forms of "negotiated confrontations" (Kregel, 1997) rather than "circulating or recycling comparative advantages" (Ozawa, 1995) both cited in (Kasahara, 2004). Therefore, regional hierarchies may not be linear in trend as predicted by the FG paradigm.

The literature on the FG theory is related to this study in three ways. The theory will serve as a framework of analysis to address the questions: (i) whether there is evidence of industrial development through shifting comparative advantage in African clothing and accessories manufacturing; and (ii) whether there is a shift in comparative advantage from China and

India to Africa in clothing and accessories manufacturing; and (iii) whether this is beneficial to Africa.

We will estimate the SRC between RCAI vectors of the 13 African countries in the sample and the Asian drivers for the period 1995-2004 for the commodity under discussion. Then, the sign and magnitude of the SRC will give us an implication for shifting comparative advantage between the African exporters of clothing and accessories. Considering China and India as references in exporting clothing and accessories, the SRC on RCAI vectors of the 13 African countries will be compared with those of China and India. The sign and magnitude of the SRC will answer the question of whether comparative advantage has been shifting from the Asian drivers to Africa (see detail in section 3.2 of chapter 3).

CHAPTER 3: MODEL SPECIFICATION ISSUES AND ESTIMATION RESULTS

In this chapter, specification, estimation issues and analysis of the models presented in the previous chapter will be discussed. More specifically, the benchmark model specified in equation (2.4) and the spearman's rank correlation coefficient in equation (2.5) will be estimated. Section 3.1 will deal with the estimation of the gravity model while section 3.2 contains results of SRC for testing the FG theory.

3.1 ESTIMATING THE GRAVITY MODEL

3.1.1 THE MODEL

We estimate the following benchmark model:

$$\begin{aligned} lnM_{ijt} = {} & \beta_o + \beta_1 lnChEXP_{it} + \beta_2 lnINDEXPit + \beta_3 lnGDPM_{it} + \beta_4 lnCAPM_{it} \\ & + \beta_5 lnGDPX_{jt} + \beta_6 lnCAPX_{jt} + \beta_7 lnDIST_{ijt} + \beta_8 lnAreap_{ijt} + \beta_9 Border_{ijt} \\ & + \beta_{10} Comlang_{ijt} + \beta_{11} Comclo_{ijt} + \beta_{12} Colony_{ijt} + \beta_{13} ImpCorrup_{it} \\ & + \alpha_i + \lambda_t + \varepsilon_{ijt} \end{aligned} \quad (3.1)$$

Variables are as defined in chapter 2.

3.1.2 DATA

3.1.2.1 AFRICAN EXPORTERS AND THE THIRD MARKET

African exporting countries in this study are determined based on the principle that, the smaller the population, the bigger the sampling ratio has to be for an accurate sample (i.e., one with a high probability of yielding the same results as the entire population) is applied. The commonly accepted approach is that for a small population (under 1000), a researcher needs a large sampling ratio (about 30%). Alemayehu (2002:332-333) on the basis of the ECA definition has classified the African countries in to three regions as East and Southern Africa (ESA), North Africa (NA) and West Africa (WA) and Central Africa (CA). Taking the sample from each group is justified since this will avoid the problem of non-representativeness. Nevertheless, if I proceed with a simple random sampling, I may end up with all samples from a particular region say East and Southern Africa. However, the historical, cultural and economic set up of Eastern and Southern Africa is not similar to the remaining regions. On the basis of the above-mentioned classification, 13 countries are selected from 52 African countries (see also section 1.5.2 in chapter 1). Before taking the sample, countries for which data was not available in SITC Rev.3 in the study period are excluded. From each classification, sample size is determined proportionally. Finally, total of 13 countries are selected from each group using probability sampling. The 13 countries in this study count 25% of the African countries (in terms number). In terms of their trade in the SITC Rev.3, according to the data from UN Comtrade, they constitute 73% of the African export of clothing and accessories classified under SITC Rev.3 during the study period. Therefore, the selected countries can be considered to represent Africa well for this study. The United Nations Commodity Trade Statistics provides the major importers of clothing and accessories from each of the selected African exporters. Therefore, the major importers of clothing and accessories are taken as third market. One would expect 13 countries to be in the third market. However, France and USA happened to be major common importers of Clothing and accessories from seven and two African countries in the sample respectively. Therefore including France and USA, there are 6 countries in the third market (see Appendix 3 for detail).

3.1.2.2 SELECTION OF THE COMMODITY TO BE STUDIED

A Labor-intensive commodity is selected for this study. The reason for such commodity is the fact that Africa is labor-abundant and is facing competition from China and India in labor-intensive manufactures on the third market. Owns and Woods (1997) and Cutler *et al* (2003) include clothing and accessories in labor-intensive classification. In relation to our gravity model, the selection of clothing and accessories as specific commodity is true because the data used in most empirical estimation are in aggregate form while specification in $(A1.6')$ requires disaggregated data, (see for example Oguledo and MacPhee, 1994:113). The United Nations Commodity Trade Statistics Database classifies this under different ranges such as SITC Rev.1, SITC Rev.2, SITC Rev.3 and more recently HS1996 and HS2002.

In general, the rule in using a given classification is to use older classifications such as SITC Rev.1 and SITC Rev.2 to obtain long time series and use recent classifications like HS2002 and HS1996 for more detailed information.

The drawback of use of SITC Rev.1 is that a lot of modern technology was not available at the time of the introduction of this classification (around 1960). The newer classifications (like HS2002) will have more clearly defined commodities , but have been in use only recently, which means that only a few years of data can be found for that classification.

However, SITC Rev.3 is taken for our purpose. The reason for using SITC Rev.3 is that it was put in to use since 1990. Since then many countries started to report using this classification. This allows the use of time series data and technological embodiment for the commodity in question.

3.1.2.3 DATA SOURCE

The trade flow data is obtained from the United Nations Commodity Trade Statistics Database (UN comtrade) and IMF's DOTS while the income variables are from the World Development Indicators (WDI). The usual gravity variables and dummies (distance, common border, and common language) are taken from Professor Robert Feenstra's Web site and Encarta Encyclopedia 2007. The study covers the period 1995 to 2005; the rationale for selecting this period is that data on the selected commodity classification is reasonably available for countries in the sample and study period.

Real GDP and GDP per capita are in constant 2000 U.S. dollars. Imports and exports are deflated by U.S CPI (2000=100). This is because the values of trade flows from IMF's Direction of Trade Statistics and United Nations Commodity Statistics data base are given in current U.S. dollars.

3.1.2.4 DEALING WITH MISSING VALUES

A number of questions remain to be answered regarding the estimation of the gravity equation of trade flows. One of these is how to deal with missing values. The standard gravity model cannot easily deal with missing values. This has resulted in a widespread practice in the literature to drop missing values in the analysis of bilateral trade. However, missing observations contain important information for understanding the patterns of bilateral trade, and should not be discarded *a priori* (Linders and Groot, 2006).

In our data set, some dependent variable values are missing. Disregarding missing values can bias empirical results. Omitting missing values of observations implies we loose information on the causes of very low trade (Linders and Groot, 2006).

Several approaches have been suggested in the literature to address this problem. The approach I adopted here is that of King (1995), King *et al* (2000) and King *et al* (2001). King *et al* (2001) in particular note that multiple imputation is a superior approach to the problem of missing data scattered through one's explanatory and dependent variable than the methods currently used in applied analysis. King *et al* (2001) noted as "we adopt an algorithm and use it to implement a general-purpose multiple imputation model for missing data. This algorithm is considerably faster and easier to use than the leading method recommended in the statistics literature".

According to King *et al* (2001), a multiple imputation involves imputing m values for each missing item and creating m completed data sets. Across these completed data sets, the observed values are the same but missing values are filled with different imputations to reflect uncertainty levels. That is, for the missing cells, the model predicts well, variations across the imputations are small. Analysts can then conveniently apply the statistical method they would have used if there were no missing values to each of the m data sets, and m can be as small as 5 or 10 (King *et al,* 2001:53).

The procedure outlined by (King *et al,* 2001) is: first quantity of interest, Q, such as a univariate mean, regression coefficient, predicted probability or first difference in each data set, j (j=1,2,...,m). The overall point estimate $\bar{X}$ of Q is

$$\bar{X} = \frac{1}{m}\sum_{j=1}^{m} q_j \tag{3.2}$$

Following this procedure and using *Ameliaview* multiple imputation software developed by King and for j=5, values for the missing data are imputed. Then for each j imputed data set, only the one with minimum standard deviation is used for our analysis.

3.1.3 DATA EXPLORATION

Estimation of econometric model requires a prior knowledge about the statistical characteristics of the data set that is facing the model. In technical terms, it is essential to explore our data. Alemayehu *et al* (2005) note data exploration as a pre-requisite for good model formulation. Alemayehu *et al* (2005:10) reasoned out the importance of data exploration as “one has to know the pattern of the data in order to give it a mathematical form i.e., to model it”. According to these authors data exploration and inference comprises three major techniques: graphical inspection and summary statistics, data transformation, and diagnostic analysis. Following Alemayehu *et al* (2005), we proceed to explore our data using the first two techniques in the next section while the diagnostic analysis will be contained under the estimation framework.

3.1.3.1 GRAPHICAL INSPECTION, SUMMARY STATISTICS AND DISTRIBUTIONAL TESTS OF THE DATA

Graphical inspection provides us with quick information about the behavior and distribution of our variables over time. Under graphical inspection, we will employ scatter plot to investigate how the major gravity variables in equation (3.1) are distributed. Figures (1 to 5) show two dimensional scatter plots for the major variables in levels.

Looking at the two dimensional scatter plots of each variable, we note the following. Real imports by the third market are highly concentrated near zero while the peaks are highly dispersed. Furthermore, the intensity of the low concentration around zero is very high in the middle of the study period (see Fig.1). Real exports of China and India to the third market are shown in Fig.2 and Fig.3 respectively. Real exports by China are relatively more uniformly distributed and rising relatively faster than that of India which is more concentrated around zero and middle values in the study period.

Real GDPs of importers are scattered uniformly (see Fig 4) while those of exporters are highly concentrated around zero with dispersed peaks (see Fig.5). This is probably due to the fact that most of the third market countries are from DCs (relatively homogenous economies) when measured in weighted economic size while exporters are African countries at different level of economic growth (for example South Africa at high level of economic growth and Lesotho and Niger are at low level of economic growth).

The summary statistics contains important information about all variables. The Summary statistics for level variables are reported in Table1. For example, among the variables, the real imports have means and standard deviation of 23 and 125 million dollars respectively with the coefficient of variation of 5.434 showing the highest degree of variability among the variables. This is probably because the importing countries considered in the sample as the third markets include developed (France, United States, and United Kingdom) and developing countries from Africa (Nigeria, Uganda and Zimbabwe). Hence one would expect high imports for the developed countries and low imports in value terms for the developing countries which led to high degree of variability. In the level variables, the GDP per capita of importing countries has the lowest degree of variability of 1.011 with mean and standard deviation of 13515.67 and 13672.66 USD respectively.

Statistical distributions of variables are very important in testing hypotheses after running regression. The degree of Skewness and Kurtosis give very important information about distribution of sample point or residuals after running regression. In this regard, real imports have skewness and kurtosis of 7.556 and 62.689 respectively implying positively skewed and leptokurtic (lucks kurtosis) distribution. The aforementioned summary shows, in level, real imports by the third market exhibits high degree of variability and asymmetric distribution.

However, GDP per capita of the third market countries shows evidence of normality with a skewness of 0.248 (which is less than 1) and with an excess kurtosis of 1.385. All other level variables exhibit variability and distributional characteristics somewhere between those of real imports and

GDP per capita of the importing countries (see table 1 in Appendix 3 for detail).

The question of whether the samples of the variables specified in equation (3.1) are drawn from a population with normal distribution is addressed by investigating the statistical distribution of major gravity variables using box plot and the Jarque-Bera (JB) test for normality.

Fig 6 shows the box plot for the level variables. All level variables exhibit non-normal distribution. However, real GDP of the third market countries seem to have been drawn from near normal distribution.

The JB test for normality is due Jarque and Bera (1980, 1981 and 1987). In statistics, the test is a goodness-of-fit measure of departure from normality. It is based on the sample kurtosis and skewness.

Jarque and Bera (1980, 1987) used the Lagrange Multiplier procedure to derive efficient joint tests for residual normality, homoskedasticity and serial independence. The test statistic is given by Jarque and Bera (1987) as:

$$LM = N\left[\frac{b_1}{6} + \frac{(b_2-3)^2}{24}\right] \tag{3.3}$$

Where, b_1 and b_2 are measures of sample skewness and kurtosis coefficient respectively, N is sample size. Jarque and Bera (1987) showed that the LM as asymptotically distributed as x^2_2 and a test based on equation (3.3) is locally powerful.

The null is a joint hypothesis of both the skewness and excess kurtosis to be zero.

$Ho: b_1 = 0$ and $b_2 = 3$

And the alternative hypothesis is

$H_1: H_0$ is not true.

The null hypothesis is rejected if the calculated statistic is greater than the appropriate significance point of X^2_2.

The *JB* test result for the level variables is shown in table 3 of appendix 3. Based on *JB* statistic, except for the product of the areas between importers and exporters, the computed values of the LM statistics is grater than the theoretical value of 5.99 at 1%. Thus, we fail to accept the null hypothesis for normality. Therefore, the following subsection will discuss the way out of this problem.

3.1.3.2 DATA TRANSFORMATION

The standard solution to this problem is to transform the data. Transformation could be differencing the variables or logarithmic transformation. But, logarithmic transformation is the most relevant to this study because the estimable form of the gravity model is specified in logarithm of each variable.

The two-dimensional scatter plot for log-transformed variables is given from (Figures 6-11). From the scatter plots we note that the log-transformed variables exhibit near normal distribution. Also, Fig 12 shows the box plot graph for the log-transformed variables. We note that most of the variables exhibit relatively near normality.

We also note from the summary statistics (see table 2) of the log-transformed variables that most of the variables exhibit less variability and evidence for a near normal distribution. For example, the log transformed real imports show variability of 0.714 with mean and standard deviation of 7.456 and 5.330 respectively. Skewness and kurtosis appeared to be 0.7450 and 2.604 respectively. The log-transformed GDPs of importers, GDP per capita of importing countries, China's and India's export to the third market and the distances show negatively skewed but very close to normal distribution. In terms of kurtosis all the log transformed variables exhibit a positive excess kurtosis. The JB-statistic is also shown in table 4. The computed test statistics have now improved.

In sum, from our data exploration using graphical and summary statistics, box plots and JB test, all gave us consistent result that level values of the variables exhibit more variability and deviate more from the normal distribution than their level values where as their logarithmic transformed counter parts exhibit less variability and statistically closer to normal-distribution. Thus, we estimate our model using log-transformed values for the variables discussed. This will enable us to base our test and interpretation of estimated parameters on the usual econometric assumptions.

3.1.4 ESTIMATION FRAMEWORK: DIAGNOSTICS AND ESTIMATION PROCEDURE

Our objective in this section is to test the hypothesis that China and India's exports of clothing and accessories crowd out Africa's exports from the third market. To do this, first we need to carryout some diagnostic tests to examine which estimation technique fits the model and the data well.

Our data is constructed from 6 importers (third market countries), 13 exporters and 11 years. Despite numerous advantages of the use of panel data, its estimation requires statistical justification. Thus the estimation starts with several tests which allow us to decide whether fixed effect, random effect or simple OLS should be preferred.

Step1. Testing for fixed effects: Owing to country specific-effects and year-specific effects in the data, we perform fixed-effects test. Towards that end an F-test is applied on estimation results from the fixed model. This answers the question of whether to use fixed effect or pooled OLS. Following Baltagi (2001), we test for the joint significance of the country specific and business cycle (time-specific) dummy variables in equation (3.1). The null and alternative hypotheses are:

$H_o: \alpha_1 = \alpha_2 = ...\alpha_{13} = 0$ and $\lambda_{1995} = \lambda_{1996} = \lambda_{1997} = ...\lambda_{2005} = 0$

and

$H_1:$ *there are country and time specific effects*

In the F-test, the restricted residual sum of squares (RRSS) is that of pooled OLS and the unrestricted residual sum of squares (URSS) is that from the within regression. The F-statistic is given by Baltagi (2001:30) as:

$$F_1 = \frac{(RRSS - URSS)/(N+T-2)}{URSS/((N-1)(T-1)-K)} \sim F_{[(N+T-2),(N-1)(T-1)-K]} \quad (3.4)$$

The computed value, 2.56 is greater than the critical value which is 1.30 and the p-value is zero at 5%. Hence, we fail to accept the null hypothesis, meaning there are in deed country and time specific effects in our data (see the test result in table 5 of Appendix 3).

Step 2. Tests for poolability: Whenever one has a large panel data, it is always tempting to estimate without examining whether the data are poolable or not. In this regard, Màtyàs (1998) notes that it is very important to test whether the slope parameters are the same for all countries in the sample period. While this has been maintained hypothesis in all previous applications in gravity model, none of the researchers bothered to actually test it (Màtyàs, 1998). When a linear regression is used to represent an economic relationship, the question often arises as to whether the relationship remains stable within two periods of time, or whether the relationship holds for two different groups of economic units (Chow, 1960). The question of whether to pool the data or not naturally arises with panel data (Baltagi, 2001:50). This question asks if slopes are the same across groups or over time. For across groups, the null and the alternative hypothesis of the poolability test is respectively:

$H_o: \beta_{ik} = \beta_k$ for $i = 1,2,...,N$ and

$H_1: H_o$ is not true

Màtyàs (1998) gives the F-statistic as

$$F_{obs} = \frac{(e'e - \sum e_i'e_i) / (N-1)K}{\sum e_i'e_i / N[(N-1)T-K]} \sim F_{[(N-1)K,\, N[(N-1)T-K]} \qquad (3.5)$$

Where $e'e$ is the residual sum of squares from the pooled regression consisting of the six countries regarded as third market and $\sum e_i'e_i$ is the sum of the residual sums of squares from each third market. If the null hypothesis is rejected, the panel data are not poolable. The computed F-statistic is 1.14 which is less than the theoretical value of 1.30 at 5 %. So, we fail to reject the null hypothesis. Therefore, we give preference to pooled panel estimation.

Step 3. Hausman Specification Test

Since poolability test suggests that panel estimation should be preferred, the Hausman specification test is applied to discriminate between fixed and random effect estimation of the panel data.

Hausman and Taylor (1981) noted that an important benefit from pooling time-series and cross-section data is the ability to control for individual-specific effects, possibly unobservable, which may be correlated with the other included variables in the specification of an economic relation. Analysis of cross-section data alone can neither identify nor control for such individual effect (Hausman and Taylor, 1981:1377). The authors further noted that a crucial assumption of the cross-section specification is that the conditional expectation of the disturbances given knowledge of explanatory variables is zero. An extremely useful property of panel data is that by following the cross-section panel over time, we can test this assumption. Moreover, the fact that the within, between, and GLS estimators are affected by the failure of this assumption, suggests that we may base a test of it on functions of these statistics (Hausman and Taylor, 1981:1382).

The Hausman test determines whether there is a correlation between the error term and explanatory variables, that is, whether the bias created by random estimation is so large that it prohibits the use of random effects procedure. Under the null hypothesis, there is no correlation between the error term and the explanatory variables, and thus if the null is rejected, one should proceed with fixed effects estimation. The test statistic under this test is:

$$chi^2(Q) = (b - B)'[(V\_b - V\_B)^{\wedge}(-1)](b - B) \qquad (3.6)$$

Where,

b = consistent under H_o and H_1; obtained from random effect regression

B = inconsistent under H_1, efficient under; H_o obtained fixed effect regression

Hausman and Taylor (1981) showed that the test statistics is $X^2{}_k$ distributed asymptotically as $X^2{}_k$.

Under Hausman test for discriminating between fixed and random effect for equation (3.1), the null and alternative hypotheses are:

H_o: *difference in coefficients is not systematic*

H_1: *there is a systematic difference in coefficients*

The test result is shown in table 5. The computed statistic ($X^2{}_{22}$) is 0.60 with probability value of 1 at 1%. Thus, we fail to reject the null hypothesis and proceed to fit our model with random effect.

Step 4. Test for Heteroskedasticity

Breush and Pagan (1979) noted that in some applications of the general linear model, the usual assumption of homoskedastic disturbances and fixed coefficients may be questioned. The authors further argued that when these requirements are not met, the loss in efficiency in using OLS may be substantial and more importantly, the biases in the estimated standard errors may lead to invalid inferences (Breush and Pagan, 1979:1287).

Heteroskedasticity does not affect the consistency of estimators, and it is only a minor nuisance for inference (Wooldridge, 2000:125). Nevertheless, sometimes we want to test for the presence of heteroskedasticity in order to justify use of the usual OLS or 2SLS statistics.

We performed Breush and Pagan test for our model. The null and alternative hypotheses under Breush and Pagan (1979) for our equation (3.1) are:

H_o: *Homoskedasticity of disturbance terms*

and the alternative hypothesis is

H_1: H_o *is not true*

The computed statistic shown in table 5 is 1234.30 which is greater than the critical value of 50.89 at 1%. Thus we fail to accept the null hypothesis of homoskedasticity and proceed to fit our model with GLS which is efficient under heteroskedasticity.

Step 5. Hausman Test for Endogeneity

Since GDPs, imports and exports are tied through national account identity, we shall suspect the endogeneity of GDPs of exporting and importing countries in equation (3.1). Furthermore, it is possible that the variable of interest, China's and India's exports, in equation (3.1), may not be exogenous. Any unobserved factors (for example, an improvement in the consumers sentiment world wide) captured by the error term that increase imports of country i, say France from country j, say Kenya may also increase China and India's exports to France. These could result in high correlation between the error term and key explanatory variables. Endogeneity is formally tested using the endogeneity test of endogenous regressor. This is referred as Hausman test for endogeneity (see Hausman, 1978). The test statistic under Hausman (1978) is:

$$chi^2(Q) = (b-B)'[(V\_b-V\_B)\wedge(-1)](b-B) \qquad (3.7)$$

Where b = consistent under H_o and H_1 ; obtained from IV regression

B = inconsistent under H_1, efficient under H_o ; obtained from OLS regression

Under Hausman test for endogeneity in equation (3.1), the null and alternative hypotheses are:

H_o: *difference in coefficients is not systematic*

H_1: *there is a systematic difference in coefficients*

Hausman (1978) showed that the test statistic is distributed asymptotically as central X^2_k under the null hypothesis with K degree of freedom where K is the number of unknown parameters in the slope parameters when no misspecification is present (Hausman, 1978:1254). The computed statistic is 36, which is greater than the critical value of 16.81 at (1%). The test result is shown in table 5. Based on the test, we are unable to accept the null of regressor exogeneity.

The standard solution to a problem of correlation between the regressor and unobserved effects is to estimate by IV using appropriate set of instruments. A crucial prerequisite for IV estimation is that all instruments must satisfy two conditions: (i) they must be correlated with the endogenous variables (instrument relevance); and (ii) they must be uncorrelated with the error term (instrument exogeneity).

The recent attempts to account for endogeneity of income includes Cyrus (2002) who uses population to instrument income in the gravity model. Population is correlated to income but not correlated to error term. Therefore, we instrument GDPs of exporting and importing countries by their population. Furthermore, distance is highly correlated to exports but not correlated to error term. Hence, distance fully satisfies instrument relevance and instrument exogeneity. Therefore, we instrument China and India's exports respectively by the distance of China and India from the third market countries.

Step 6: Testing For Serial Correlations for AR (1)

When explanatory variables are not strictly exogenous, so that one or more explanatory variables are correlated to the error terms, neither t-terms from our equation nor the overall significance of equation (3.1) are valid. We formally tested for presence of the first order autocorrelation. The null and alternative hypotheses for testing AR (1) are:

$Ho : \theta_{o} = 0$

and the alternative hypothesis is

$H_1 : H_0$ is not true.

θ_o is the coefficient of the one period lagged error term where the error term is included as additional regressor in (equation 3.1). The test result is shown in table 5. Based on the test, we fail to accept the null hypothesis and conclude that our model is not free from AR(1).

Since GLS is robust to homoskedasticity and serial autocorrelation, we estimate our model with G2SLS.

3.1.5 ECONOMETRIC ESTIMATION RESULTS AND INTERPRETATION

The model is estimated by Generalized Two Stage (G2SLS) with the pooled data consisting of 6 importing countries regarded as the third market, 13 exporting countries, for the sample period 1995 -2005. The estimation result is shown in table 3.1. The model fits the data well with overall R^2 of 0.5002. Overall, the variables in the model are jointly significant. This is evidenced by the Wald static of 964.72 with p-value of zero at 1%.

As gravity model would expect, distance entered with negative and significant coefficient. All other things remaining the same, a 1% difference in distance will reduce third market of clothing and accessories from Africa by 1.178%. A 1% difference in importer's and exporter's combined land area would increase trade in clothing and accessories by 2.07%. Common border, common language, importer's colonization of African exporters have positive impacts on third market imports of clothing and accessories from Africa.

TABLE 3.1: G2LSLS IV REGRESSION RESULT: DEPENDENT VARIABLE LOG OF THIRD MARKET IMPORTS

Independent Variable	*coefficient*	*t-ratio (99%)*	*P-value (99%)*
Log of china's Export	***-2.254911***	***-3.69***	***0.0***
Log of India's Export	***2.076933***	***4.64***	***0.0***
Log of Importers real GDP	***0.3280297***	***0.70***	***0.487***
Log of Exporters real GDP	***-1.907183***	***-1.00***	***0.316***
Log of Exporters real GDP per capita	***-1.49785***	***-1.57***	***0.117***
Log of Importers real GDP per capita	***0.2294681***	***0.22***	***0.829***
Log of distance between importer and exporter countries	***-1.178627***	***-4.52***	***0.0***
Log of importer and exporters land area product	***2.043857***	***3.58***	***0.0***
Importer corruption index	***0.8056255***	***1.35***	***0.177***
Common border between importer and exporter countries	***1.727755***	***2.24***	***0.026***
Common language between importer and exporter countries	***1.691126***	***2.92***	***0.004***
Importer and exporters being colonized by common colonizer	***0.131363***	***0.30***	***0.763***
Importer post 1945 colonization of exporters	***1.961635***	***2.76***	***0.006***
α –Exporter specific dummy for Algeria	***-10.67817***	***-2.32***	***0.021***
α –Exporter specific dummy for Burkina Faso	***-14.87288***	***-2.79***	***0.005***

Independent Variable	*coefficient*	*t-ratio (99%)*	*P-value (99%)*
α –Exporter specific dummy for Cot d' Ivoire	***-8.70415***	***-2.59***	***0.01***
α–Exporter specific dummy for Gabon	***-8.70415***	***-3.32***	***0.001***
α–Exporter specific dummy for Ghana	***-11.74319***	***-2.63***	***0.009***
α –Exporter specific dummy for Kenya	***-7.536141***	***-2.16***	***0.031***
α –Exporter specific dummy for Lesotho	***-9.7457***	***-1.49***	***0.135***
α–Exporter specific dummy for Madagascar	***-11.02602***	***-1.49***	***0.026***
α –Exporter specific dummy for Niger	***-19.92438***	***-3.17***	***0.002***
α –Exporter specific dummy for Rwanda	***-11.77865***	***-1.98***	***0.048***
α–Exporter specific dummy for South Africa	***-2.368801***	***-0.40***	***0.692***
α–Exporter specific dummy for Tunisia	***-0.0409379***	***-0.01***	***0.99***
α–Exporter specific dummy for Zambia	***-16.88231***	***-3.43***	***0.001***
λ_{1995}***–time specific dummy for year 1995***	***-3.73643***	***-2.07***	***0.038***
λ_{1996}***–time specific dummy for year 1996***	***-3.182293***	***-3.60***	***0.000***
λ_{1997}***–time specific dummy for year 1997***	***-1.902323***	***-2.33***	***0.020***
λ_{1998}***–time specific dummy for year 1998***	***-2.617729***	***-3.04***	***0.002***
λ_{1999}***–time specific dummy for year 1999***	***-2.445917***	***-3.05***	***0.002***
λ_{2000}***–time specific dummy for year 2000***	***-0.9448664***	***-1.31***	***0.189***
λ_{2002}***–time specific dummy for year 2002***	***1.316061***	***1.88***	***0.060***

Independent Variable		coefficient	t-ratio (99%)	P-value (99%)
λ_{2003}–time specific dummy for year 2003		0.8659062	1.17	0.244
λ_{2004}–time specific dummy for year 2004		2.505528	2.71	0.007
λ_{2005}–time specific dummy for year 2005		3.042821	2.66	0.008
Constant		16.12676	0.32	0.751
R^2 **Within**	0.3711	0.3711		
Between	0.9404	0.9404		
Overall	0.5002			
Wald chi2(36)	964.72			
Number of observations	**858**			
Prob > chi2	0.0000			
Sigma _U 6.659e-09				
Sigma_ e 4.103549				
Rho 2.633e-18 (fraction of variance due to U_i)				

3.1.5.1 OVERALL IMPACTS OF CHINA AND INDIA

Over the period 1995-2005, China's export of clothing and accessories has significantly displaced African export of the clothing and accessories from the third market. All others remaining the same, a 1% increase in the export of China to the third market leads to a 2.25 % reduction of the third market imports from the African manufacturers of clothing and accessories. This is a strong evidence for Chinese manufacturing exports to displace those of Africa from third markets. Thus, China is competing with Africa in the third market.

The result is opposite for India. All others remaining the same, a 1% increase of India's exports to third market increases African exports of the same commodity by 2.07% significantly. This is again a strong evidence for Indian manufacturing exports to complement African exports of this commodity in the same destination market. Thus, India is complementing Africa in the third market.

3.1.5.2 VARIATION IN IMPACTS ACROSS AFRICA

Given evidence that China's exports of clothing and accessories drive out African exports from the third market, it will be natural to ask in which African exporters face severe competition from China. This question is adequately addressed by analyzing country specific effects.

By looking at country specific dummies, we note that Niger, Zambia and Burkina Faso are the most three vulnerable exporters of clothing and accessories followed by Ghana, Algeria, Gabon, Cot D'Ivoire and Kenya with displacement effect[10] of 19.92%, 16.88%, 14.87%, 11.74%, 10.67%, 8.704%, 8.704% and 7.54% respectively.

Looking at these exporters, we note that except Zambia, Ghana and Kenya, most of the affected countries are the former colonies of French. This may imply the effect of colonial history to still persist in the African trade pattern.

3.1.5.3 DYNAMICS OF THE IMPACTS OVER TIME

Given the evidence that China is competing and India is complementing the African manufacturing in the third market of clothing and accessories, now, it is natural to ask whether these impacts are the same in the earlier and later years of our sample period.

To this end, we investigate the business cycle dummies. The early years were characterized by higher displacement than the later years. The years 1995-1999 were characterized by substantial displacement effect. However, the displacement effect has been declining up to 1999. In fact years 2004 and 2005 did show complementary effects.

Therefore, we answer the question of whether there has been dynamics in the impacts positively, as yes, there has been dynamics in the impacts and the direction is from displacement in the early years to complementarity in the late years as evidenced by positive and significant time dummy coefficients of 2.50 and 3.04 for the years 2004 and 2005 respectively.

This is, probably, as the result of the African Growth and Opportunity Act (AGOA) legislation which became law in 2000. AGOA provides for duty-free and quota-free access to US market without limit for apparel made in eligible

[10] Note that these are interpreted as semi-elasticities with country specific dummies

SSA countries from US fabric, yarn and thread. The legislation also provides for substantial growth of duty-free and quota-free apparel imports made from fabric produced in beneficiary countries.

Having this in mind, we can see how USA's imports of clothing and accessories from African beneficiaries of AGOA have been changing. For example, from our data set from UN Comtrade, USA never imported from Lesotho before 2000. But in year 2000, USA import from Lesotho was 146 million in current USD. The USA import value increased to 482 million in year 2004. In the case of Madagascar, USA's import value of clothing and accessories was 49.06 million in 1999. This jumped to 116 million in 2000 and 294 million in 2005. Four years (1995-1998) total USA import from Madagascar was 60.32 million USD which is only 52.12% and 20.5% of its import from Madagascar in 2000 and 2005 respectively.

Another possible explanation for Asian drivers' to complement African manufactured exports in the later years of the study period is the rapid growth of the drivers. Their growth will obviously increase the propensity of imports of primary commodities and minerals from Africa. This may create a channel for African and the Asian drivers' exports to complement on the third market.

3.2 ESTIMATION RESULTS OF THE FG MODEL FOR AFRICA AND THE ASIAN DRIVERS IN THE MANUFACTURING OF CLOTHING AND ACCESSORIES

3.2.1 HISTORICAL CHANGE IN COMPARATIVE ADVANTAGE

To address the question of (i) whether there is a dynamics of comparative advantage in African manufacturing of clothing and accessories and (ii) whether there is an evidence of shifting comparative advantage from the Asian drivers to Africa, RCAI for clothing and accessories are constructed for the 13 major African manufacturing exporters which constitute 73% of African export of manufacturing under the classification of SITC Rev.3. Owing to data availability, the FG test period covers 1995-2004. For quick overview, the trend of RCAI over time is given in a two dimensional graph of individual country plotted for this period (see Figures 13-28 for detail).

Inspecting the trend of RCAI each country, we note the following two major points. First, in the period 1995-1999, RCAIs have been declining for most of the African exporters in our sample (with minor exceptions for Rwanda, Gabon and Ghana), but RCAI vectors of China and India have been moderately stable (see Figures 26 and 27). Secondly, in the period 2000-2004, for African exporters, RCAIs behaved differently. Algeria, Burkina Faso, Cot d'Ivoire, Lesotho, Madagascar, Niger, Rwanda and Zambia are exporters with declining RCAIs. For Gabon, it was initially rising and then declining after 2002 while that of Ghana was fluctuating and finally declining. For Tunisia, it has been stable. The RCI for Kenya and South

Africa revealed consistent and significant rise after 2002. However, RCAIs of china and India have been declining moderately from their value in the year 2000. However, it important to note that though the RCAI are falling, the level values of exports of China and India have been rising.

From the preceding analysis, we note that the RCAI trends are consistent with the results from econometric estimation of the gravity model. In the results from the gravity model, the earlier period was characterized by overall displacement effect which is evidenced by negative and significant coefficients of the time specific dummies for that period while the later period was characterized by overall complementarity effect as evidenced by positive and significant coefficients of the time specific dummies for the years 2004 and 2005. During those years when time specific effects in the gravity model were negative and significant, the RCAIs of China and India have been rising, while during those years when time specific effects in gravity model were positive and significant, the RCAI vectors of China and India have been declining. Thus, the results from the econometric estimation of gravity model and analysis of RCAI vectors are supporting each other.

3.2.2 INCREASING RCA AND WORLD DEMAND FOR CLOTHING AND ACCESSORIES

Given the above result, it is useful to examine whether increases in RCAI were beneficial for those countries whose comparative advantage has been increasing. The idea is that it is benefit to the African countries if the world demand for clothing and accessories was growing fast.

In order to test whether the increases were beneficial to those countries who were gaining comparative advantage, we define two vectors as (i) the RCAI's of those countries which gained comparative advantage and (ii) the growth rate of world demand for clothing and accessories. Furthermore, we proxy the world demand for clothing and accessories by the growth rate of world imports during 1995-2004. Positive correlation between the changes in the RCAI vectors during a given period and the growth rate of world demand for particular country would mean that the country had successfully gained comparative advantage in commodities in growing world demand. A negative sign would mean that the country gained comparative advantage in declining industry (Rana, 1990). The time graph of the growth rate of the world demand is shown in Fig. 28.

Since countries which gained comparative advantage were Kenya and South Africa, we focus our analysis on them. We see that the correlation coefficient between RCAI and the world demand growth rate vectors are 0.3178 and -0.0555 for Kenya and South Africa respectively. The implication is that Kenya was gaining comparative advantage in the study period when world demand for clothing and accessories was increasing relatively fast and South Africa was gaining comparative advantage in declining industry. Having this evidence, now the question is whether South Africa has moved from manufacturing of clothing and accessories to a higher ladder of industrial development as the FG theory would predict. The next subsection will address this question.

3.2.3 IS THERE A SHIFT IN COMPARATIVE ADVANTAGE FROM THE ASIAN DRIVERS TO AFRICA IN MANUFACTURING OF CLOTHING AND ACCESSORIES?

To test whether comparative advantage has moved from China and India to Africa, the Spearman's rank correlation coefficient (SRC) between RCAI vectors of each of the 13 African exporter countries on the one hand and China and India on the other are calculated for the period 1995-2004. Considering China and India as references in exporting clothing and accessories, the SRC on RCAI vectors of the 13 African countries will be compared with those of China and India. The sign and magnitude (significance level) of the SRC will answer the question of whether comparative advantage has been shifting from the Asian drivers to Africa. A negative and statistically significant coefficient suggests that the recipient country/group of countries replace the source recipient country/group of countries, thus indicating uni-directional shifts in comparative advantage. In this context, negative sign would mean Africa is increasing its industrial development. This provides support for the FG theory. Similarly, a positive and significant coefficient indicates that the comparative advantage of the pair of countries/group of countries is moving in the same direction and there are complementary export expansions between the pair rather than a FG relationship (Dowling and Cheang, 2000). The null and alternative hypotheses for this test are respectively:

Ho: The RCAI vectors for pair of countries are independent

H_1: Ho is not true

The result is shown in table 3.2.

TABLE 3.2: SPEARMAN'S RANK CORRELATION COEFFICIENT BETWEEN THE RCAI'S OF AFRICAN EXPORTERS AND THE ASIAN DRIVERS

No.	*African Exporter*	*Asian Driver*			
		china		*India*	
		Rho	*P-value*	*Rho*	*P-value*
1	*Algeria*	*0.2485*	*0.4888*	*0.2317*	*0.5195*
2	*Burkina Faso*	*0.5030*	*0.1383*	*0.4878*	*0.1526*
3	*Cot D'IVoire*	*0.5714*	*0.0844*	*-0.217*	*0.5468*
4	*Gabon*	*-0.357*	*0.3104*	*-0.061*	*0.8671*
5	*Ghana*	*0.2736*	*0.4444*	*-0.067*	*0.8535*
6	*Kenya*	*0.6485***	*0.0425*	*0.2439*	*0.4971*
7	*Lesotho*	*-0.082*	*0.8218*	*0.5027*	*0.1387*
8	*Madagascar*	*0.1879*	*0.6032*	*0.7134***	*0.0205*
9	*Niger*	*0.8545****	*0.0016*	*0.6159**	*0.0580*
10	*Rwanda*	*-0.0453*	*0.9012*	*-0.2407*	*0.5030*
11	*South Africa*	*-0.6659***	*0.0356*	*-0.1431*	*0.6933*
12	*Tunisia*	*-0.1636*	*0.6515*	*-0.1098*	*0.7628*
13	*Zambia*	*0.1394*	*0.7009*	*-0.1341*	*0.7118*

NB: ** Significant at 5%, *** Significant at 1 %

In Table 3.2, the second and the third columns show the SRCs and their P-values, respectively, between each African exporter and China while the fourth and the fifth column show the same but with that of India.

The SRCs give very important information about shifts in comparative advantage. From the table, we note that Kenya, Madagascar and Niger are the African exporters of clothing and accessories with positive and significant SRC. The SRC between Kenya and China is 0.6485 and significant at 5% while SRC between Madagascar and India is 0.7134 and significant at 5%. For between Niger and China and Niger and India, SRCs are 0.8545 and 0.6159 respectively and both significant at 5%. Thus, we fail to accept the null hypothesis and conclude that these countries' manufacturing exports did not receive comparative advantage from China and India to undergo substantial structural change in manufacturing. Niger, Madagascar and Kenya are in their order from the highest to the lowest according to the degree of their comparative advantage is moving in the same direction as China and India.

However, the SRC between South Africa and China is -0.6659 and significant at 5%. Thus we fail to reject the null hypothesis. We conclude that South Africa has received comparative advantage from China, has undergone a substantial structural change in that industry which manufactures clothing and accessories and has moved to the next stage of industrial development. This supports the FG theory. Thus, in the spirit of the FG theory, South Africa is a "leading goose" in the African region.

But what guarantee do we have to say this? In order to say this, we need to verify our findings. One way is to see how the manufacturing process in Kenya is linked to China and India and particularly how the manufacturing process in South Africa is linked to China and India on hand and to the rest of Africa on the other. In line to this, Mangieri (2006) noted, the South-South linkages in the production, trade and consumption of textiles and apparel in Kenya, particularly as Kenya links to India, China and Arabian Peninsula are both indicative of the current structure of the global textile and apparel industry and ignored by research that focuses exclusively on the economic aspects of these ties. In Kenya, a view of the current ownership and management of textile and apparel manufacturing indicates a majority of Indian investment. Given the deeply implicated histories of South Asians in Kenya, as elsewhere in East Africa, attention must be paid to their role in establishing and in deed expanding textile production under the current AGOA regime (Mangieri, 2006).

In the case of South Africa, the available evidence on the linkages is even well documented. As Rogerson (2000) puts it, the decade (1990-2000) was evident that the clothing sector in South Africa underwent a metamorphosis as protected domestic manufacturers had given way to market which was increasingly exposed to international competitions. In the view of the National Clothing Federation of South Africa, in the year 2000, the clothing sector in South Africa was undergoing dramatic change and is in the process of entering the global market (Rogerson, 2000:694).

CHAPTER 4: CONCLUSIONS AND POLICY IMPLICATIONS

4.1 MAJOR FINDINGS AND CONCLUSIONS

Understanding the impact of China and India on the present, past and future path of the global trading system in general and on that of African manufacturing exports in particular would be the major task of researchers and governments.

This study asks whether China and India are competing with or complementing Africa in the third market of manufacturing exports. The third market imports of six third market countries from thirteen African major exporters of three digits SITC Rev.3 manufactured clothing and accessories were examined for the period 1995-2005. The major innovation of this study is that, unlike other researches which rely on a single approach to evaluate the impact of China and India on different regions of the world, we employed two approaches to asses the magnitude and the direction of the impacts. First, the gravity equation which involves econometric estimation of parameters is employed to evaluate the impact of china and India on the manufacturing export on the third market and, secondly, the FG model which is based on Spearman's rank correlation coefficient (a non-parametric test for hypothesis) used to detect an evidence for shifting comparative advantage from China and India to Africa. The principal conclusions of this study are as follows.

China and India affect Africa differently. In the early years of the study period, particularly before the year 2000, the overall impact of China was crowding out African labour intensive manufacturing export. India on the other hand, has been complementing the African exports of labour intensive manufacture to the third market during the same period. However, the overall impact of China and India seems to be that of complementarity during the later years of the study period. This is subject to two different interpretations. First, it could be because during the early years, Africa has been importing consumer goods which do not have production enhancing effect in the manufacturing process from China while competing in the third market with china, but has been importing capital goods or skills which augment African manufacturing process production from India. The complementarity effect during the later years in the study period would imply Africa has been importing production augmenting capital goods or skills and technology from both China and India. Secondly, the AGOA act of May 2000 could be another possibility. This is particularly true as AGOA provides a special rule for textile and apparel which applies to duty- free and quota-free access to SSA's textile products made from USA fabrics, yarns and threads following what has been called triple transformation rule (Nouve and Staatz, 2003). Obviously, duty-free access of SSA's export to USA would mean the duty-free import by USA off-sets high initial production cost in Africa which enabled Africa to compete with China and India on USA market. This is reflected by the fact that year specific dummies are positive and significant for the later years in the econometric estimation of the gravity equation.

The impact varies from country to country. The source of these variations could be different. But one source of variation seems to be the colonial history. This is evidenced by the fact that (i) dummy for importers colonization of exporters is significant and positive and (ii) except for Tunisia, for countries which were the former colonies of French, the country specific dummies are significant and negative. This could provide an evidence for the structure of the destinations for African exports remained concentrated around limited markets and once these markets become competitive by China India's exports, it is possible for the African manufacturing exports to be crowded out from these markets.

Using the FG theory of industrial development, we found an evidence for shifting comparative advantage from China and India to Africa. However, this should be interpreted with caution. Since Spearman's rank correlation coefficient is based on revealed comparative advantage, it is possible for a country to gain (loose) comparative advantage in the process of de-industrialization (industrialization) in absolute terms. Nevertheless, empirical evidences (see for example, Rogerson, 2000) show that particularly South Africa has gained comparative advantage and has undergone substantial structural change in manufacturing. It is also possible to argue that the source of the comparative advantage could be countries or regions other than China and India. However, the findings in this study are meant to show there has been a significant shift of comparative advantage from the Asian drivers to Africa.

Another important finding of this study is related to the methodological issues. We found that, the gravity model (which involves econometric estimation of parameters) and the FG theory (which involves a non-parametric test) provided us with similar evidences. This implies that in research areas, such as the topic under discussion and where conclusive empirical evidences are non-existent while debates continued to exist, employing different methodologies may result in a reliable conclusion.

4.2 POLICY IMPLICATIONS

Given different African countries are affected by China and India differently, and due to the dynamic nature of the impacts, it will be natural to think of the optimum policy design that could enable African manufacturing exporters to maximize the benefits while minimizing the risks. Major policy stances that could emanate from this work include the following.

First and foremost, in the world where China and India are rearranging the global economic order dynamically, the outcomes of traditionally received wisdom of trade liberalization and industrialization policies in the spirit of export promotion may be dubious. This is particularly true in a situation where African exporters of labor-intensive manufacturing commodities adopt endowment based trade policies, and yet, our econometric estimation of gravity model offered evidence that China's labor-intensive manufactured exports are crowding out African similar commodities from the third market.

Secondly, for Africa to be beneficiary from a shift in comparative advantage from China and India, it useful to understand the long run trend of the growth rate of world demand for the commodity in which Africa is gaining comparative advantage. Otherwise, it is possible that Africa gains comparative advantage, but in commodities in which the growth rate of the world demand is declining implying the shift in comparative advantage is not beneficial to Africa.

This study questions the overall impact of China and India on the third market. This is only a single channel through which the impact of the Asian drivers could be transmitted to Africa. However, other channels such as FDI, governance and aid transmission channels are open to research. Furthermore, domestic market and net impacts of China and India are other areas for future research.

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APPENDICES

APPENDIX 1: FORMAL DERIVATION OF THE GRAVITY EQUATION

Oguledo and MacPhee (1994) approach

In this appendix, the gravity equation is derived from linear expenditure system

Assumptions set 1:

1. Two country world, i= exporter country, and j = importer country
2. The share of the traded good (b_i or b_j) is the same for all countries
3. There are identical Cobb-Douglas Utility functions everywhere, so income elasticities always sum to unity
4. Each country is completely specialized in the production of its own goods, so that there is one good for each country, and that transport cost and tariffs are zero.

With above assumptions, the imports of the goods from country i by country j could be written could be written as

$$M_{ij} = b_j Y_j \qquad \text{(A1.1)}$$

Where b_j = share of importables in country j's total expenditure, and Y_j = country j's total income. If it is assumed that income must equal sales, one can write the budget constraint or the trade balance equation for country i as:

$$Y_i = b_j \sum Y_j \qquad \text{(A1.2)}$$

It is assumed in equation (A1.2) that non-traded goods have zero values. From equation (A1.2),

$$b_j = \frac{Y_i}{\sum Y_j} \qquad \text{(A1.3)}$$

If equation (A1.3) is substituted in (A1.1), the result becomes

$$M_{ij} = \frac{Y_i Y_j}{\sum_j Y_j} \qquad \text{(A1.4)}$$

Equation (A1.4) gives the simplest form of gravity equation. If the error term is appended to equation (A1.4) and is assumed to be well-behaved, and if the denominator is regarded as a scale factor, the OLS technique can be used to estimate equation (A1.4).

Assumptions set 2:

1. All countries produce traded goods (TG) and non-traded goods (NTG)
2. Preference function that is weakly separable with respect to partition TG and NTG.

The utility function can be written as

$$U = u\left[g(TG), NTG\right] \qquad \text{(A1.5)}$$

Now let Θi and Θ_j be the shares of certain traded goods in each country's (i and j) total expenditure on tradables, respectively, and let Φ_i and Φ_j be the shares of all traded goods in countrys' (i and j) total expenditure. Therefore the $\Theta's$ and $\Phi's$ could be expressed as

$$\Phi_j = F_j(Y_j, N_j, P_j) \qquad \text{(A1.6)}$$

$$\Phi_i = F_i(Y_i, N_i, P_i) \qquad \text{(A1.7)}$$

$$\Theta_j = f_j(P_i, P_j) \qquad \text{(A1.8)}$$

$$\Theta_i = f_i(p_j, p_i) \qquad \text{(A1.9)}$$

Where Y_j = national income of country j

Y_i = national income of country i

N_i = population of country i

N_j = population of country j

P_j = general price level in country j

P_i = general price level in country i

If Φ_i and Φ_j are assumed to be constant over time, they will satisfy the following approximation:

$$\frac{\Phi_k}{Y_k} \approx F_k\left(\frac{N_k}{Y_k}, \frac{P_k}{Y_k}\right), \text{ for } k = i, j \qquad (A1.6')$$

Equation (A1.6') is necessary if a linear expenditure function homogeneous of degree zero in income is assumed. The emphasis in this situation will be the change in the composition of Φ_j which is caused mainly by the income effect of a change in relative prices (since the substitution effect is negligible or zero). But if the linear expenditure assumption is relaxed, it is possible to assume that $\Phi_j(\Phi_i)$ varies over time and the specification of equation (A1.6) or equation (A1.7) can be used for estimation purpose. This is true because the data used in most empirical estimation are in aggregate form, while specification (equation (A1.6')) requires disaggregated data. With equations A1.5-A1.9, country j's imports of good from country i could be written as:

$$M_{ij} = \Phi_j \Theta_j Y_j \qquad (A1.10)$$

The trade balance equation for country i (the exporting country implies)

$$Y_i \Phi_i = \Theta_j \sum_j Y_j \Phi_j \qquad (A1.11)$$

Equation (A1.11) states that planned expenditure of country i (on tradables) is equal to planed sales.

From equation (A1.11) we can solve for Θ_j as

$$\Theta_j = \frac{\Phi_i Y_i}{\sum_j Y_j \Phi_j} \tag{A1.12}$$

Substituting equation (A1.12) in to equation (A1.10) gives

$$M_{ij} = \frac{\Phi_i Y_i \Phi_j Y_j}{\sum_j Y_j \Phi_j}$$
$$= \frac{\Phi_i Y_i \Phi_j Y_j}{\sum_i \sum_j M_{ij}} \tag{A1.13}$$

If equation (A1.6) and (A1.7) are substituted in to equation (A1.13), we have

$$M_{ij} = \frac{F_i(Y_i, N_i, P_i) Y_i F_j(Y_j, N_j, P_j) Y_j}{\sum_j [F_j(Y_j, N_j, P_j) Y_j]} \tag{A1.14}$$

If equation (A1. 14) is log-linearized with the denominator taken as constant (k) common to both i and j, a gravity equation with the distance term suppressed (to one) is derived.

Equation (A1.14) could be more estimable by appending the scale factor (or constant term) and log-normal disturbance term, U_{ij} where $E(\log U_{ij}) = 0$. Therefore,

$$M_{ij} = \gamma \frac{F_i(Y_i, N_i, P_i) Y_i F_j(Y_j, N_j, P_j) Y_j}{\sum_j [F_j(Y_j, N_j, P_j) Y_j]} U_{ij} \tag{A1.15}$$

Linearization of Equation (A1.15) gives

$$F_i(Y_i, N_i, P_i) = Y_i^{a1} N_i^{a2} P_i^{a3} \tag{A1.16}$$

$$F_j(Y_j, N_j, P_j) = Y_j^{\beta 1} N_j^{\beta 2} P_j^{\beta 3} \tag{A1.17}$$

If the denominator of Equation (A1.15) is treated as a constant (k), it could be written as

$$M_{ij} = \frac{\gamma}{k} Y_i^{\alpha 1} N_i^{\alpha 2} P_i^{\alpha 1} Y_j^{\beta 1} N_j^{\beta 2} P_j^{\beta 3} U_{ij} \tag{A1.15′}$$

The inclusion of P_i and P_j in Equation (A1.15) and (A1.15′) is plausible because of the heterogeneous competition (or product differentiation) which increasingly characterises world trade flows.

Distance among trading partners can be added to Equation (A1.15′) in order to reflect the effect of transportation cost. The effect of tariff can also be incorporated.

Let us assume that the delivery of (or landed value) of country j's imports from i is given as $M_{ij}T_{ij}$ where M_{ij} is the foreign price value(of imports) and T_{ij} is the transport cost from i to j. This leads to:

$$M_{ij}T_{ij} = \Theta_j(T_{ij})\Phi_j Y_j \quad \Rightarrow \quad M_{ij} = \frac{\Theta_j(T_{ij})\Phi_j Y_j}{T_{ij}} \qquad \text{(A1.18)}$$

The trade balance equation then becomes

$$\begin{aligned} M_{ij} &= (\sum_j \frac{\Phi_j Y_j \Phi_j Y_j}{T_{ij}})\Theta_j(T_{ij}) \\ &= (\sum_j TCij\Phi jYj)\Theta_j(T_{ij}) \end{aligned} \qquad \text{(A1.19)}$$

$$TC_{ij} = \frac{1}{T_{ij}}$$

Where,

Hence, $$\Theta_j(T_{ij}) = \frac{\Phi_i Y_i}{\sum_j TC_{ij}\Phi_j Y_j} \qquad \text{(A1.20)}$$

Substitution of equation (A1.20) in to equation (A1.18) gives

$$M_{ij} = \frac{\Phi_i Y_i \Phi_j Y_j T'C_{ij}t_j}{\sum_j Y_j \Phi_j T'C_{ij}t_j} \qquad \text{(A1.21)}$$

TC_{ij} in equation(A1.21) could regarded as the total trade 'resistance variable', i.e.,

$$TC_{ij} = T\hat{}C_{ij}t_j \qquad \text{(A1.22)}$$

Where, $T\hat{}C_{ij}$ is the distance (or transport cost) from i to j, and t_j is the advalorem tariff imposed by j on imported goods form i.

If equation (A1.22) is substituted in to equation (A1.21), the result is

$$M_{ij} = \frac{\Phi_i Y_i \Phi_j Y_j T'C_{ij} t_j}{\sum_j Y_j \Phi_j T'C_{ij} t_j} \qquad \text{(A1.21}'\text{)}$$

and

$$M_{ij} = \frac{\gamma}{k} Y_i^{\alpha 1} N_i^{\alpha 2} P_i^{\alpha 1} Y_j^{\beta 1} N_j^{\beta 2} P_j^{\beta 3} T\hat{}C_{ij}^{\epsilon 1} t_j^{\epsilon 2} U_{ij} \qquad \text{(A1.23)}$$

If the denominator of equation (A1.21′) is treated as a constant (k), equation (A1.23) could be regarded as a ‘full-blown’ gravity equation (model) that includes both the trade-inducing and trade-resisting variables. The main difference between equation (A1.23) and the conventional gravity equation includes the following. First, equation (A1.23) contains price variables as factors that influence trade flows between trading countries (i and j).Second, a tariff variables(t_j) is explicitly included in the equation (A1.23)

If equation (A1.23) is written in log-linear form, it becomes

$$\begin{aligned} logM_{ij} = log\gamma' + \alpha_1 logY_i + \alpha_2 logN_i + \alpha_3 logP_i + \beta_1 logY_j \beta_2 logN_j + \beta_3 logP_j \\ + \epsilon_1 logT\hat{}C_{ij} + \epsilon_2 logt_j + \epsilon_3 logd_{ij} + logU_{ij} \end{aligned} \qquad \text{(A1.24)}$$

Where preferential dummy variable (d_{ij}) is added to capture any effects of preferential treatment which a tariff coefficient might not pick up, and $\gamma' = \frac{\gamma}{k}$

APPENDIX 2: DERIVATION OF THE GRAVITY EQUATION AND THE SILVER MEDAL MISTAKE THROUGH MINIMALIST PROCEDURE

Baldwin & Taglioni (2006) Approach

The inspiration for gravity model comes from physics where the law of gravity states that the force of gravity between two objects is proportional to the product of the masses of the two objects divided by the square of the distance between them. In symbols

$$FG = G\frac{M_1 M_2}{(dist_{12})^2} \qquad \text{(A2.1)}$$

Where,

FG = the force of gravity

M_1 = mass of the object 1

M_2 = mass of object 2

G = gravitational constant

$dist_{12}$ = distance between them

In trade we replace the force of gravity with the value of bilateral trade and the masses M_1 and M_2 with trade partner's GDP s.

1. A First-Pass Gravity Equation for Bilateral Trade

Step 1: The expenditure shared identity

The first step is the expenditure share identity for a single good exported from the 'origin' nation to the 'destination' nation:

$$p_{od}X_{od} \equiv share_{od}E_d \qquad \text{(A2.2)}$$

Where,

p_{od} = the price of the good inside the importing nation (also called the landed price)

X_{od} = the quantity of bilateral exports of a single variety from nation ‘o’ to destination nation‘d’

E_d = the destination nation’s expenditure

$share_{od}$ = the share of expenditure in nation d on a typical variety made in nation-o.

Step 2: The Expenditure function: shares depend on relative prices

Assumptions

- The expenditure share is assumed to depend only on relative price
- CES demand functions are adopted
- All goods are traded

The imported good’s expenditure share is linked to its relative price by:

$$share_{od} \equiv \left(\frac{P_{od}}{P_d}\right)^{1-\sigma}, \text{ where } P_d \equiv \left(\sum_{k=1}^{R} n_k (p_{kd})^{1-\sigma}\right)^{\frac{1}{1-\sigma}}, \sigma > 1 \qquad \text{(A2.3)}$$

Where, $\frac{P_{od}}{P_d}$ = the “real price” of P_{od}

P_d = nation-d’s ideal CES price index (assuming all goods are traded)

R = the number of nations from which nation –d buys things (this includes itself)

σ = elasticity of substation among all varieties (all varieties from each nation are assumed to be symmetric for simplicity)

n_k = the number varieties exported from nation k

Combining (A2.3) and (A2.2) yields product specific import expenditure equation. This could be estimated directly, but researchers often lack good data on the trade prices. We can get around this by putting more structure on the problem.

Step 3: adding the pass-through equation

$$P_{od} = \mu P_o \tau_{od}$$

$$V_{od} \equiv n_o S_{od} E_d$$

$$V_{od} = n_o (P_o \tau_{od})^{1-\sigma} \frac{E_d}{P_d^{\,1-\sigma}}$$

$$P_{od} = \mu P_o \tau_{od} \qquad \text{(A2.4)}$$

Where,

P_o = the product price in nation-0

τ_{od} = reflects all traded costs, natural and manmade (this assumes that the price-cost mark-up is the parameter)

μ = 1 (for simplicity as in Dixit-Stigliz monopolistic competition or perfect competition on with Armington-goods)

Step 4: Aggregating across individual goods

So far we have per-variety exports. To get total bilateral exports from ‘o’ to ‘d’

$V_{od} \equiv n_o S_{od} E_d$ and

$$V_{od} = n_o (P_o \tau_{od})^{1-\sigma} \frac{E_d}{P_d^{\,1-\sigma}} \qquad \text{(A2.5)}$$

Where,

n_o = number or symmetric varieties that nation ‘o’ has to offer

V_{od} = total volume of trade

Step 5: Using general equilibrium in the exporting nation to eliminate the nominal price

The producer price, P_o, in the exporting nation-o must adjust such that nation-o can sell all its output, either at home or abroad. Equation (A2.5) gives us nation o's sales to each market. Summing over all markets, including o's own market, we get total sales of nation-o goods. Assuming markets clear, nation o's wages and prices must adjust so the nation o's production of traded goods equals its sales of trade goods. In symbols, this requires:

$$Y_o = \sum_{d=1}^{R} V_{od}$$

Where,

Y_o = nation-o's output measured in terms of the numeraire. Relating V_{od} to underlying variables with (A2.5), the market condition for nation-o becomes:

$$Y_o = n_o P_o^{1-\sigma} \sum_{d=1}^{R} \left(\tau_{od}^{1-\sigma} \frac{E_d}{P_d^{1-\sigma}} \right) \qquad \text{(A2.6)}$$

Where the summation is over all markets (including o's own market).From equation (A2.6) we can solve for $n_o P_o^{1-\sigma}$ as

$$n_o P_o^{1-\sigma} = \frac{Y_o}{\Omega_o} \quad \text{Where} \quad \delta > 1 \qquad \text{(A2.7)}$$

Ω_o = a mnemonic for 'openness' since it measures the openness of nation-o's export to world markets.

Step 6: A first-pass gravity equation

Substituting (A2.7) in to (A2.5), we get our first-pass gravity equation:

$$V_{od} = \tau_{od}^{1-\sigma} \left(\frac{Y_o E_d}{\Omega_o P_d^{1-\sigma}} \right) \qquad \text{(A2.8)}$$

Note that all variables are measured in terms of numeraire. Expression (A2.8) is a microfounded gravity equation.

Basic Econometric Biases: The medals

A large fraction of the gravity model studies contain series errors, some of which have been repeated to often that they become accepted practice even though some of them are well recognized by researchers specializing gravity model estimation. This appendix is devoted to derive the *silver medal mistake* which is the concern in estimating the gravity model.

The Silver medal mistake

The basic theory tells us that the gravity equation is a modified expenditure function: it explains the value of spending by one nation on the goods produced by another nation. That is to say, the gravity equation explains a uni-directional bilateral trade. Most gravity models, however, are not estimated on uni-directional trade. Most researchers mistake the *log of the average for the average of the logs*.

Multiplying the left and the right hand sides of equation (A2.8) by the isomorphic expression for V_{do} and taking the geometric average, we get (dropping the time superscripts for notational convention).

$$\sqrt{V_{od}V_{do}} = \frac{\sqrt{\tau_{od}{}^{1-\sigma}\tau_{do}{}^{1-\sigma}}}{\sqrt{\Omega_o P_o{}^{1-\sigma}\Omega_d}} Y_o E_d \qquad \text{(A2.9)}$$

$$\Rightarrow \frac{lnV_{od} + lnV_{do}}{2} = \left(1 - \sigma\right) ln\tau_{od}^{avg} + lnY_oE_d + D_{ot} + D_{dt}$$

Where, the superscript '*avg*' on the bilateral trade costs indicates the geometric average of τ_{od} and τ_{do}. The key point here is that the theory tells us that the averaging should be done after taking the logs, not before. Most researchers make the mistake of taking the log of the average of a uni-directional flows rather than the average of the logs. Specifically, these authors estimate (simplifying to make the point)

$$\frac{V_{od} + V_{do}}{2} = \tau_{od}{}^{1-\sigma} \left(\frac{GDP_o}{P_o^{gdp}} X \frac{GDP_d}{P_d^{gdp}} \right)$$

This can seriously bias the results.

The sum of the logs is approximately the log of the sum, but the approximation gets worse as the two flows to be summed up diverge. Defining δ as the ratio of the bilateral trade flows,

$$V_{od} = \delta V_{do}$$

$$\Rightarrow ln\left(\frac{V_{od} + V_{do}}{2} \right) = ln\left(V_{do} \frac{1+\delta}{2} \right) = lnV_{do} + ln\left(1+\delta\right) - ln2 \qquad \text{(A2.10)}$$

The proper way of averaging yields,

$$\frac{1}{2} ln\left(V_{od} V_{do}\right) = lnV_{do} + \frac{ln\delta}{2} \qquad \text{(A2.11)}$$

The wrong way minus the right way, the difference between (A1.10) and (A2.11) gives us the bias.

$$Error = lnV_{do} + ln\left(1+\delta\right) - ln2 - lnV_{do} - \frac{ln\delta}{2} = ln\left(1+\delta\right) - \frac{ln\delta}{2} - ln2 \, , \delta > 1 \qquad \text{(A2 .12)}$$

In plain English, the error will not be too bad for nations that have bilaterally balanced trade, in which case δ is close to unity-but it can truly be unbearable for nations with unbalanced trade. In the real world, bilaterally unbalanced trade is the rule not an exception for North-South trade flows in particular. Note also that the error is always positive, in other words the silver medal mistake means that the researchers are working with overestimates of the bilateral trade. Since this error ends up with residuals, it will bias the point estimate if the error is correlated with included variables. See Baldwin and Taglioni (2006) for details.

APPENDIX 3: AFRICAN EXPORTERS OF CLOTHING AND ACCESSORIES

Countries included in the study are selected on the basis of the ECA and Alemayehu (2002:332-333) classification of African countries. This is presented as follows.

1. WESTERN AFRICA

Benin, Burkina Faso, Cape Verde, Guinea, Guinea Bessau, Liberia, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, Cot d'Ivoire, Gambia, Ghana

Samples (4): Niger, Cot d'Ivoire, Ghana, Burkina Faso

2. CENTRAL AFRICA

Burindi,Cameroon,CentralAfricanRepublic,Chad,Congo,EquatoriaGuniea,Gabon,Ruanda, Sao tome, Zaire, DR. Congo

Samples (2): Gabon, Rwanda

3. NORTH AFRICA

Algeria, Egypt, Libya, Morocco, Tunisia

Samples (2): Algeria and Tunisia

4. EAST AND SOUTHERN AFRICA

Angola, Botswana, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Malawi, Madagascar, Mauritius, Mozambique, Seychelles, South Africa, Swaziland, Somalia, Sudan Tanzania, Uganda, Zimbabwe, Eritrea, Namibia, Zambia

Samples (5): Zambia, Lesotho, South Africa, Madagascar, Kenya

The underlined countries were excluded out before the sampling process has taken place because they never reported in SITC Rev.3 the study period

5. THE THIRD MARKET COUNTRIES: IMPORTERS OF CLOTHING AND ACCESSORIES

Samples (6): France, Nigeria, Uganda, UK, USA, Zimbabwe

FIGURES

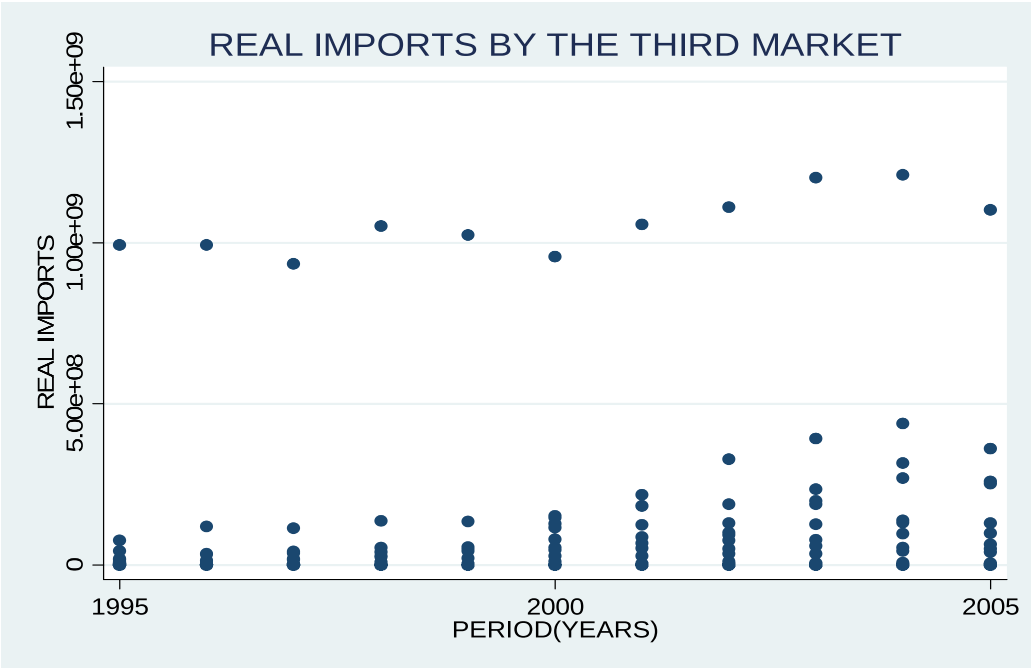

FIGURE 1: REAL IMPORTS BY THE THIRD MARKET

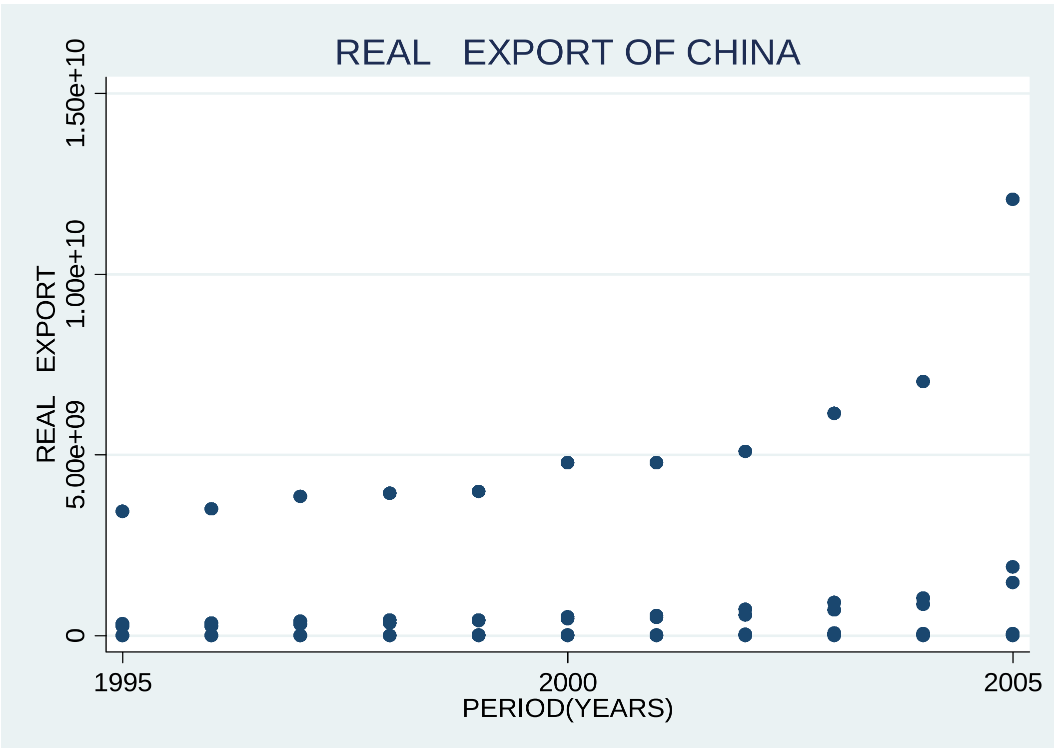

FIGURE 2: REAL EXPORTS OF CHINA

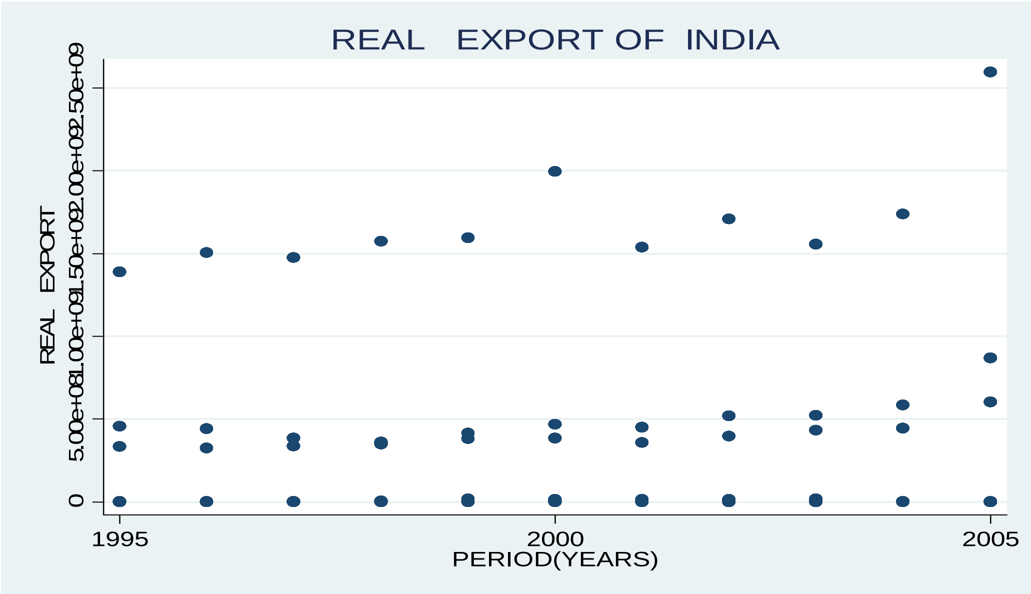

FIGURE 3: REAL EXPORT OF INDIA

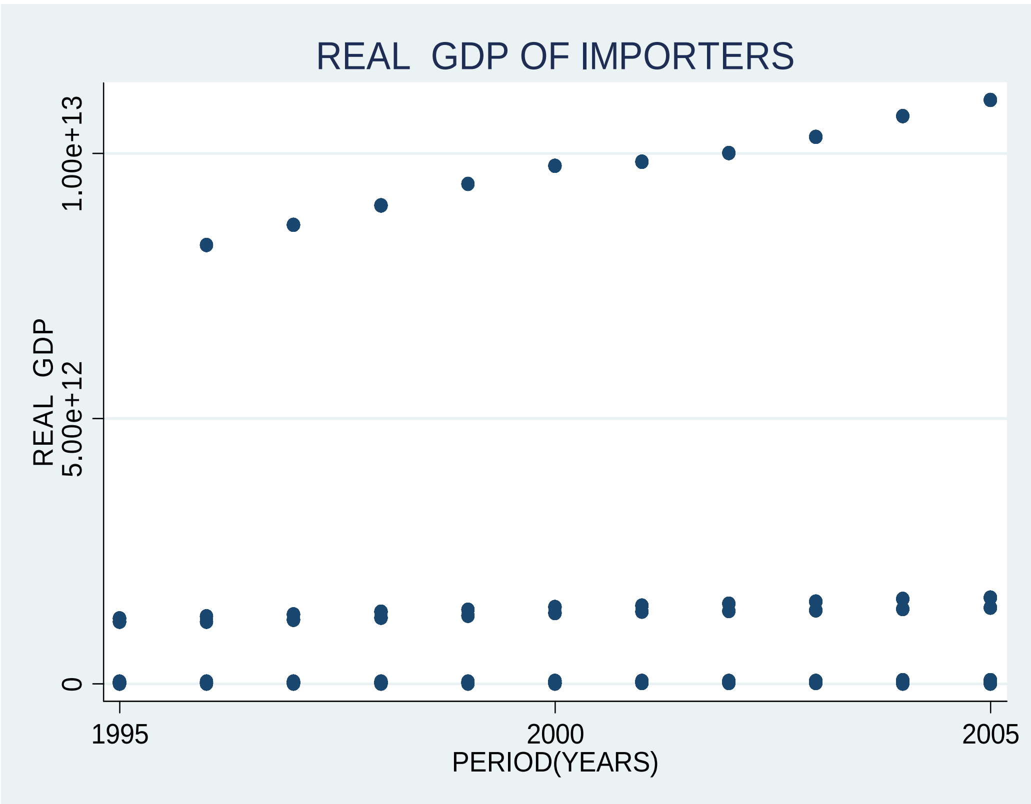

FIGURE 4: REAL GDP OF THIRD MARKET COUNTRIES

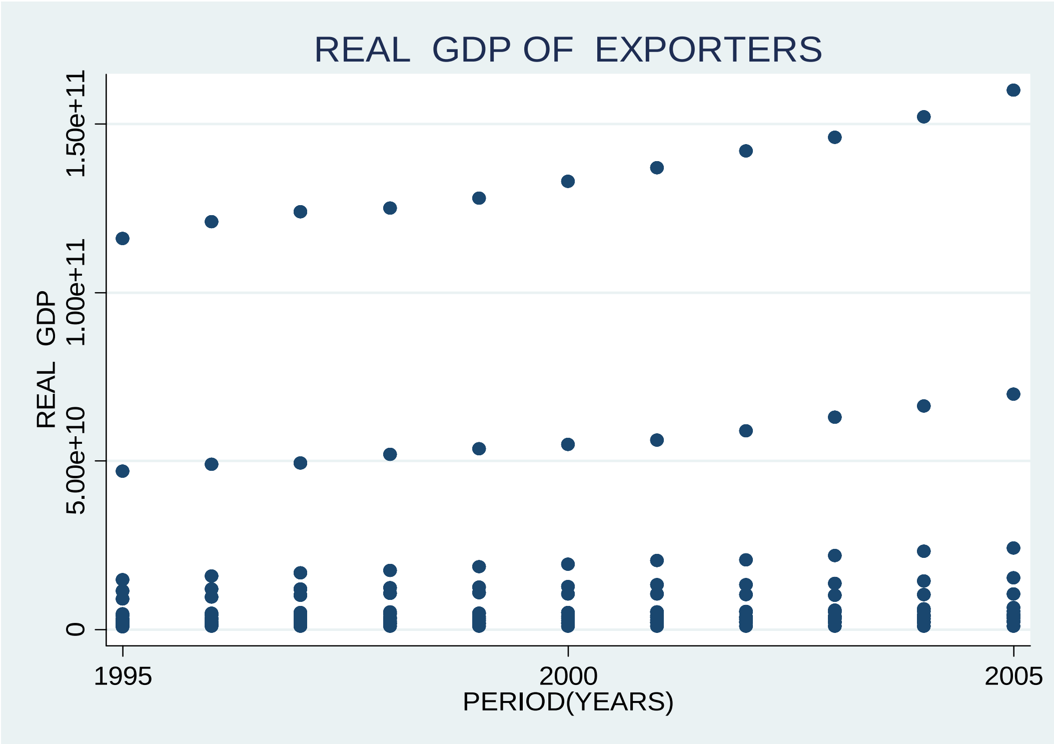

FIGURE 5: REAL GDP OF EXPORTERS

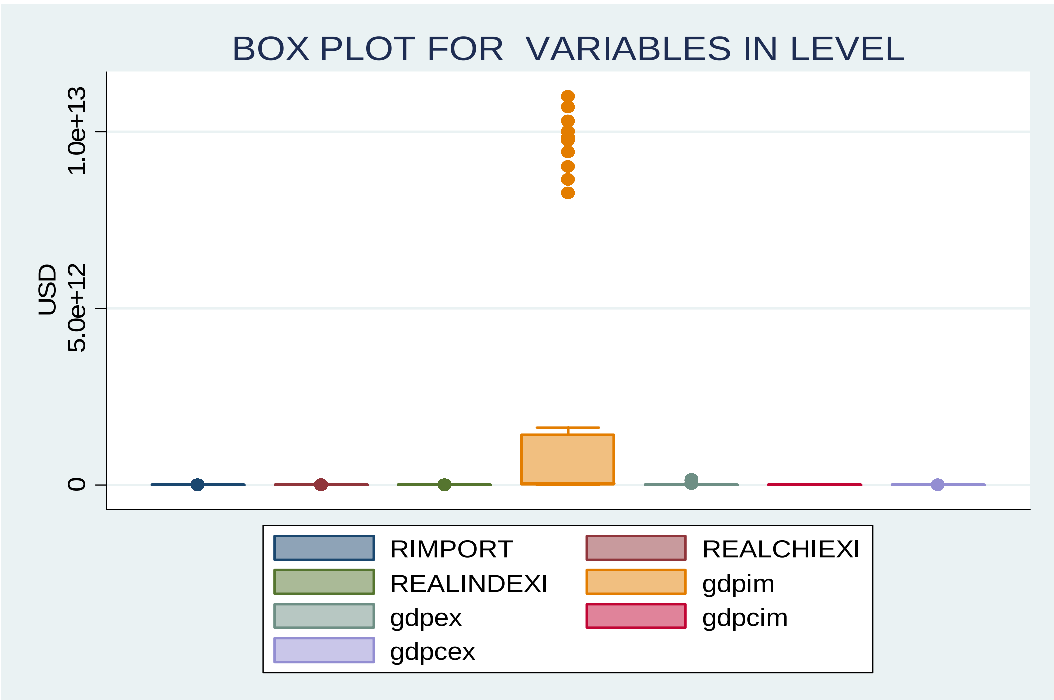

FIGURE 6: BOX PLOT FOR REAL VARIABLE IN LEVEL

KEY

RIMORT	=	Real import of clothing & accessories by the third market
REALCHIEXI	=	China's real export of clothing & accessories to third market i
REALINDEXI	=	India's real export of clothing & accessories to third market i
gdpim	=	Real GDP of importer country i
gdpex	=	Real GDP of exporter country
gdpcim	=	Real GDP per capita of importer country
gdpcex	=	Real GDP per capita of exporter country

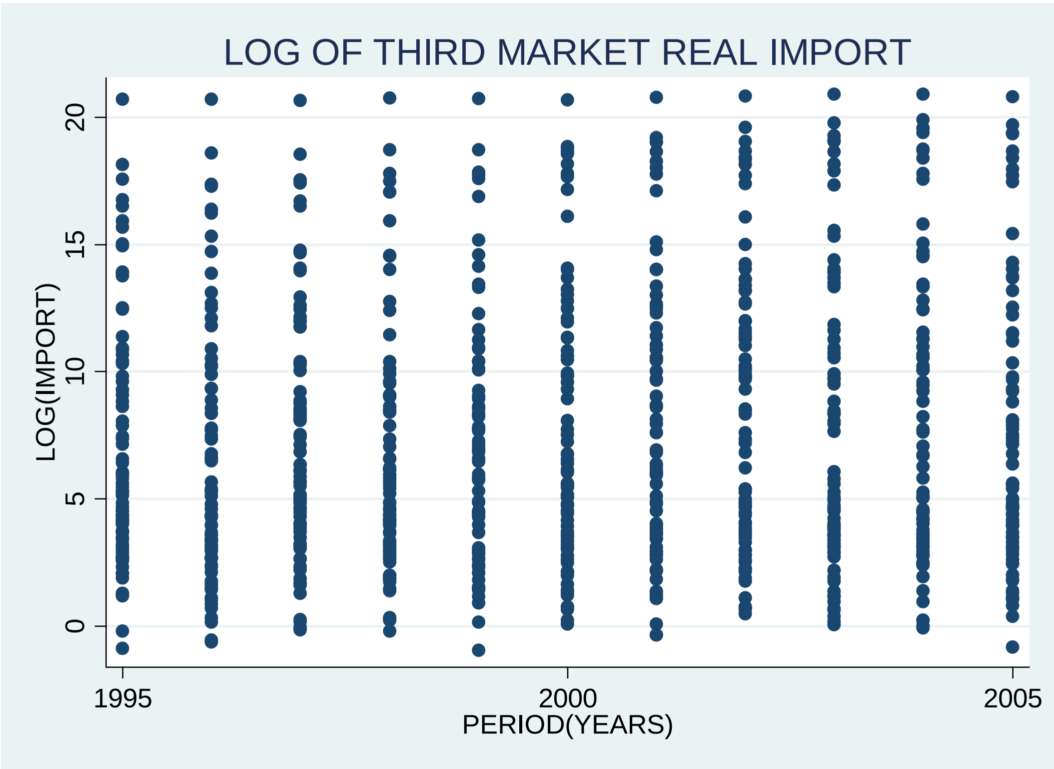

FIGURE 7: LOG OF THIRD MARKET REAL IMPORT

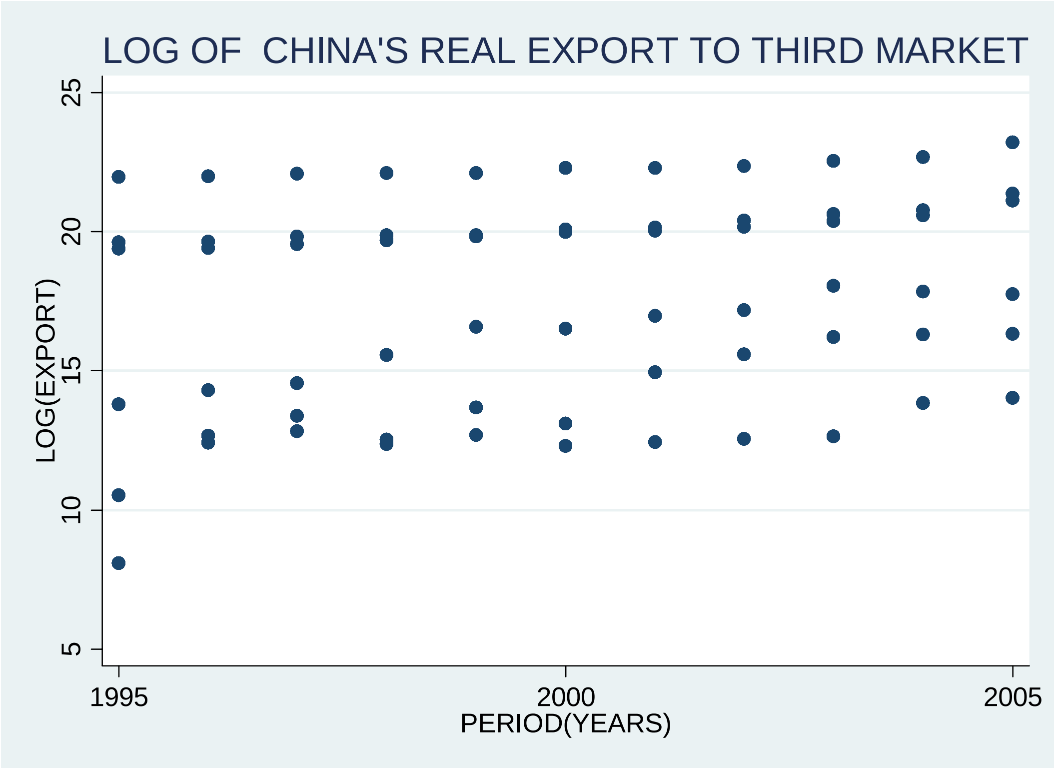

FIGURE 8: LOG OF CHINA'S REAL EXPORT TO THIRD MARKET

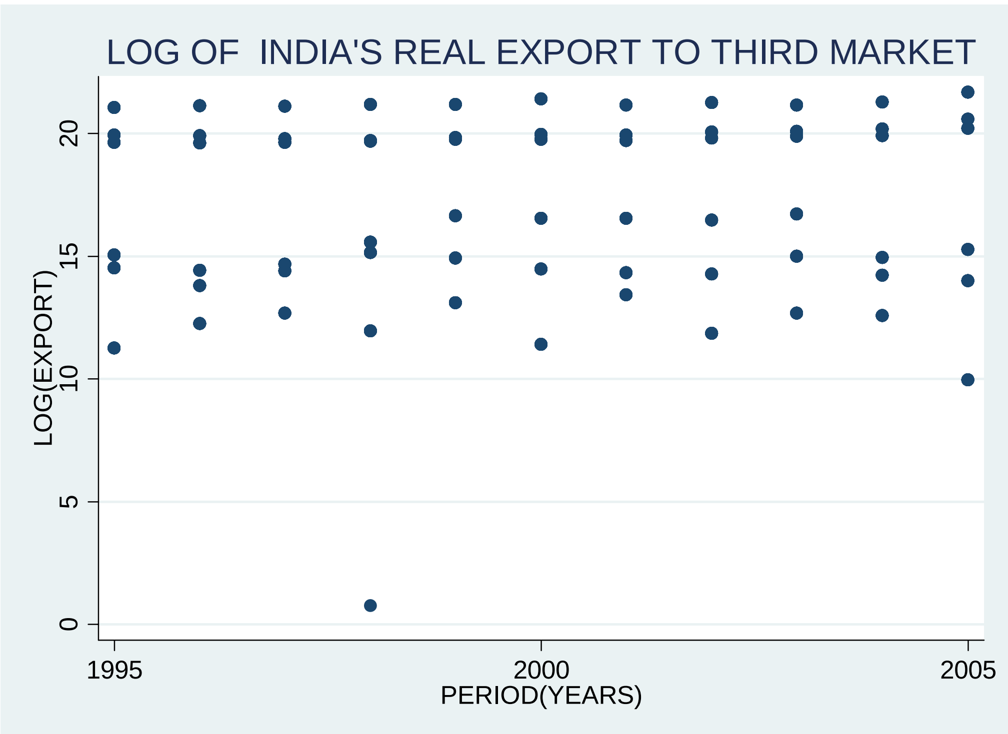

FIGURE 9: LOG OF INDIA'S REAL EXPORT TO THIRD MARKET

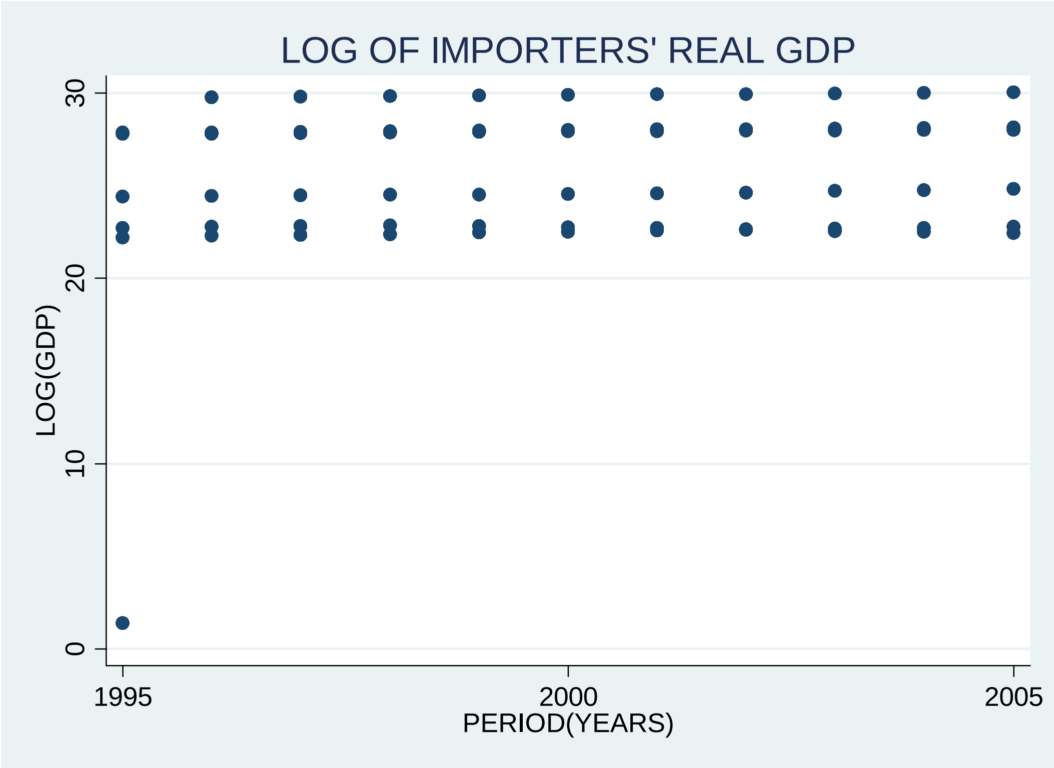

FIGURE 10: LOG OF IMPORTERS' REAL GDP

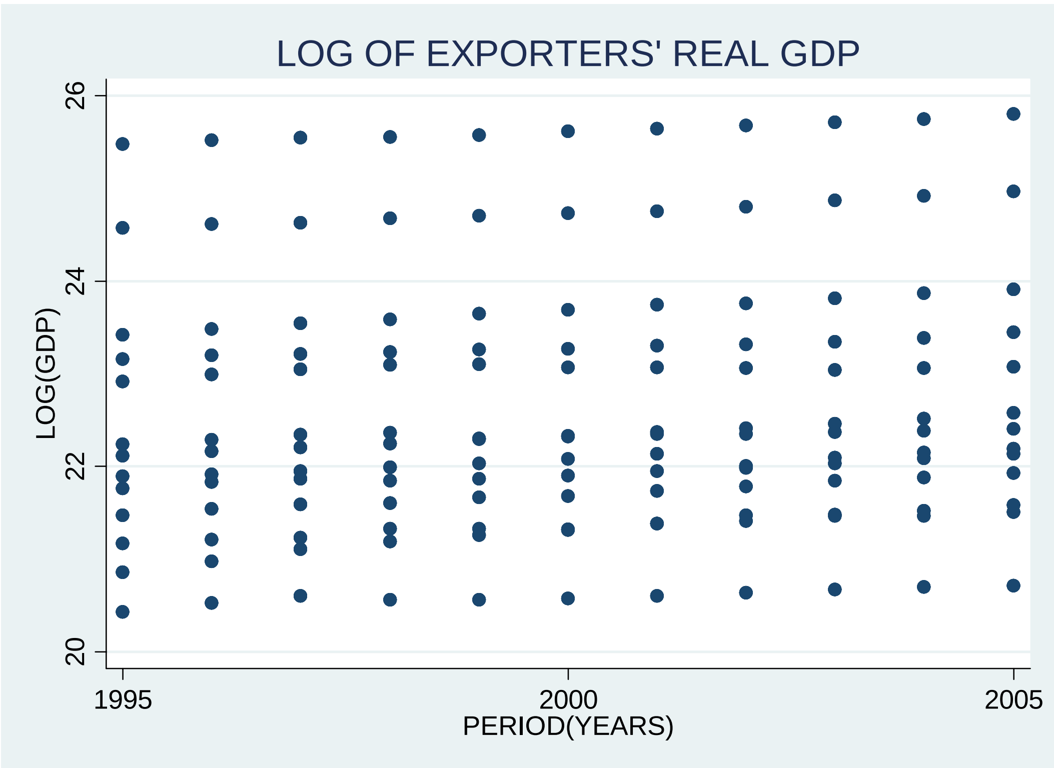

FIGURE 11: LOG OF EXPORTERS' REAL GDP

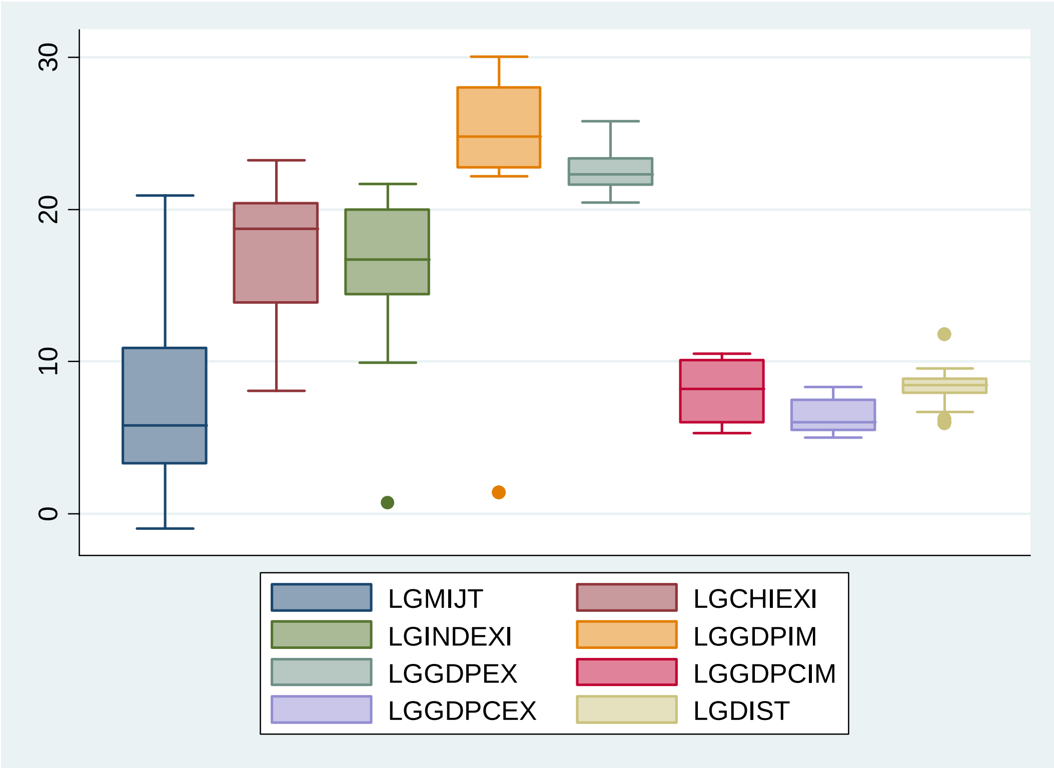

FIGURE 12: BOX PLOT FOR LOGARITHM OF THE VARIABLES

KEY:

LGMIJT	=	log of third market real imports of clothing & accessories
LGCHIEXI	=	log of China's export of clothing & accessories to country i
LGINDEXI	=	log of India's export of clothing & accessories to country i
LGGDPIM	=	log of importer country's real GDP
LGDPEX	=	log of exporter country's real GDP
LGGDPCIM	=	log of importer country's per capita GDP
LGGDPCEX	=	log of exporter country's per capita GDP
LGDIST	=	log of the distance between the exporter & importer country

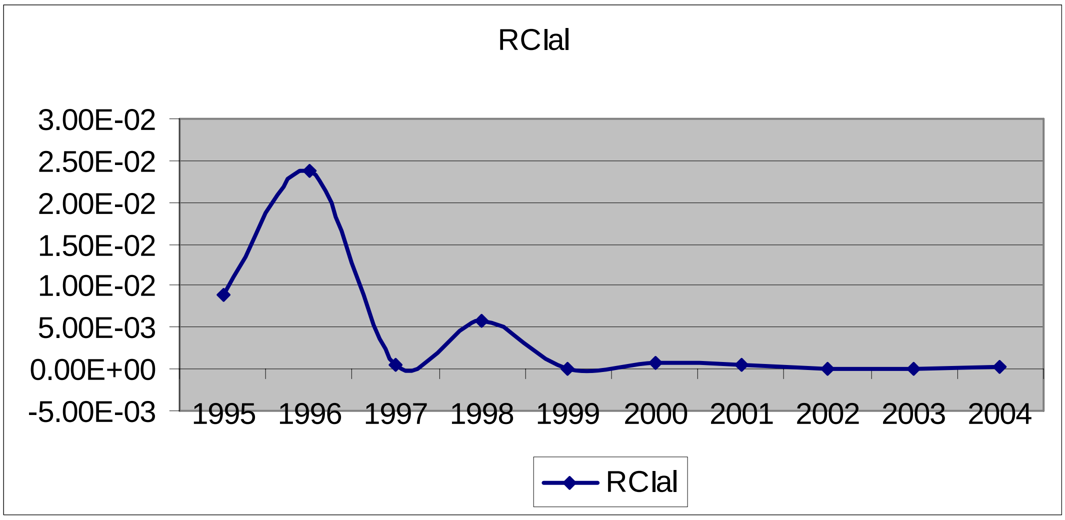

FIGURE 13: RCAI OF ALGERIA

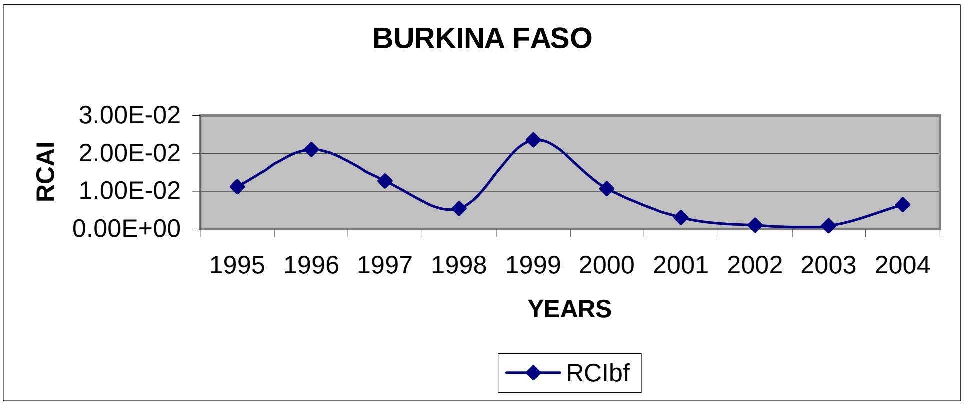

FIGURE 14: RCAI OF BURKINA FASO

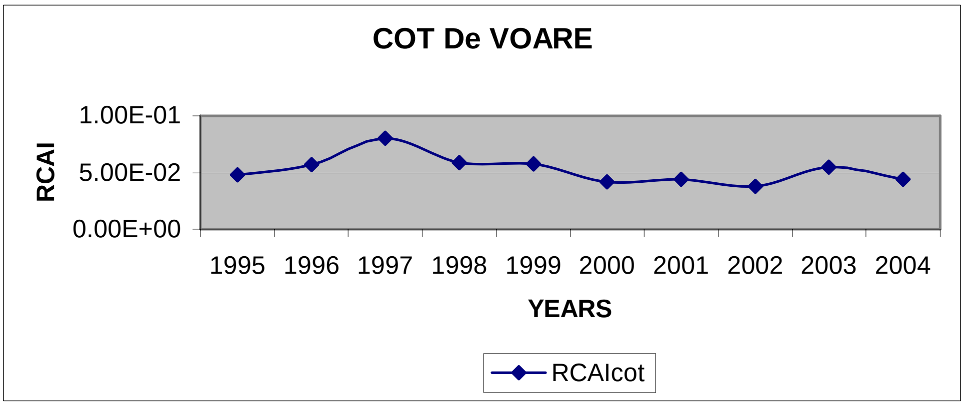

FIGURE 15: RCAI OF COT D'VOIR

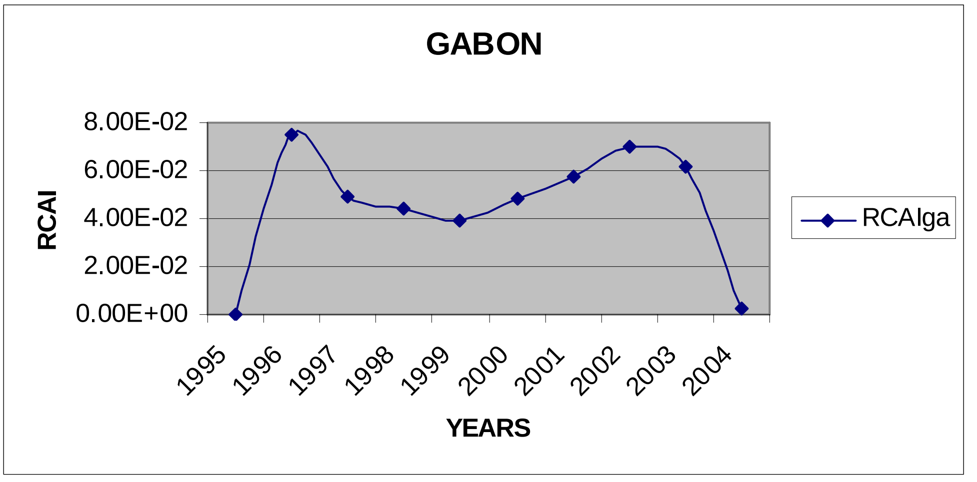

FIGURE 16: RCAI OF GABON

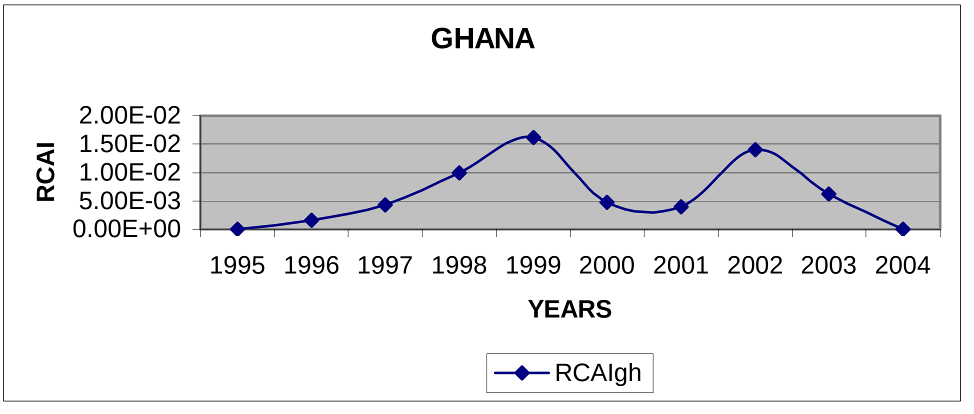

FIGURE 17: RCAI OF GHANA

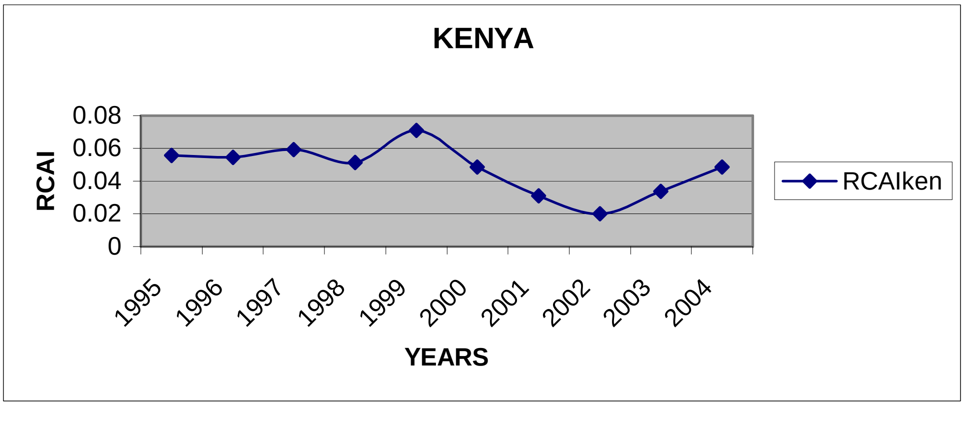

FIGURE 18: RCAI OF KENYA

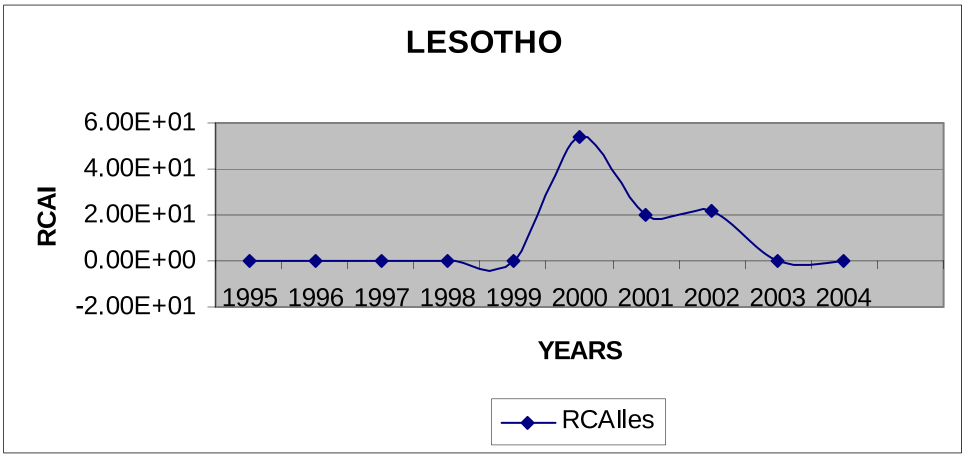

FIGURE 19: RCAI OF LESOTHO

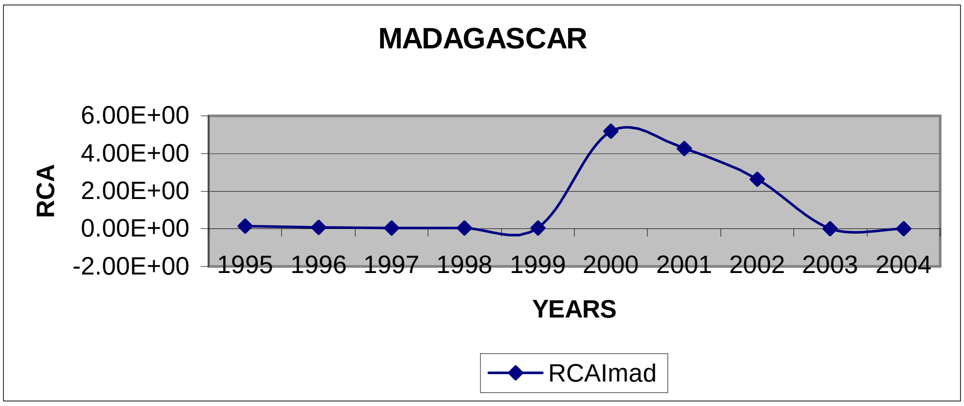

FIGURE 20: RCAI OF MADAGASCAR

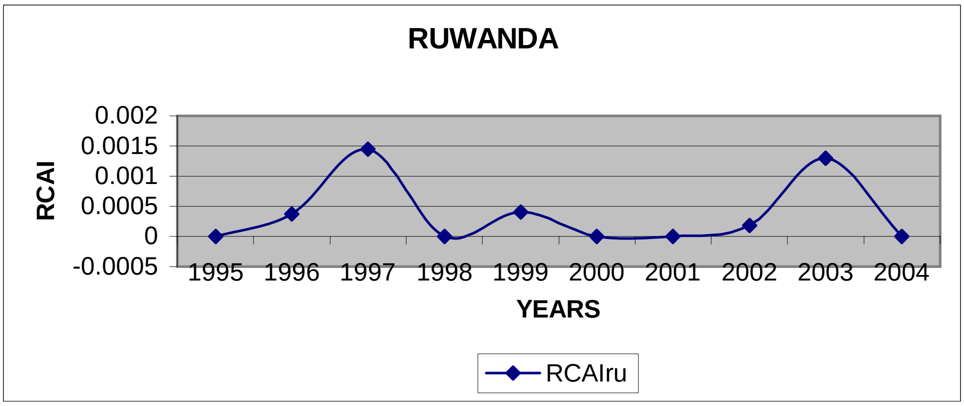

FIGURE 21: RCAI OF RWANDA

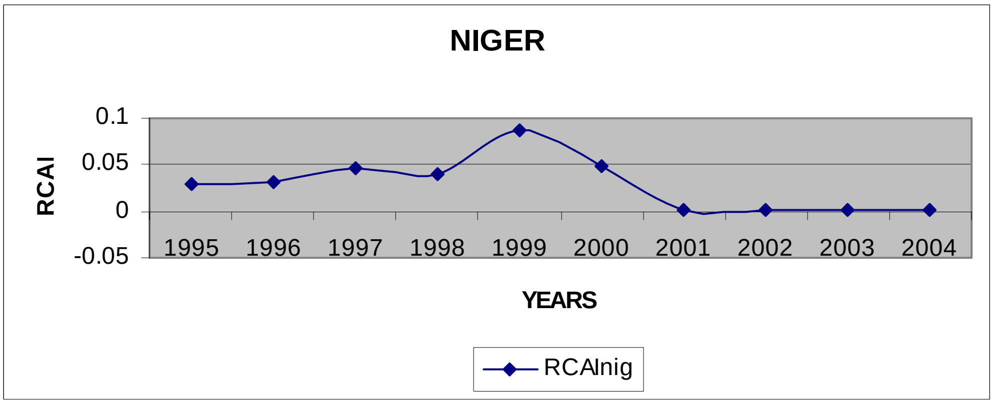

FIGURE 22: RCAI OF NIGER

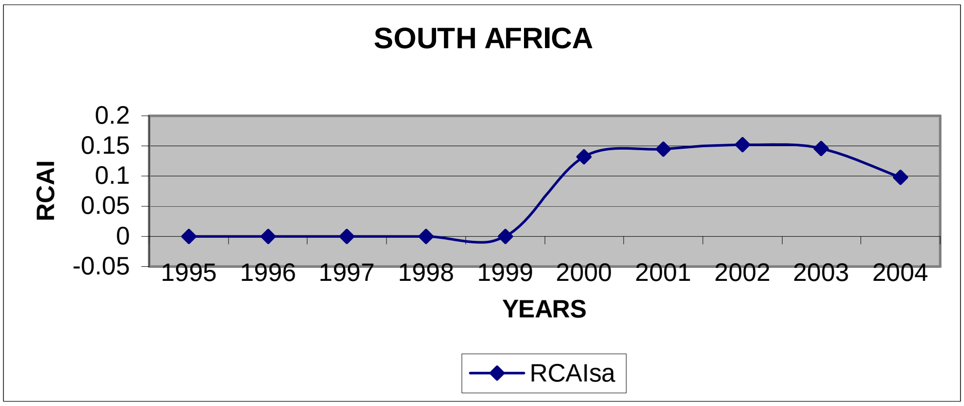

FIGURE 23: RCAI OF SOUTH AFRICA

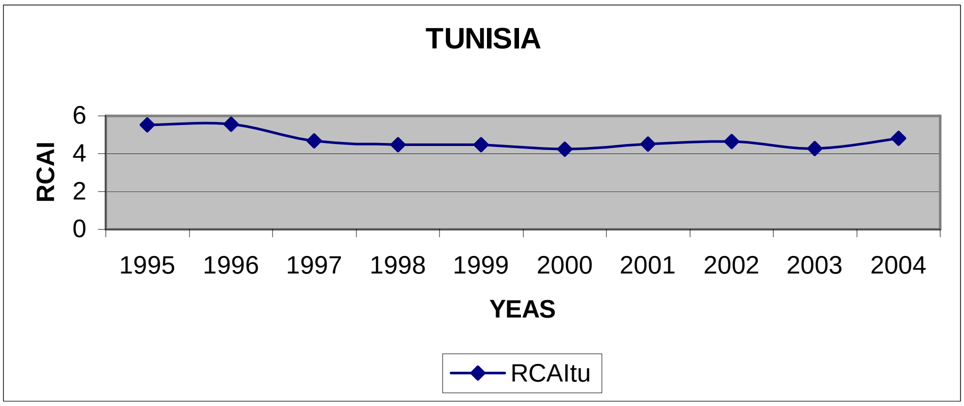

FIGURE 24: RCAI OF TUNISIA

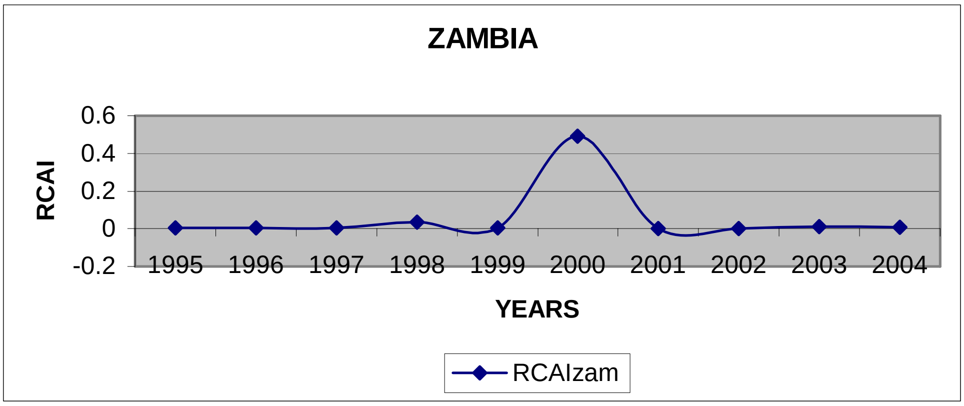

FIGURE 25: RCAI OF ZAMBIA

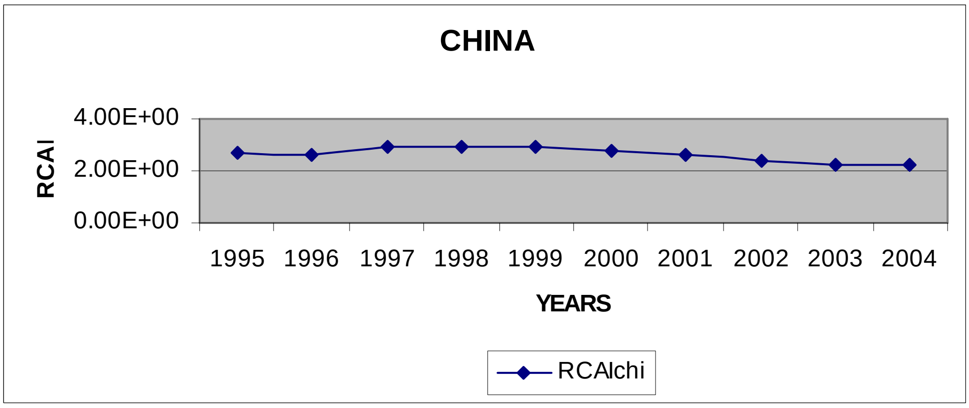

FIGURE 26: RCAI OF CHINA

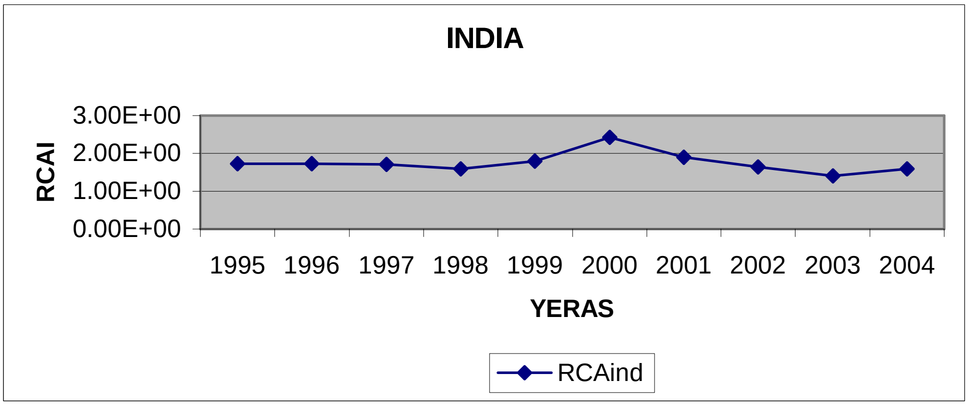

FIGURE 27: RCAI OF INDIA

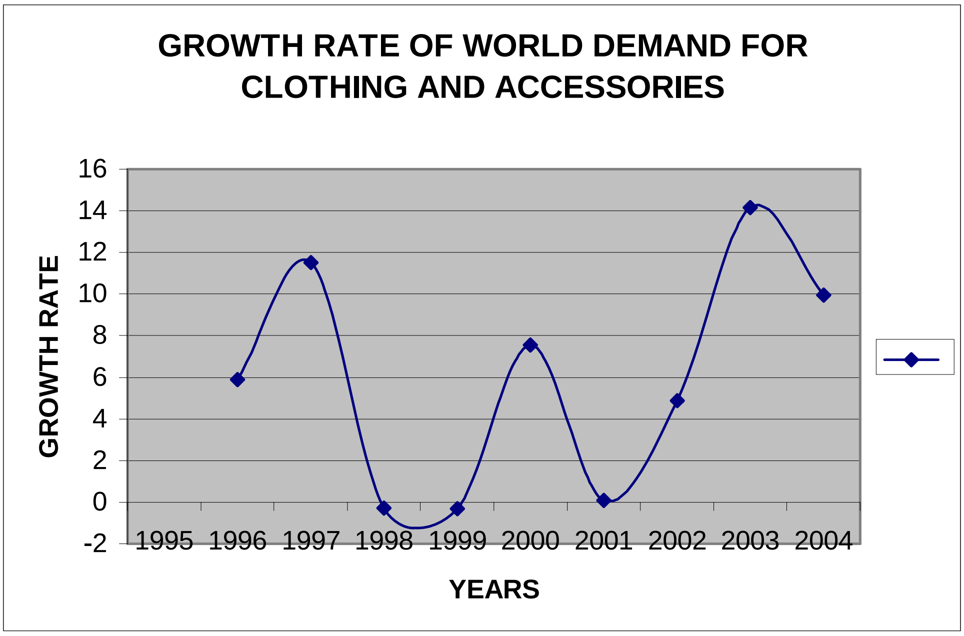

FIGURE 28: GROWTH RATE OF WORLD DEMAND FOR CLOTHING AND ACCESSORIES

SUMMARY STATISTICS

TABLE 1: SUMMARY STATISTICS OF THE LEVEL VARIABLES

Item	*Variable*	*Mean (million)*	*Standard deviation (million)*	*Skewness*	*Kurtosis*	*CV*(variability)*
1	***Real Import***	***23***	***125***	**7.556858**	***62.68948***	***5.434***
2	***Real GDP of Importers***	***1930000***	***3350000***	***1.847857***	***4.708836***	***1.735***
3	***Real GDP of Exporters***	***19900***	***36400***	***2.549861***	***8.439709***	***1.829***
4	***Real GDP per capita of importers *****	***13515.67***	***13672.66***	***.2480959***	***1.385594***	***1.011***
5	***Real GDP per capita of exporters*****	***1026.215***	***1174.671***	***1.378446***	***3.564692***	***1.144***
6	***Real China's export***	***1100***	***2160***	***2.822491***	***12.1328***	***1.963***
7	***Real India's export***	***432***	***616***	***1.602486***	***4.677422***	***1.425***
8	***Distance between importers and exporters*****	***6739.456***	***14443.29***	***8.017568***	***68.68827***	***2.143***
9	***Importer-exporter Land Area Product (Km^4)***	***1180000***	***3140000***	***4.627819***	***27.0136***	***2.661***

**** Coefficient of Variation*** ***** in units not in millions***

TABLE 2: SUMMARY STATISTICS FOR THE LOG TRANSFORMED VARIABLES

Item	*Variable*	*Mean*	*Standard deviation*	*Skewness*	*Kurtosis*	*CV*(variability)*
1	*Log of Real Import*	*7.456802*	*5.330312*	*.7450398*	*2.604034*	*0.714*
2	*Log of Real GDP of Importers*	*25.48818*	*4.090347*	*-2.965248*	*18.64386*	*0.1604*
3	*Log of Real GDP of Exporters*	*22.61932*	*1.382405*	*0.7024709*	*2.725742*	*0.6111*
4	*Log of Real GDP per capita of importers*	*8.053947*	*2.137573*	*-0.031528*	*1.076909*	*0.2654*
5	*Log of Real GDP per capita of exporters*	*6.346639*	*1.045344*	*0.6414225*	*1.931869*	*0.1647*
6	*Log of Real China's export*	*17.54921*	*3.747843*	*-0.373956*	*1.977259*	*0.21356*
7	*Log of Real India's export*	*17.1899*	*3.421275*	*-0.410717*	*2.182336*	*0.1990*
8	*Log of Distance between importers and exporter*	*8.319499*	*.923863*	*-0.211046*	*5.146128*	*0.1110*
9	*Log of Importer-exporter Land Area Product*	*26.11135*	*1.822314*	*0.1839944*	*2.970618*	*0.0697*

TABLE 3: JB–TEST (VARIABLES IN LEVELS)

Item	Variable	Pr(Skewness)	Pr(Kurtosis)	Adj $\chi^2(2)$	Prob> χ^2
1	Real Import	0.000	0.000	393.34	0.0000
2	Real GDP of Importers	0.000	0.000	273.22	0.0000
3	Real GDP of Exporters	0.000	0.000	447.16	0.0000
4	Real GDP per capita of importers	0.003	.	.	.
5	Real GDP per capita of exporters	0.000	0.005	171.99	0.0000
6	Real China's export	0.000	0.000	528.46	0.0000
7	Real India's export	0.000	0.000	234.64	0.0000
8	Distance between importers and exporters	0.000	0.000	1207.61	0.0000
9	Log of Importer-exporter Land Area Product	0.000	0.000	827.65	0.0000

TABLE 4: JB–TEST (VARIABLES IN LOGARITHM)

Item	Variable	Pr(Skewness)	Pr(Kurtosis)	Adj $\chi^2(2)$	Prob> χ^2
1	Log of Real Import	0.001	0.000	42.01	0.0000
2	Log of Real GDP of Importers	0.000	0.000	.	0.0000
3	Log of Real GDP of Exporters	0.000	0.072	50.48	0.0000
4	Log of Real GDP per capita of importers	0.704	.	.	.
5	Real GDP per capita of exporters	0.000	0.000	.	0.0000
6	Log of Real China's export	0.000	0.000	.	0.0000
7	Log of Real India's export	0.000	0.000	.	0.0000
8	Log of Distance between importers and exporter	0.012	0.000	43.30	0.0000
9	Log of Importer-exporter Land Area Product	0.028	0.954	4.84	0.0890

TABLE 5: DIAGNOSTICS SUMMARY

Type of test	*Observed statistic*	*Theoretical value*	*P-value*
Presence of fixed effect	***2.52***	***1.30***	***0.0000****
Poolability over the whole market	***1.140***	***1.30***	***0.0000****
Presence of time specific effect	***1.28***	***1.30***	***0.000****
Hausman Specification test for Fixed and Random effects	***0.60***		***1***
Hausman Endogeneity Test for Joint Exogeneity of China and India's exports and GDPs of exporting and importing countries	***36***	***16.81***	***0.000*****
Test for AR(1) serial correlation after	***16.84***	***2.0***	***0.000*****
Test For Heteroskedasticity	***1234.30***	***50.89***	***0.0000*****

Note

*** indicates the test result is at 5%*

**** indicates that the test result is at 1%*