COUNTRY AND INDUSTRY SPECIFIC DETERMINANTS OF INTRA-INDUSTRY TRADE: AN ANALYSIS OF ZAMBIA'S TRADE WITH SOUTH AFRICA AND TANZANIA, 1990 – 2015

by

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A dissertation submitted to the University of Zambia in partial fulfillment of the degree of Master of Arts in Economics

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DECLARATION

I, **Obby Phiri**, declare that this dissertation represents my own work. This paper has not previously been submitted for a degree at this or any other university and does not incorporate any published work or material from another dissertation.

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APPROVAL

This dissertation of **Obby Phiri** has been approved as a partial fulfillment of the requirements for the award of the degree of Master of Arts in Economics by the University of Zambia.

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ABSTRACT

The main objective of this study was to establish both the country specific and industry specific determinants of intra industry trade (IIT) between Zambia and its trading partners in the Southern African region namely South Africa and Tanzania using the modified gravity model of trade. The gravity model was initially criticized for being ad hoc and lacking theoretical foundation, however, this is certainly no longer true today because there are several theoretical developments that have provided support for the model. Using the gravity model in the present study is advantageous for two main reasons. Firstly, the application of gravity equations is consistent with the main objective of the study, that of identifying variables that act to encourage or discourage Zambia's involvement in IIT with its partner countries. Secondly, the gravity equations are consistent with many general equilibrium trade models.

Using a modified gravity model in a panel data framework for the period 1990-2015, the estimation results from the Feasible Generalized Least Squares in the random effects model suggested that the significant factors in explaining intra industry trade (IIT) between Zambia and its trading partners in the Southern African region are; joint market size, dissimilarity in per capita income, transactional costs, product differentiation, capital intensity, economies of scale and the revealed comparative advantage index.

DEDICATION

To my family and friends for their continued support

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LIST OF ACRONYMS & ABBREVIATIONS

ATR	Ad valorem Tariff Rate
BLUE	Best Linear Unbiased Estimator
B-P test	Breusch-Pagan Test
CA	Categorical Aggregation
CCCN	Customs Cooperation Council Nomenclature
CCMA	Consistent Coefficient Model Approach
CER	Closer Economic Relations
CI	Capital Intensity
Dis	Distance
DPCI	Dissimilarity in per capita income
EI	Economic Integration
ES	Economies of Scale
FE	Factor Endowment
FEMA	FEMA
FGLS	Feasible Generalized least squares
F-H	Flam and Helpman
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GDP*GDP	Joint Market Size
GL (G-L)	Grubel-Lloyd
GLS	Generalized Least Square
H-0	Heckscher-Ohlin
IIT	Intra-Industry Trade
INT	Inter-Industry Trade
MR	Multilateral (price) Resistance
NTB	Non-Tariff Barrier
OLS	Ordinary Least Square
PCI	Per Capita Income
PD	Product Differentiation
RCA	Revealed Comparative Advantage
RESET	Regression Specification Error Test
RSS	Residual Sum of Squares
SA	South Africa
SADC	Southern Africa Development Community
SIC	Standard Industry Classification
SIIC	Standard International Industrial Classification
SITC	Standard International Trade Classification
TB	Trade Barriers

TI	Trade Intensity
TZ	Tanzania
UN COMTRADE	United Nations Commodity Trade Statistics Database
WTO	World Trade Organization

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CHAPTER ONE

INTRODUCTION

1.1 Background

Trade is the action of buying and selling goods and services. Trade occurs out of necessity, in the sense that one person is not able to produce all the variety of products one would like to consume. The system of trade has changed over time. In the early stages of civilization, people traded goods in exchange for other goods based on a barter system, but in modern times, most trade involves the exchange of money. According to the standard models of international trade, much trade between countries is based on their endowments of factors of production. Capital-abundant countries tend to export capital intensive products and are prone to import labor-intensive products. Similarly, labor abundant countries are likely to export labor-intensive products and import capital intensive products. Though the trading system and medium of exchange differs from barter trade, the basic concept of international trade has remained the same (Łapinska, 2014).

The export and import of different products based on absolute or comparative advantage is known as inter-industry trade (INT). This trade type is supported by nearly all traditional trade theories. For example, the Heckscher–Ohlin model, the theory of absolute advantage, the theory of comparative advantage, and mercantilism, all concern INT, and were developed between the seventeenth and twentieth centuries. However, countries do not always export and import products based on differences between countries in terms of factor endowments. Trade sometimes involves simultaneous exports and imports of goods and services from the same industry. Such trade has also been variously called "two-way trade" (Gray, 1973), "trade overlap" (Finger, 1975), and "two-way trade in similar products" (Rahman, 1986).

Early references to IIT were made by Verdoom (1960) and Balassa (1966) when they observed that most of the growth in manufacturing trade occurred within industries rather than between industries. Unfortunately, their observation of the phenomenon was virtually ignored and little attention was given to it in the contemporary literature until the seminal work of Grubel and Lloyd (1975). Since then, it has become a prominent aspect of the international trade literature (Greenaway & Milner, 1986) and there is now sufficient interest in it to warrant further investigation.

The theoretical and empirical interest in studying the phenomenon of intra-industry trade mainly results from the fact that although the traditional trade models are still good at explaining why one country engages in trade with another, they do not specifically address the potential for simultaneous exports and imports of goods and services from the same industry (i.e. IIT). Standard trade theory explains trade mainly on the basis of differences in their relative factor endowments across countries (Thorpe, 2013). For instance, the traditional factor-proportions theory posited by Heckscher and Ohlin does not provide a complete explanation for the volume of international trade which takes place within an industry and between similar (in terms of resources, industrial structure, and demand patterns) rather than dissimilar economies. This is because the H-0 theory has a number of theoretical limitations, including its failure to give due attention to the role of economies of scale and product differentiation.

Therefore, a number of trade economists have attempted to account for the prevalence of IIT by overcoming the limitations of the H-0 theory through relaxing some of its assumptions. For instance, Krugman (1979, 1980) introduced monopolistic competition with product differentiation based on increasing returns to scale, while Falvey (1981) focused on differentiation between products based on quality, and Brander (1981) put emphasis on oligopolistic markets. Helpman and Krugman (1985) synthesized factor endowment and monopolistic competition models in an attempt to explain IIT, and the result was the development of a distinct IIT model that allowed for the interplay between product differentiation, economies of scale and factor proportions.

Statistically, IIT accounts for approximately 40% of world trade by volume (World Bank, 2015). This rise in IIT has resulted in sizable part of the recent "New Trade Theory" being directed at explaining various issues relating to IIT rather than inter-industry trade. These various aspects include measuring the magnitude of intra-industry trade, developing theoretical explanations for intra-industry trade's existence and finally, investigating the empirical determinants of intra-industry trade (Zhan et al 2005). This is because intra-industry trade brings several benefits. Firstly, IIT increases gains from trade arising from increasing returns to scale and product differentiation (Ruffin, 1999; Sharma, 2000). Secondly, adjustment costs will be relatively minor if trade expansion takes the form of IIT rather than inter-industry trade (Balassa, 1966). The reason for this is that it is more expedient for resources to be reallocated within an industry than between industries.

Finally, the specialization within industry categories which results from intra-industry trade may stimulate innovation because producing a greater variety and a greater number of particular goods increase general knowledge of technology and know-how (Ruffin, 1999). For these reasons an interest in investigating the determinants of the intra-industry trade phenomenon has been developed and a few researchers e.g. (Thorpe, 1993), (Gustafsson, 2012) have tried to investigate the specific determinants of this type of trade. However most of these researches that have been done focus on western and industrialized countries and very little attention has been placed on developing countries like Zambia.

1.2 Statement of problem

Trade has played a critical role of an effective development strategy for many developed and developing countries. As a result, many countries have resorted to forming regional trade arrangement to boast intra-regional trade as a strategy for poverty reduction and economic growth. In Africa, there are more than thirty regional trade arrangements mostly focused on deeper regional integration (Zhang & Gupta, 2005). Although intra-African trade remains small, at 10% of its internal trade, a substantial amount of trade in non-traditional exports occurs within the continent. For example, in 2015, over 51% of Zambia's NTEs were exported to markets within the SADC and COMESA member countries. During the same year, Zambia sourced over 39% of its imports from South Africa. The dominance of regional trade in NTEs has resulted in increased IIT in the region.

Despite the increasing importance of intra-regional trade among developing countries, empirical studies on IIT have focused primarily on industrialized economies such as Thorpe & Zhang (2001) who investigate the determinants intra-industry trade among Asian countries and Gustafsson (2005) who analyzed the pattern of intra-industry trade between Sweden and the European Union.

There have been only a small number of studies on this subject that focus on developing countries. The few available studies on Sub-Saharan Africa that include Musonda (1997), Chidoko (2006) and Mulenga (2012) mainly focused on country specific determinants of IIT such as distance and having a common boarder. None of these studies have analyzed the industry specific determinants of IIT such as product differentiation and economies of scale. As Clark and Stanely (1999) argues, these factors should not be ignored in analyzing IIT patterns because IIT is greatly influenced by the degree of product standardization and differentiation, as well as by the globally integrated nature of the production process. Rather than focusing on a narrow range of potential influences like previous studies have done, the present study accounts for a wide variety of country characteristics and industry structural determinants.

This study seeks to bridge this empirical gap in the literature by exploring the nature and extent of intra-industry trade in the Southern African Region. The study also extends the existing literature by considering the industry and country-specific causes of IIT among emerging economies in Africa. In particular the study looks at IIT between Zambia and its major trading partners in the SADC region for the period covering 1990 to 2015 which are South Africa & Tanzania (the justification for this choice is made in chapter 2).

1.3 General Objectives

The main objective of this study is to analyze the extent and the determinants of intra-industry trade in the food and live animals, manufactures and chemicals industries between Zambia and its Southern African trading partners (South Africa and Tanzania).

1.3.1 Specific Objectives

The specific objectives of this study is to explore the extent to which industry and country specific factors affect intra-industry trade between Zambia and its key regional trading partners. In particular, the study investigates:

1) The impact of joint market size on IIT.
2) The impact of trade reforms on IIT.
3) The impact of product differentiation on IIT.

1.4 Hypothesis

1) The joint market size is a key driver of IIT.
2) Tariff reductions increases IIT.
3) Adjacency, joint market size, trade intensity, infrastructure, economies of scale, product differentiation, capital intensity and the inflation rate determines the level of IIT.
4) Increased product differentiation increases IIT.

1.5 Research Questions

1.5.1 Primary Research Question

What are the determinants of IIT between Zambia and its Southern African trading partners?

1.5.2 Secondary Research Questions

1) How does the level of product differentiation influence IIT?
2) How do changes in the tariff rates affect IIT?
3) Does a larger joint market size entail high IIT?
4) Which country and industry specific variables determine IIT?

1.6 Significance of the Study

The study originated from a perceived need for further empirical investigation of the nature and extent of IIT in the Southern African region. IIT studies for the region are few (Musonda, 1997), Chidoko (2006) and have focused primarily on country specific determinants of IIT neglecting possible industry specific determinants like product differentiation and economies of scale. Thus there is an empirical gap on the effects of industry level factors on IIT in the region. Clark and Stanely (1999) argue that these factors should not be ignored in analyzing IIT patterns because IIT is greatly influenced by the degree of product standardization and differentiation, as well as by the globally integrated nature of the production process.

Another thing to note about the empirical studies that have been done in the region on IIT is that they have primarily focused on the gravity factors such as distance, the size of the economy and geographical factors. These studies have paid insufficient attention to the role of other country-specific factors such as trade intensity, multilateral resistance and trade orientation. By covering a wide range of the determinants of IIT for the region, the research has the potential to provide a basis for more efficacious policy prescriptions which will enable the region to benefit from IIT through innovation and gains from trade arising from product differentiation and economies of scale.

Further, this study provides us with a good opportunity to improve our understanding of IIT in the region because of the three countries special characteristics. These include, firstly, the fact that South Africa is classified as an upper-middle income economy while Zambia and Tanzania are classified as lower middle income countries (World Bank, 2016). The countries give a good benchmark for testing both South-South IIT models and South-North IIT models on the Southern African data set.

Finally, the period to be covered is from 1990 to 2015 inclusive, this period is of particular relevance because during this time Zambia experienced many changes that have had an impact on its international trade. In particular, after the implementation of the structural adjustment programs (SAPs), there were changes that involved rapid economic growth, increasing foreign aid, increasing foreign investment, and a reduction in tariff barriers.

1.7 Organization of Study

The reminder of this study is organized as follows: Chapter two outlines the context of the study, Chapter three reviews the theoretical and empirical literature, Chapter four outlines the methodology and estimation techniques, Chapter five presents an analysis, presentation, and discussion of results while Chapter six presents the conclusion, recommendations for policy makers and limitations of the study.

CHAPTER TWO

CONTEXT OF THE STUDY

This chapter presents the context of the study. It is organized around two sections with the first highlighting the choice of the countries. The second section highlights the choice of industries and the third section combines section one and two to explore the patterns of intra-industry trade between Zambia-South Africa & Zambia-Tanzania in the three selected Industries.

2.1 The Choice of Countries

South Africa and Tanzania were chosen for the analysis for three main reasons. Firstly the choice of countries was influenced by the availability of data for the variables used in the model. Trade between Zambia and the two countries chosen is well documented compared to trade between Zambia and other countries like the Democratic Republic of Congo (DRC) which remains largely unrecorded due to weak border controls and smuggling.

Secondly the two countries give a good benchmark for analyzing both South-South and South-North trade since one is an industrialized country (South Africa) and the other one is a developing county (Tanzania) just like Zambia. Thus we want to observe the patterns of Intra-Industry trade between countries with dissimilar economic structures (Zambia-South Africa) and make comparisons with Intra-Industry Trade among countries with similar economic fundamentals (Zambia-Tanzania).

Thirdly South Africa and Tanzania are undoubtedly Zambia's major trading partners in the SADC region (World Bank, 2015). Compared to the rest of SADC (RoSADC), South Africa accounts for almost half of Zambia's imports and exports markets. Possible reasons for South Africa's prominence could include the emergence of trade opportunities in the post- Apartheid era; increasing South African investment in Zambia; and the duty free offer to Zambia, by the Southern African Customs Union (SACU), on copper wire and sugar exports. In addition, Zambia also exports some products to preferential markets, like the US market, through third-party arrangements which involve South Africa. Zambia's major exports to South Africa include copper cathodes, cotton, sugar, and tobacco and leather products.

Indeed, as with South Africa, Zambia has had a special cordial relationship with Tanzania, at political and economic levels among other areas. The transport and communication systems between them are good, facilitated by the joint building of the railway line, TAZARA, an all-weather tarmac road and an oil pipeline (TAZAMA). Zambia has also been using the Dares Salaam harbour facilities for a long time. The countries share a common border and cultural relationship. The main exports to Tanzania are engineering products, mainly copper cables, which are inputs for its booming mining sector and which enter the Tanzanian market under the SADC Trade Protocol. Imports from Tanzania are mostly processed and unprocessed food products, pharmaceutical products and chemicals.

2.1The Choice of Industries

The study will focus on three industries namely the food and live animals industry, the chemicals and related products industry and the manufacturing industry classified chiefly by materials industry. These industries have been chosen because they are the ones that have shown immense levels of intra-industry trade over the years. The industries are also important to the Zambian economy and will be the engine of growth for the next decade and beyond as the country aims to diversify its economy from over dependence on copper exports. Zambia's dependency on copper makes it vulnerable to depressed commodity prices, thus these industries remain the key priority sectors in the growth and poverty reduction agenda of Zambia.

2.3 Patterns of IIT between Zambia-South Africa & Zambia-Tanzania in selected Industries

Adopting the framework developed by Grubel and Lloyd (1975), the unadjusted G-L index, IIT_{jk}, between Zambia and other trading countries is specified as for a good j with exports Xj and imports Mj as:

$B_j = (1 - \frac{|X_j - Mj|}{X_j + M_j}) \times 100$……………………..Equation 2.1

IIT_{jk} is a percentage from 0-100. When IIT_{jk}= 0, it is all inter-industry trade and when IIT_{jk}= 100, it is all intra-industry trade. The standard international trade classification (SITC Rev.4) was used to classify goods into different industrial groupings. As mentioned earlier, the industries analyzed in this study are the food and live animals industry, the chemicals and related products industry and the manufacturing industry. The intra-industry trade index was calculated for each the three industries using the formula above.

2.3.1 Food and live animals Industry

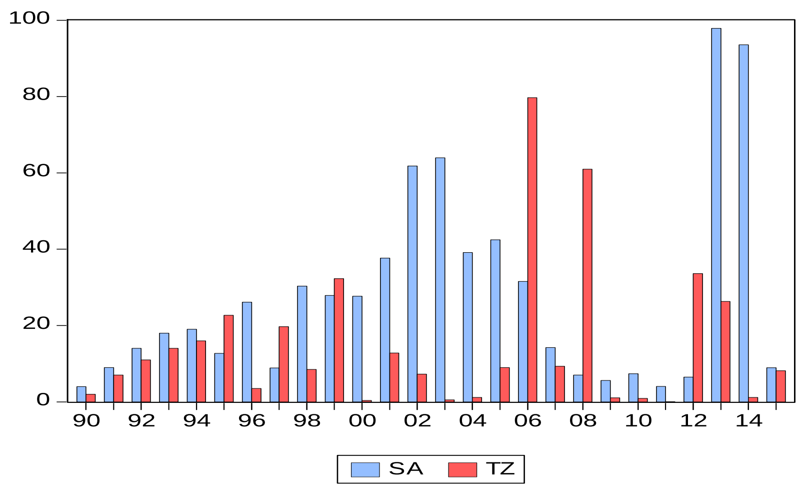

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Figure 1.1 INTRA INDUSTRY TRADE BETWEEN ZAMBIA-SOUTH AFRICA AND ZAMBIA-TANZANIA IN FOOD AND LIVE ANIMALS IDUSTRY

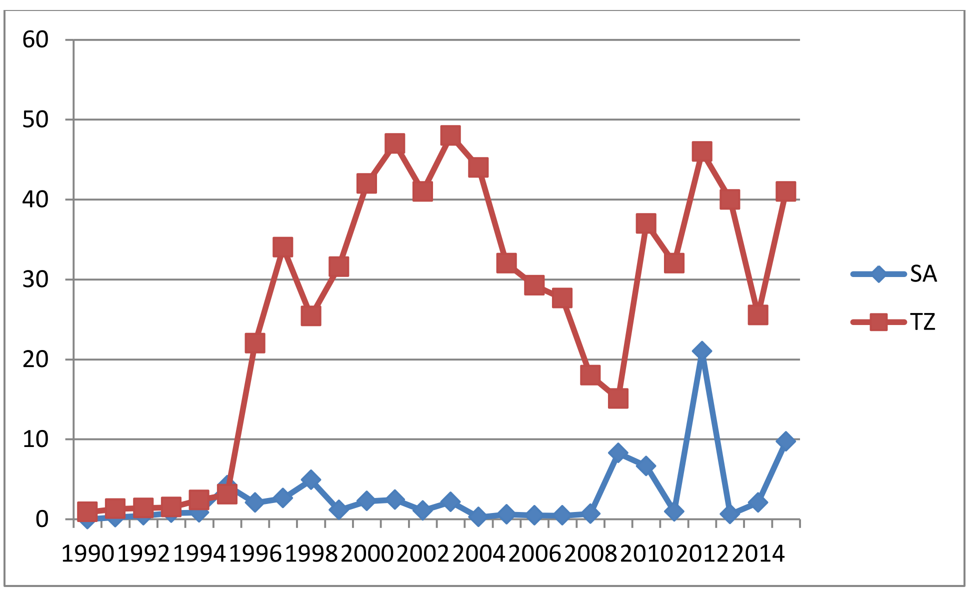
Intra-Industry trade in this industry is more pronounced between Zambia and South Africa. This could be because a large number of commercial farmers in Zambia are whites with South African roots who could be exporting to preferential markets, like the US market and Asia through third-party arrangements which involve South Africa. The products that show high levels of IIT are non-traditional exports such as cotton, sugar preparations, honey, molasses, soya beans, tea, cereals and cereal preparations.

IIT between Zambia and Tanzania was quite low and without a definite pattern in this industry. However, some products such as fish, processed fish products, tea, spices, vegetables and fruits showed strong levels of IIT between the two countries.

Intra industry trade in this industry shows a rising trend from the early 1990s Up to the early 2000s, this could have been a direct result of the agriculture sector policy reforms as part of the general economic reforms that fell under pursuit of the structural adjustment programs. These were targeted at liberalizing the agricultural sector alongside promoting private sector participation in the agricultural supply chain (Ministry of Agriculture and Co-Operatives, 2004).

The formation of the Southern Africa Development Community (SADC) in 1992 might also explain the rising trend of IIT in the early 1990s as producers in member countries found new markets across the border for their output. The rate of IIT slowed down in the early 2000s partly due to the emergency of China as an export destination for products produced in this industry as while as the slowdown in the global economy which drastically reduced international trade.

2.3.2 Chemicals and related products Industry



Source: Output from Excel

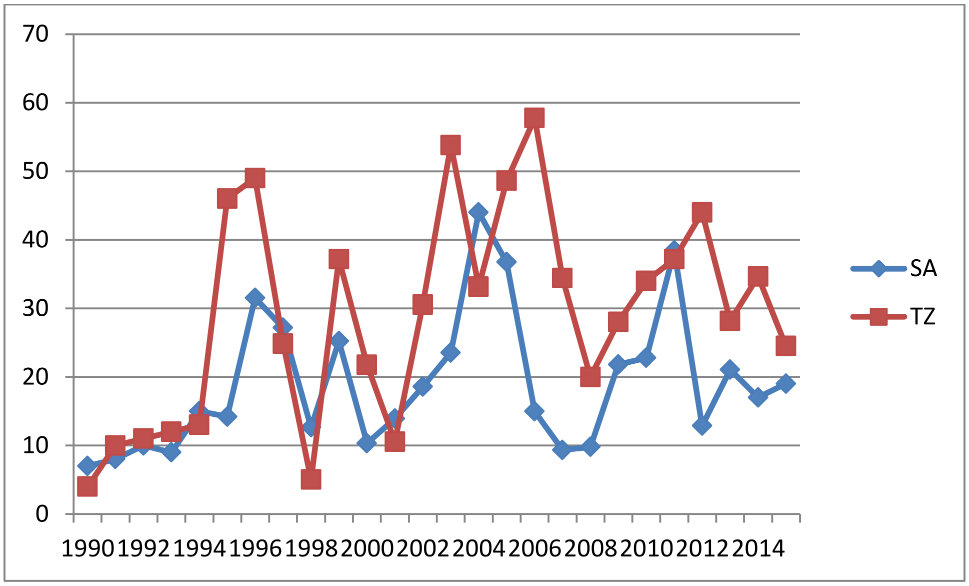
Figure 1.2 INTRA INDUSTRY TRADE BETWEEN ZAMBIA SOUTH AFRICA AND ZAMBIA-TANZANIA IN THE CHEMICALS AND RELATED PRODUCTS INDUSTRY

Intra-Industry trade in this industry was more prominent between Zambia and Tanzania. The main reason why IIT between South Africa and Zambia was not significant in this industry is because the industry is very advanced in South Africa and the products manufactured in Zambia cannot compete at the same level with the products manufactured in SA. The industry is the largest of its kind in Africa (Brand South Africa, 2017). It is highly complex and widely diversified, with end products often being composed of a number of chemicals which have been combined in some way to provide the required properties and characteristics. The per capita income disparity between the two countries also implies that South Africa is an advanced consumer of the latest on offer from international sources such as Germany and China which are South Africa's largest Source of imports in this Industry.

This industry however is not very advanced in Tanzania which like Zambia is largely an agrarian economy. The products that show high levels of IIT between the two countries are essential oils, resinoids, fertilizers, hair products, synthetic organic detergents, inorganic alkaline detergents, crude and refined glycerine from vegetable and animal fats, organic and inorganic chemicals whilst products like medicines and pharmaceutical products revealed low levels of IIT due to the controls and regulations both countries have put in place on the importation of drugs.

In terms of trend in this industry, IIT was on a rise from 1996 up to 2004 when it started to decline all the way up to 2009. However in 2010, the levels of IIT in the industry began to rise driven mostly by the high demand for fertilizer and agricultural pesticide in both countries.

2.3.3 Manufactured goods classified chiefly by materials industry



Source: Output from Excel

Figure 1.3 INTRA INDUSTRY TRADE BETWEEN ZAMBIA SOUTH AFRICA AND ZAMBIA-TANZANIA IN THE MANUFACRURING INDUSTRY

Intra Industry trade in this industry does not have a definite pattern and it fluctuates from year to year. IIT is more momentous between Zambia and Tanzania in this Industry in products like leather, leather manufactures, textile yarn, fabrics and wood products. Trade between Zambia and South Africa in this Industry also involves simultaneous exports and import of dressed furskins, textile yarns and wood manufactures (excluding) furniture).

The manufacturing industry in Zambia is not very technologically advanced, therefore it is not surprising that the majority of products that exhibited IIT in this industry can be produced using crude methods. Tanzania's manufacturing industry is similar in many aspects to that of Zambia whilst the industry is very sophisticated and technologically advanced in South Africa.

In summary, this study builds mainly upon the existing empirical and theoretical literature on IIT with the intention of advancing the understanding of this phenomenon. Particular reference is made to its occurrence in Zambia in the three industries outlined above. Relevant research achievements were reviewed and an appropriate research methodology was identified and applied to the Zambian data set.

CHAPTER THREE

LITRETURE REVIEW

This section presents the review of the literature. It is divided into two subsections. The first looks at the theoretical literature and models that depart from the traditional H-O theory. The latter part looks at studies that have been undertaken on the determinants of intra-industry trade.

3.1 Theoretical Literature Review

3.1.1 The Gravity Model of Trade

The general idea behind the model stems from and derives its name from the theory of gravity as it is studied in physics. The model is referred to as the gravity model because it identifies forces that encourage and discourage countries in their trade with each other. In other words, the gravity model consists of pull and push factors (akin to gravitational and other physical forces) that influence bilateral trade flows. Newton's law of gravity in the field of physical mechanics states that two bodies attract each other with a force that is proportional to the product of each body's mass (in kilograms) divided by the square of the distance between their centers of gravity (in meters).

The gravity model was first applied to the analysis of international trade by Tinbergen (1962) and Poyhonen (1963). In their basic formulation of this model of trade, the volume of trade between two countries was assumed to be positively related to their size, as measured by their national incomes, and negatively related to the transport costs of trade, as measured to the transport costs of trade, as measured by the distance between their economic centers.

The simplest and standard (or basic) functional form of the gravity equation relates the volume of trade T between country i and country j to the product of each country's GDP Y_i Y_j and to the distance between them D_{ij} as a proxy for transaction costs. Specifically:

T_{ij}=A$\frac{Y_i Y_j}{D_{ij}}$ ... …………………..Equation 3.1

where $\boldsymbol{A}$ is a constant of proportionality. This is a baseline model that when estimated is said to give relatively good results. However, it is known that there are other factors that may also influence the level of trade other than the traditional gravity factors cited in the equation above. Variations of this basic single-equation model involve the inclusion of additional explanatory variables. In the present study, these will include tariff rate variable, dummy variable for common boarder, dissimilarity in per capita income, trade orientation, trade intensity, inflation, product differentiation, economies of scale, factor endowment and capital intensity variable. For reasons that are ready apparent, this type of model is sometimes known as "the augmented gravity model" (Cheng & Wall, 2004).

Despite its widespread and successful empirical application, the gravity model was initially criticized because it lacked theoretical foundations. However, this is certainly no longer true today because there are several theoretical developments that have provided support for the model. The theoretical basis for the gravity model framework is found on a set of general equilibrium models that derive specific predictions for bilateral trade. Examples include Anderson (1979), Bergstrand (1985, 1989, l99O), Deadorff (1984, 1995, 1998), Helpman and Krugman (1985), Keller (1998, 2002), Anderson and Wincoop (2001), Harrigan (2001), Hansson and Xiang (2002), and Cheng and Wall (2004). The common elements in each of these contributions are complete specialization and identical preferences. Their differences, though, help to explain the variety of specifications and some of the diversity of the results that have appeared in empirical applications.

What the preceding discussion shows, then, is that using the gravity model in the present study is advantageous for two main reasons. Firstly, the application of gravity equations is consistent with the main objective of the study, that of identifying variables that act to encourage or discourage Zambia's involvement in IIT with its partner countries. Secondly, the gravity equations emanate from a general equilibrium theory of trade; in the other words gravity equations are consistent with many general equilibrium trade models, including those of Bergstrand (1985, 1989, and 1990), Helpman and Krugrnan (1985).

3.1.2 Theories of Intra industry trade

Several researchers have developed and analyzed the variants of the theoretical models of trade. Verdoom (1960) and Balassa (1966), were among the first to notice the existence of simultaneous export and import trade in products from the same industry between similar economies. However, the underpinnings of many present-day theoretical models of IIT date back to the work of Grubel and Lloyd (1975). Although these latter authors did not develop a formal theoretical model of IIT, they nonetheless provided the foundation for much of the future theoretical work concerning the phenomenon. In particular, they identified economies of scale and monopolistic competition as key factors associated with IIT. Subsequently, a number of theoretical models have been developed to account for this type of trade. Most, but not all, of these models depart from the traditional Heckscher-Ohlin (H-0) framework by relaxing one or more of its assumptions to allow for the effects of the imperfect competition, economies of scale, and product differentiation on international trade.

3.1.2.1 Classical and Neo-Classical Trade Theories

Classical and neo-classical trade theories hypothesize that trade occurs because of differences between economies and the subsequent prospect of gains from specialization. The classical economist, Adam Smith (1776), developed the theory of absolute advantage and was the first to argue the need for free trade to benefit a country. Two influential theories on international trade have been developed based on Adam Smith's absolute advantage theory. The first was David Ricardo's (1817) comparative advantage theory and later, two Swedish economists, Eli Hecksher and Bertil Ohlin, develop the Hecksher-Ohlin theory (1933) of international trade. According to Ricardian comparative advantage, countries produce and export commodities in which they have a relative cost advantages and import those commodities in which they have a relative cost disadvantage. The Ricardian model explained that specialization based on differences in labour productivity using different technologies determines a country‘s comparative advantage. The Heckscher-Ohlin trade model extended the Ricardian model to show that countries specialize and export products that use their abundant and cheap factors of production and import products that use the countries' scarce (and therefore costly) factors. Hence, factor endowments (capital, land and labour) determine a country's comparative advantage.

3.1.2.2 New Trade Theories

However, a new trade pattern has emerged in most developed countries. Increased IIT of which the classical theories of Smith, Ricardo and Hecksher-Ohlin could not fully account for has been on a rise. Moreover, the classical trade theories above emphasized that firms have homogeneous productivity and thus are expected to trade in similar quality goods, which is no longer the case today. Balassa (1966) and Grubel (1967) were among the first to observe tendencies towards trade of similar but differentiated products—intra-industry trade—rather than specialization, in the trading patterns of the European Economic Community. Their work heralded the search for new theories of international trade capable of explaining the phenomenon of IIT. Of the new trade theories, Krugman (1979; 1980) and Lancaster‘s (1980) monopolistic competition models are among the best known. They introduce two key assumptions: increasing returns to scale and consumers love for variety. Under the assumption of increasing returns to scale, large firms have a cost advantage over smaller firms and monopolistic competition ensues. Opening up to trade means firms can serve a larger market and hence reduce costs and consumers can benefit from an increased range of varieties. Increased competition may also force prices down but consequently forcing smaller firms out of the market. Brander and Krugman (1983) add that intra-industry trade may take place even in instances in which goods are homogenous.

Domestic monopolists may enter foreign markets at a lower price than that charged for goods at home market leading to the prospect of reciprocal dumping‘: two-way trade in the same product, even if the goods is identical, the initial prices are equal and trade is costly. Theories of economic geography add another possible explanation for intra-industry trade. The role of external returns to scale is more explicit here. The argument is that geographical location of firms leads to the development of clusters with technological and pecuniary externalities and external economies of scale. The success of the gravity model of trade flows also underlines that distance matters, and proximity to markets is a significant determinant of trade (gravity models also reflect the Linder hypothesis, which proposes that trade often occurs between similar sized economies (Linder, 1961). Lastly, geographically fragmented production sees different stages of the value change dispersed across countries according to factor endowments or labour productivity. This can occur within multinational firms or between firms at different levels of the supply chain. Ether (1982) presents a model through which restricted trade in intermediate goods requires final good production to be located near to intermediate goods, explaining the emergence of industrial clusters.

Debaere (2005) shows that new trade theory doesn‘t hold for non-OECD countries where many of the key assumptions—namely mature industries capable of realizing economies of scale and trading highly differentiated goods—do not reflect realities of African economies. Somewhat crudely we can say that factor endowments determine North-South trade in line with the Heckscher-Ohlin framework, with new trade theories offering insights into North-North trade. However, intra-industry trade is emerging as vital to our understanding of South-South trade.

UNCTAD (2011) suggests three alternative analytical frameworks of South-South trade in which intra-industry trade is pivot. Firstly, the flying geese model (Gray, 1962) of regional industrialization allowed East Asian economies to dovetail on the success of regional leaders. Intra-industry trade here is mechanism for learning, as low flying geese import more sophisticated goods from their neighbors at first as a means of acquiring production know-how which allows for their manufacture for reverse export. Secondly, new-centre-periphery patterns envisage that African countries may be subject to foreign FDI flows in the shape of large multi-national corporations which engage in intra-firm, intra-industry trade, but bring little in terms of diversification or development. Thirdly, the emergence of regional growth poles may lead to external economies of scale and agglomeration economies, allowing for product differentiation and intra-industry trade.

We may add a fourth analytical framework in the shape of regional value chains. In a Ricardian perspective of intra-industry trade relatively capital-intensive economies can specialize in the production of finished products, the intermediate inputs for which can be off shored to relatively labour abundant economies thereby generating region value chains (Falvey, 1981).The importation of raw materials for processing and subsequent re-export is an example of vertical IIT, that in which the traded goods which differ by quality rather than horizontally differentiated goods, which differ by price (Fontagné and Freudenberg, 1997).

3.1.2.3 Neo- Chamberlinian

The other class of models explaining intra-industry trade is the neo- Chamberlinian models. In these models the explanation for intra-industry trade is that goods are "horizontally differentiated", that is varieties differ in their characteristics and this difference may be actual or perceived. Neo-Chamberlinian models consider monopolistic competition and horizontally differentiated goods on the supply side. On the demand side, the model is based on ‘love of variety’ approach. According to this approach all varieties enter the individual’s utility function in a symmetrical fashion; that is, individuals gain utility from greater variety, in other words, from being able to consume more varieties, rather than from being able to consume a preferable variety (Williamson and Milner, 1991).

Fundamental work on demand for variety was done by Dixit and Stiglitz (1977) in the context of a closed economy organized along lines of the Chamberlinian model of imperfect competition. In their model, trade is caused by economies of scale rather than by differences in factor endowments. The Dixit and Stiglitz model was then applied to the open economy by Krugman in a series of articles (Krugman, 1979, 1980, 1982), as well as by Dixit and Norman (1980). Therefore, the essential features of the neo-Chamberlinian model can be illustrated by reference to these authors.

3.1.2.4 Neo-Hottelling

Another group of models are neo-Hottelling models. These are related to neo- Chamberlinian models but differ in terms of how they consider consumers' demand for variety. The neo-Hotelling model, as in the neo-Chamberlinian case, is also based on monopolistic competition and horizontally differentiated products on the supply side of the economy. However, from the demand spectrum, consumer preferences characteristics of the neo-Hotelling model are completely different from those of the neo-Chamberlinian model. While the Dixit-Stiglitz-Krugman model is based on ‘love of variety’ approach, the neo-Hotelling model questions this approach and introduces a new one; the ‘ideal variety’ approach. According to the ‘ideal variety’ approach, individuals have different most preferred locations, in other words mixes of attributes, and each individual consumes only his or her most preferred variety, or the 'nearest available'. Under this approach individuals gain utility from being able to consume preferable variety. The alternative, Chamberlinian, 'love of variety' approach is to claim that all varieties enter the individual's utility function in a symmetrical fashion. Individuals gain utility from consuming more varieties, rather than from being able to consume a preferable variety as in the case of 'ideal variety' approach (Williamson and Milner, 1991).

Later on, Eaton and Kierzkowski (1984) raised horizontal differentiation into a context of oligopoly. They assume that there exists two identical economies and in each of them two groups of consumers with a different "ideal variety" preferences. Then, international trade leads to the existence of only one producer for each of the ideal varieties in each market, which give rise to IIT. In all aforementioned models, each variety is produced under decreasing costs and when countries open up to trade, the similarity of the demands leads to intra-industry trade. Therefore, IIT is more likely to occur between countries with similar factor endowments, so that it cannot be explained by traditional trade theories

Other models include oligopolistic models such as the Brander-Krugman model based on the Cournot duopoly model of behavior. Yet other models includes the reciprocal dumping model where transport cost is taken into consideration, and the vertical differentiation and natural oligopolies model that takes into account the research and development expenditure for the existence of vertically differentiated products.

3.2 Empirical Review

Empirical studies of intra-industry trade are few. Balassa (1986) investigates this trade in developing countries (EU, America and Canada) for the period 1980-1983. He uses country characteristic variables including average per capita income, income inequality, and average country size, inequality in country size, trade orientation, distance, border and common language variables. He employed the widely used gravity model of international trade to measure the determinants of intra industry trade. The key findings were that most of hypotheses put forward were supported in many of them, although some (inequality in country size and average per capita income) were not significant.

Rasekhi and Shojaee (2012) studied factors determining IIT in the agricultural sector for Iran with its main trading partners during the time period between 2001 and 2007. The authors first measured the types of IIT and then assessed the determinants of vertical and total IIT in the agricultural sector using panel data modeling techniques. They used methods developed by Greenaway, Hine and Milner (GHM) applied to a 6-digit Harmonized System (HS) product classification and then analyzed the determinants of total IIT and VIIT using theoretical and experimental models. The authors used level of development, difference in GDP per capita, average GDP, difference in factor endowments, the real exchange rate, and market size difference as independent variables and found economic development and difference in GDP per capita had positive and significant effects on Iran's bilateral IIT. However, factor endowments, the real exchange rate, average GDP, market size differences each impacted the IIT negatively.

Łapinska (2014) reported similar results as those found by Rasekhi and Shojaee (2012) in investigating the country-specific determinants of IIT between Poland and its EU trading partners in agricultural and food products. Her study covered the time period between 2002 and 2011. In 2004, shortly after the beginning of the period of analysis, Poland joined the EU. The author found that agricultural and food products played an important role in Poland's trade with other EU member states. The author also found that the intensity of IIT in agricultural and food products was positively influenced by the intensity of trade with other EU countries. That is, IIT shares were high for those trading partners with which Poland engaged in relatively large amounts of trade (e.g. Germany). The author found that Poland's IIT with other EU member nations increased as a result of its EU membership. She further found that IIT increased in particular with the trading partners with similar Slavic-based languages (related languages and comparable cultures may involve similar kinds of taste). The author found that the degree of the trade imbalance between trading partners, relative differences in the size of the economies and relative differences in levels of economic development each had a negative impact on IIT.

Jámbor (2015) analyzed country and industry-specific determinants of IIT in agri-food products between the Visegrad countries (the Czech Republic, Hungary, Poland and the Slovak Republic) and the European Union during the 1999-2013 period. All four countries became members of the

EU in 2004. The author used the absolute difference in per capita GDP between trading partners, the absolute difference in agricultural area per capita between trading partners, the absolute difference in per capita agricultural labor between trading partners, the absolute difference in per capita agricultural machinery between trading partners, the distance between trading partners' capital cities, the percentage of the labor force employed in the agri-food industry, FDI, and the contribution of value-added agriculture to GDP as explanatory variables. Jámbor found that IIT was mainly of a vertical nature in the Visegrad countries, though the majority of their exports consisted of low-quality value-added agri-food products to the EU markets. The results were obtained by way of a generalized method of moments (GMM) model applied to panel data. The author found that the absolute difference in agricultural area per capita between trading partners, FDI, value-added agriculture and distance were negatively related to IIT, whereas the absolute difference in per capita GDP, the absolute difference in per capita agricultural machinery, the absolute difference in per capita agricultural labor between trading partners were positively related to IIT.

Clark and Stanley (2003) investigated determinants of intra-industry trade between the United States and twenty-two industrial nations. They analyzed the country-level characteristics suggested by modern models of monopolistic competition and trade and industry-level variables relating to imperfect competition, scale economies, and product differentiation. Country-level determinants of intra-industry trade used in the study include relative factor endowment differences, relative country size differences, distance, trade orientation, and the trade balance. Measures of factor intensity, scale economies, market structure, and product differentiation are included as country-level variables. IIT is found to decline with greater differences in relative factor endowments. Economic size and trade orientation of the developing country influence IIT in a positive way. Distance exerts a negative effect on IIT. Results show IIT occurs in nonstandard, made-to-order, vertically differentiated, labor intensive products produced by large globally integrated industries. No support is provided for the role of scale economies in determining North-South IIT.

The study by Clark and Stanley (1999) investigates country- and industry-level determinants of North-South IIT between the United States and the 30 largest developing countries. The study used data on trade flows pertaining to 1992 for 30 developing countries and 300 four-digit U.S. SIC industries. The study found that IIT to fall with greater differences in relative factor endowments (proxied by differences in per capita GDP) between the North and South. Size of the trading partner influences IIT in a positive way. These findings are consistent with predictions of Helpman and Krugman’s (1985) theoretical model. Distance influences IIT in a negative way. Trade orientation of the developing country exerts a positive effect on IIT.

Gonzalez and Valez (1995) presents estimates for the level of intra-industry trade in the 1994 bilateral commerce between the United States and Argentina, Brazil, Chile, Colombia, Mexico, Paraguay, Uruguay, and Venezuela. The findings of the study suggest that intra-industry trade is positively correlated with income, product differentiation, economies of scale and with foreign investment. Furthermore, Mexico and the United States present high levels of intra-industry trade, while the other Latin American countries analyzed have relatively low levels. The paper concludes that Mexico should experience much less difficulty in adjusting to free trade with the United States than the other countries.

Thorpe and Zhang (2005) provide another empirical study for Asian countries for the period 1998-2000. The variables included are both country and industry specific, although the final report concentrates on country specific variables. A modified gravity model of international trade was employed and the result of the study shows that absolute difference in Per Capita Income, Trade orientation and joint market size were significant.

In their seminal work, Grubel and Lloyd (1975) proposed an index measure of intra-industry trade, hereafter referred to as the G-L index, which is now widely accepted. Grubel and Lloyd (1975) pointed out that earlier measures of Intra industry trade possess a downward bias if the country’s total trade is not balanced, implying that the exporting country conditions cannot be matched by imports in every commodity grouping. Grubel and Lloyd (1975) proposed an unadjusted index and adjusted index, derived as the proportion of total trade minus the overall trade balance for aggregation across individual industries.

Prabir De (2006) examined the determinants of bilateral trade in manufactures between Asian developing countries (China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand) and developed countries (UK and USA).They concluded that the key factors that influenced intra industry trade were the country characteristics, such as income per capita, transactional costs depicted by the interaction between distance and tariffs and openness of the economy. In a related study, Thorpe (1993) focused on examining the determinants of intra industry trade of three ASEAN nations, namely, Malaysia, the Philippines, and Singapore and their trading partners over the period 1970-1989. Thorpe (1993) found that, although Singapore played a key role in intra-industry trade among member countries, due partly to its position as entry-port and as the most developed country within the group, the levels of bilateral trade between countries appear to have risen not only with one another, but also with countries outside the region.

Osimani and Leans (2001) investigated the determinants of IIT between 10 Asia - Pacific region countries: China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Taiwan, Singapore, Korea, Thailand and the United States from 1990 through to 1998 by combining cross section and time series observations. They observed that capital endowment and economic size are important determinants of bilateral intra industry trade. In a related study, Menon (1996) considered the ASEAN free trade area (AFTA) using data for manufacturing at 3-digit SITC 5-8 level covering 130 industries. He found that more than 75 percent of the growth in Thailand's intra-ASEAN trade between 1986 and 1991 was due to Intra industry trade growth, while in Malaysia and Singapore the percentage was above 60 percent. For Indonesia and the Philippines, intra industry trade growth accounted for almost half and one third of the growth in intra-ASEAN trade, respectively..

Loertscher and Wolter (1980) points out that joint market size is a very important determinant of intra industry trade, in a large market the supply-induced effect of economies of scale ensures production in large volumes of differentiated products. As Helpman and Krugman (1985) note the larger an economy, the larger its domestic market size and hence a greater possibility to reap economies of scale and increase the variety of products. As pointed out by Hirschberg *et al*. (1994), the specification of gross domestic product (GDP) in purchasing power parity terms enables one to compare the cost of purchasing a comparable basket of goods and services, and this removes the influence of macroeconomic and policy factors that may only influence exchange rate markets and which are not meaningful for international comparisons. Following Stone and Lee (1995), this study measures the market size of three trading partners as gross domestic product for exporting country and destination country. A positive relationship is hypothesized between the market size and the share of IIT.

Linder (1975) argues that dissimilarity in Per Capita Income defines the ability of that country to produce differentiated products. If the size of economies of trading partners is similar, they are likely to trade with each other. The level of per capita income captures, on the demand side, the pattern of demand structure including the degree of quality or sophistication of each product demanded (Loertscher and Wolter, 1980), while on the supply-side it indicates the level of capital-labour ratio (Helpman and Krugman, 1985). The impact of difference in economy size on IIT is indeterminate. On the one hand, a positive sign suggests that capital endowments differ between trading partners and this encourages intra-industry trade. On the other hand, a negative sign suggests that trading partners have similar characteristics and therefore have more intra industry trade (Hu and Ma, 1999).

Veeramani and Ahlström (2009) examined the impact that AFTA has had on intra-industry trade in different commodity groups and the ASEAN member countries during the years 1993-2002. The frequently used Grubel-Llyod index was employed to estimate the degree of intra-industry trade in this cross-country study, and dynamic effects from integration are evaluated by studies of growth rates in trade and intra-industry trade. Hypotheses were obtained from factors expected to increase the degree of intra-industry trade. The factors were: economies of scale and product differentiation, higher per capita income and similarity in per capita income, larger economic size and similarity in economic size and open trade policy, while intra-industry trade measures economic integration within ASEAN in comparison to intra-industry trade with the World. The trade data generally supported the hypotheses, but the intra-industry trade flows indicate that the positive impact from integration within ASEAN is found to be only marginal.

Gustafsson (2005) analyzed the pattern of intra-industry trade (IIT) between Sweden and EU during the time period 1980-2002. Focus was put on the Swedish manufacturing industry, which was divided into the forest, metal and machinery industries. With help of the Grubel-Lloyd index, values were calculated in order to measure the size of IIT with the other Member States and in product groups. Theories about two-way trade argue that countries with similar characteristics have more IIT. The results from the empirical findings show that the Swedish IIT is higher with nearby countries such as Denmark, Finland and Germany. Similar for these countries are the factor endowments, GDP per capita, culture, language, and the closeness to Sweden. The forest industry has more net trade than IIT. In the metal and machinery industries, the IIT is as large as the net trade. Regarding two-way trade within product groups, the analysis proved that products which can be differentiated into more sub-groups have more IIT. A large part of the products have higher net trade than IIT.

Time as a trade barrier has been extensively studied by Hummels (2001). He first observes that air freight has increased substantially relative to sea freight over the past decades and attributes this change partly to a sharp decline in the relative price of air freight and partly to traders' valuation of time. On the basis of data on US trade by commodity category, source of imports, mode of transport, freight rates and time in transit, he estimates the time cost of one day in transit. It is found to be the equivalent of an ad valorem tariff rate of 0.8 per cent, which in turn is equivalent to a 16 per cent tariff rate for an average length ocean shipment. This is much higher than both the US average tariff rate and average freight rates. Furthermore, he finds that each day in transit reduces the probability that a country will export to the US by one per cent for all goods and 1.5 per cent for manufactures. Finally, he argues that time costs are magnified several times in sectors where production is fragmented into vertical production stages. Time in transit probably has a non-linear impact on trade costs. Perishable goods, for instance, have no value upon arrival at the retailer if time in transit exceeds a certain number of days.

Behar (2012) presents a gravity model that accounts for multilateral resistance, firm heterogeneity and country selection into trade, while accommodating asymmetries in trade flows for Middle East and Asian countries. A new equation for the proportion of exporting firms takes a gravity form, such that the extensive margin is also affected by multilateral resistance. He develops a Taylor approximated multilateral resistance terms which captures the comparative static effects of changes in trade costs by using the consumer price index. The key findings are that for isolated bilateral changes in trade frictions, multilateral resistance effects are small for most countries. However, if all countries reduce their trade frictions, the impact of multilateral resistance is so strong that bilateral trade falls in most cases, despite the larger trade elasticities implied by firm heterogeneity. As a consequence, he argues that the world-wide trade response, though positive, is much lower.

Chidoko (2006) tried to establish the determinants of intra industry trade between Zimbabwe and its trading partners in the Southern African Development Community (SADC) region. The study was mainly motivated by the need to establish the type of goods that Zimbabwe trades with its trading partners. The study also wanted to prove the hypothesis that similarity in per capita income is not the main determinant of intra-industry trade between Zimbabwe its SADC trading partners; and also that intra industry trade does not necessarily take place among countries with similar economic structures and level of development. The study used the Modified Standard Gravity Equation which has Intra-Industry Trade Index as its dependent variable. The model was regressed using Ordinary Least Squares in excel**.** The results of the study show that per capita income, trade intensity, distance, exchange rate and gross domestic product explain Intra-Industry Trade (IIT) between Zimbabwe and its SADC trading partners. The study also established that most countries in SADC trade in more or less the same goods and this can be explained by the type of development that these countries were subjected to during the colonial era which resulted in the establishment of similar economic structures and per capita incomes that were more or less the same. As result, these countries produce and trade similar products. Both hypotheses above were proved wrong.

Musonda (1997) used available bilateral trade data between members of the Common Market for Eastern and Southern Africa (COMESA) formerly PTA to estimate the extent of Intra- Industry trade and the factors that determine this trade in the region. The hypothesis was that intra-industry trade exists in this region. The results of the study showed that indeed this trade does exist and it is determined by the same factors as those found in other regions. The principal determinant was distance, which had a negative significant relationship with intra-industry trade.

Other factors included per capita income and language. The study also revealed that trade is more significant in bordering countries that are relatively more developed in terms of their manufacturing sectors. Improved communication networks will enhance this trade within the region.

Empirical studies that have been done in the Southern African region have focused mainly on country specific determinants of intra-Industry trade and have neglected industry specific determinants of intra industry trade such as product differentiation, economies of scale, capital intensity and factor endowments. The studies have also not taken into account the multilateral (price) resistance term and the interaction variable between distance and tariffs to represent transportational costs. The studies have also neglected the joint market size hypothesis. The studies have also not compared the patterns of South-South IIT and North-South IIT. It is these gaps that this paper attempts to fill.

CHAPTER FOUR

METHODOLOGY

This section outlines the methodology that was employed to analyze both the country specific and industry specific determinants of intra-industry trade between Zambia, Tanzania and South Africa in the three industries of interest namely the food and live animal industry, chemicals and related products industry and the manufacturing industry. Nowadays, in the literature there is a plethora of models and theories about IIT, which cause sometimes a problem in choosing the most appropriate model to explain observed trade patterns. Nevertheless, the majority of empirical studies explain only partially the factors determining intra-industry trade. In particular, they have considered the relevance for intra-industry trade either of industry characteristics to the neglect of country characteristics or of country characteristics to the neglect of industry characteristics. Consequently in this study we combine these two approaches by examining simultaneously two sets of determinants of intra-industry specialization, namely from industry and country sides.

4.1 Theoretical Derivation of the Gravity Model of Trade

The theoretical development of the gravity model can be tracked back Tinbergen (1962). The simplest and standard (or basic) functional form of the gravity equation relates the volume of trade T between country i and country j to the product of each country's GDP Y_j Y_k and to the distance between them D_{jk} as a proxy for transaction costs. Specifically:

T_{jk}=A$\frac{Y_j Y_k}{D_{jk}}$…………………………………Equation 3.1

where $\boldsymbol{A}$ is a constant of proportionality. Distance in this basic formulation of the gravity model basically measures the transportational costs faced by importers and exporters. Distance remains constant over time while reforms in tariff rates are constantly changing.

Prabir De, (2006) attempted to eliminate the biasness of distance as the only measure of transportational costs by adopting an interaction variable between distance and tariffs. He specified transactional costs as:

DT_{jk}=$CT_j^{1\emptyset}T_k^{2\emptyset}D_{jk}^{3\emptyset}e_{jk}$……………………..Equation 3.2

Where DT_{jk} is the transportational costs of goods from country j to country k, C is the constant term, Tj is the tariff level of country j, and $T_k$is the tariff level imposed by country k, Djk is the distance between the two countries, ejk is an error term. Adopting the measure of transportational costs used by Prabir De (2006), the gravity model reduces to:

T_{jk}=A$\frac{Y_jY_k}{DT_{jk}}$………………………………..Equation 3.3

This gravity equation has come under scrutiny, partly because it ignores that the volume of trade from region j to region k should be influenced by trade costs between regions j and k relative to those of the rest-of-the-world, and the economic sizes of the rest-of-the-world regions (and prices of their goods). Lately the theoretical foundations for the gravity equation in international trade has been enhanced to recognize the systematic bias in coefficient estimates of bilateral trade-cost variables from omitting theoretically-motivated endogenous “multilateral (price) resistance” (MR) terms (Baier & Bergstrand ,2009).

Assuming identical, homothetic preferences of trading partners and a constant elasticity of the substitution utility function, Anderson and Wincoop (2003) define multilateral trade resistance as follows:

P_j=($\sum(B_kP_kT_{kj})$.$^{1-\emptyset}$ $)^{\frac{1}{1-\emptyset}}$ …………………………………..Equation 3.4

where P_j is the consumer price index of j. β_k is a positive distribution parameter, p_k is country k’s (exporter’s) supply price, net of trade costs, t_{jk} is the trade cost factor between country j and country k, σ is the elasticity of substitution between all goods. For simplification they assume that the trade barriers are symmetric, that is, $t_{jk}=t_{kj}$. They refer to the price index (P_j or P_k) as multilateral trade resistance as it depends positively on trade barriers with all trading partners.

Feenstra (2003) mentions that once transportation costs or any other border barriers are introduced then prices must differ internationally. Therefore, overall price indexes in each country must be taken into account. This could be done in three ways. (1) Using published data on price indexes, (2) using the computational method of Anderson and van Wincoop (2003) or (3) using country fixed effects to measure the price indexes. In this study, the consumer price index (CPI) which is the inflation variable is added to the model to capture the multilateral trade resistance.

T_{jk}=A$\frac{Y_j Y_k}{DT_{jk} INF_{jk}}$……………………………………Equation 3.5

The gravity model above is said to give relatively good results. However, it is known that there are other factors that may also influence the level of IIT other than the gravity factors cited in the equation above as clearly outlined in the literature review. Variations of this model involve the inclusion of industry specific factors such as product differentiation and economies of scale as explanatory variables (Stanely & Clark, 1999). In the present study, the industry specific factors to be included are product differentiation, economies of scale, capital intensity, factor endowment and categorical aggregation whilst additional country specific factors such as trade orientation, dummy variable for common boarder, dissimilarity in per capita income, trade intensity will be added to the model. For reasons that are ready apparent, this type of model is sometimes known as "the augmented gravity model" (Cheng & Wall, 2004).

4.2 The Empirical Model

To estimate the Standard Gravity equation, we will use the Intra-Industry Trade (IIT) index for each industry, as the dependent variable. We will employ panel data set on the Modified Standard Gravity Model which will include country specific factors such as dissimilarity in per capita income, trade intensity, distance, interaction variable between distance and tariffs, joint market size, Inflation, trade orientation and dummy for common borders as its explanatory variables. These country specific factors will remain constant regardless of the industry been analyzed. In addition, we will add another set of explanatory variables which are industry specific and they will vary from one industry to another except capital intensity which will be constant across the three industries. The industry specific factors to be included are product differentiation, economies of scale, capital intensity, factor endowment and categorical aggregation.

The estimation model is given by:

IIT_{jki}= βX_{jk} + βZ_{jki} + u.........................Equation 3.6

where X is the vector of country specific explanatory variables which will remain constant regardless of the industry been analyzed, Z is a vector of industry specific explanatory variables which will vary from industry to industry, β is the corresponding vector of coefficients, and u is the random error term. J is the trading country, which in this study is Zambia, k is the partner country and i is the industry been considered.

Three industries namely the food and live animals industry, the chemicals and related products industry and the manufacturing industry were analyzed. Thus the regression equation for each specific industry is given as follows:

IIT_{jk}=$B_0 + B_1 GDP_k$*GDP_j+$B_2 DT_{jk} + B_3 INF_{jk}$+$B_4 DIS_{jk} + B_5 PCI_k + B_6 DPCI_{jk} + B_7 TAR_{jk} +$
$B_8 TI_{jk} + B_9 TO_{jk} + B_{10} D_1 + B_{11} PD_{jk} + B_{12} ES_{jk} + B_{13} CI_{jk} + B_{14} FE_{jk} + B_{15} CA_{jk} +$
E_{jk}...........Equation 3.7

Where:
IIT_{jk} = Intra-industry trade index
PCI_k = Per capita income
$DPCI_{jk}$ = Dissimilarity in per capita income
TI_{jk} = Trade intensity
DIS_{jk} = The distance between capitals of trading countries
DT_{jk} = The interaction variable between distance and tariffs (transactional costs)
$GDP_k * GDP_j$ = Joint Market Size
INF_{jk}= The inflation rate
$INFR_{jk}$= The infrastructure Index
TAR_{jk}= Tariff rates

TO_{jk} = Trade orientation
PD_{jk}=Product differentiation
ES_{jk} = Economies of scale
CI_{jk} = Capital intensity
FE_{jk} = Factor endowment
CA_{jk} = Categorical aggregation
D_1 = The dummy for common borders
E_{jk} = error term and Bs are elasticities

At this point, the IIT data has to be counter checked to determine the estimation procedure to use. More specifically, if IIT between j (Zambia) and k (partner country) is in fact zero (0) for some years in an industry, taking logarithms effectively drops such observations from the sample, because log(0) is undefined. There is a good amount of recent evidence to the effect that zeros are in fact surprisingly common in the bilateral international trade matrix (Helpman, 2006). Dropping zeros means we are getting rid of potentially useful information. We might be able to learn something about why some countries trade in some products, but others do not. By only using a portion of the available data, we might be producing biased estimates of the coefficients we are primarily interested in.

There are no zeros (0) in the IIT matrix for the three industries been analyzed. Therefore we can take logarithms in order to interpret our results as elasticities. A logarithmic transformation of the linear model given above yields the following expression:

$$logIIT_{jk}=B_0 + B_1 logGDP_k * GDP_j + B_2 logDT_{jk} + B_3 logINF_{jk} + B_4 logDIS_{jk} + B_5 logPCI_k + B_6 logDPCI_{jk} + B_7 logTAR_{jk} + B_8 logTI_{jk} + B_9 logTO_{jk} + B_{10} D_1 + B_{11} logPD_{jk} + B_{12} logES_{jk} + B_{13} logCI_{jk} + B_{14} logIC_{jk} + B_{15} logCA_{jk} + E_{jk}$$ ……………..Equation 3.8

Where:
$LogIIT_{jk}$ = The logarithm of Intra-Industry Trade (IIT)
$logPCI_k$ = The logarithm of per capita income
$logDPCI_{jk}$ = The logarithm of dissimilarity in per capita income
$logTI_{jk}$ = The logarithm of trade intensity
$logDIS_{jk}$ = The logarithm of distance
$logDT_{jk}$ = The logarithm of the transactional costs
$logGDP_k * GDP_j$ = The logarithm for joint market size
$logINF_{jk}$ = The logarithm of the inflation rate.
$logINFR_{jk}$= The logarithm of the infrastructure index.
$logTAR_{jk}$= The logarithm of the tariff rate

$\log TO_{jk}$ = The logarithm of trade orientation
$\log PD_{jk}$= The logarithm of product differentiation
$\log ES_{jk}$ = The logarithm of economies of scale
$\log CI_{jk}$ = The logarithm of capital intensity
$\log FE_{jk}$ = The logarithm of factor endowment
$\log CA_{jk}$ = The logarithm of categorical aggregation
D_1 = The dummy for common borders. The dummy is in linear form. The dummy assumes values of zero and one, so the natural log of zero is undefined.

4.3 Variables in the model

4.3.1 Intra-industry trade index (IIT) (which is the simultaneous import and export of commodities), is the dependent variable. Adopting the framework developed by Grubel and Lloyd (1975), the unadjusted G-L index, IIT_{jk}, between Zambia and other trading countries is specified as for a good j with exports Xj and imports Mj as:

IIT_{jk}= (1-$\frac{|X_j - Mj|}{X_j + M_j}$)$\times 100$ ……………………Equation 3.3.1

IIT_{jk} is a percentage from 0-100. When IIT_{jk}= 0, it is all inter-industry trade and when IIT_{jk} = 100, it is all intra-industry trade. The standard international trade classification (SITC Rev.4) was used to classify goods into different industrial groupings. As mentioned earlier, the industries analyzed in this study are the food and live animals industry, the chemicals and related products industry and the manufacturing industry. The intra-industry trade index was calculated for each the three industries using the formula above.

4.3.2 Country-specific Variables

A brief account of the country specific variables and their economic relevance in the analysis are discussed below:

4.3.2.1 Per capita income (PCI): Per capita income is the mean income computed for every man, woman and child in a geographic area. It is derived by dividing the total income of a country's population. This measure is rounded to the nearest dollar. Similarity in economic structure enhances trade between countries, so the per capita income is expected to be directly related to IIT.

4.3.2.2 Tariffs (TAR): A tariff is a tax or duty to be paid on a particular class of imports or exports. The level of tariffs has been shown to have a negative effect IIT flows. Specifically, as the level of tariffs decreases, the amount of IIT between trading partners increases (Falvey, 1981).

4.3.2.3 Dissimilarity in per capita income (DPCI): This measure is derived by finding the differences between the per capita incomes of trading partners. The measure is expected to be inversely related to IIT, since the dissimilarity in per capita income depicts different levels of development.

4.3.2.4 Trade intensity (TI): This factor measures how intense trade is, between countries. The assumption is that the more trade is between countries, the higher the IIT. As a result trade intensity is expected to be positively or directly related to IIT. We have measured the factor using the following formula:

$T_i = \frac{X_{j+M_j}}{GDP}$……………………..Equation 3.3.2

Where:

T_i = Trade intensity

Xj = Exports of country j to partner country

Mj = Matching imports from the partner country.

GDP= The economic mass of the trading country.

4.3.2.5 Distance (DIS): The proximity of trading partners is likely to lower search and transaction costs and hence boost bilateral trade. Hence, this measure is negatively related to IIT. It is basically measured as distance in kilometers by road between trading countries capital cities.

4.3.2.6 Transactional costs (DT): The level of both tariff and non-tariff trade barriers has been shown to affect IIT flows. Specifically, as the level of transactional costs decreases, the amount of IIT between trading partners increases (Falvey, 1981). It has been suggested that high transactional costs will result in an increased demand for domestic varieties of the goods concerned due to the increase in the price of the foreign varieties. Decreased inter-industry trade and IIT must ensue. Transaction costs are measured by interacting distance and tariffs.

4.3.2.7 Joint market size (GDP*GDP): The larger the joint markets size of Zambia and its trading partners, the larger the volume of Zambia's IIT. A country with a small domestic market has limited opportunities to take advantage of economies of scale in the production of differentiated goods (Lancaster, 1980 and Helpman, 1981). However, the larger the joint market size of two trading countries, the larger the opportunities for domestic firms in these two countries to take advantage of economies of scale and to produce more varieties of a goods. Because firms can now take advantage of economies of scale, it is cost effective for them to produce different varieties of the same goods and exchange them. The market size is measured by multiplying the GDP of Country J to the GDP of Country K.

4.3.2.8 Inflation rate (INF: Feenstra (2003) mentions that once transportation costs or any other border barriers are introduced then prices must differ internationally. Therefore, overall price indexes in each country must be taken into account. This could be done in three ways. (1) Using published data on price indexes, (2) using the computational method of Anderson and van Wincoop (2003) or (3) using country fixed effects to measure the price indexes. In this study, the consumer price index (CPI) which is the inflation variable is used to capture the multilateral trade resistance. High Inflation is therefore expected to depress Intra-industry trade.

4.3.2.9 Trade orientation (TO): Trade orientation of a developing country will also influence IIT. Falvey’s (1981) model shows countries with lower trade barriers will have higher levels of IIT. Following Stone and Lee (1995), Balassa and Bauwens (1987), and Balassa (1986), trade orientation is proxied by the residuals from a regression of per capita trade (PCT) (exports plus imports) on per capita income (PCI) and population (POP). The share of IIT will be positively correlated with the developing country’s trade orientation (TO). TO is measured as the residuals from the following regression equation:

ln PCT=B_o+B_1ln PCI +B_2ln POP + e ……………………………….Equation 3.3.3

4.3.2.10 Adjacency (D1): This is represented by a dummy for common borders. Countries that share common borders are likely to trade more than countries which do not share borders. Firms in adjacent countries, countries with common language or other relevant cultural features are likely to know more about each other and understand each other's business practices better than firms operating in less similar environments. For this reason firms are more likely to search for suppliers or customers in countries where the business environment is familiar to them. Therefore, common border will capture commonalities in business practices. The dummy variable takes on the value of 1 when analyzing trade between Zambia and Tanzania since the two countries shares a common boarder (Tunduma- Nakonde) and takes on the value of 0 when analyzing trade between Zambia and South Africa since the two countries do not share a common boarder.

4.3.3 Industry-specific factors

Previous empirical studies have included a series of industry-specific factors as determinants of intra-industry trade. Ether's (1982) model predicts that the degree of IIT depends on the relative size and factor endowments of two countries but not on parameters that are related to the degree of product differentiation and economies of scale. Despite this prediction, numerous empirical studies including (Stanely & Clark, 1999) have checked whether product differentiation and economies of scale have any explanatory power over the share of IIT in manufactured goods. The results are mixed because there is no consensus among economists on how to quantify product differentiation and economies of scale. In spite of this problem, this dissertation will attempt to test whether product differentiation and economies of scale have explanatory power on the shares of IIT. The industry specific determinants are discussed more in details as follows:

4.3.3.1 Product differentiation (PD): Product differentiation has long been recognized as a basis for intra-industry trade to occur. In both the horizontal differentiation model and the vertical differentiation model, products with differentiated characteristics accommodate consumers' demand for variety, and thus promote gains from exchange. It follows that industries with higher degrees of product differentiation tend to have higher IIT shares.

Measurement of product differentiation varies in literature. For example, Hufbauer (1970) uses the coefficient of variation of export unit values as a measure of product differentiation. Other studies use different measures for horizontal product differentiation and vertical product differentiation. For example, Greenaway et al. (1994, 1995) use the number of subgroups in an industry as a proxy for horizontal product differentiation. Clark and Stanley (1999) use the advertising-to-sales ratio as a measure of vertical product differentiation based on the rationale that the advertising-to-sales ratio reflects quality intensity in an industry. In the present study, the industry specific product differentiation (PD) between Zambia and its trade partner is calculated by using the Hufbauer Index (1970) as follows;

$HUF_{jk} = \frac{SD_{jk}}{UA_{jk}}$.............Equation 3.3.4

In which *SDjk* is the standard deviation of the export unit values of an individual industry from *j* country (Zambia) to k country (trade partner country) and U*Ajk* is the unweighted average of those unit values. It is expected that PD has a positive effect on IIT.

4.3.3.2 Economies of Scale (ES): In the horizontal differentiation model, although the existence of scale economies is necessary for IIT to occur as demonstrated in Krugman (1979) and Lancaster (1980), it is not obvious that the intensity of scale economies would affect the share of IIT positively. According to Balassa (1986), scale economies may take the form of horizontal and vertical specialization, and in both cases the number of products manufactured is likely to fall. In the vertical differentiation model with oligopoly content (Shaked & Sutton, 1984)), the role of scale economies would be ambiguous since scale economies promote efficiency and raise barriers for entry at the same time. Helpman (1999) surveys the literature and concludes that the intensity of scale economies does not necessarily contribute to the rise in the share of IIT. Tybout (1993) also concludes that the gain in efficiency from scale economies cannot be described as significant. As the result, the sign of scale economies on IIT shares is expected to be ambiguous.

Measurement of industry-specific scale economies usually takes the form of minimum efficient scale accounted for cost disadvantage, as initiated by Caves (1981) and Balassa (1986). Zarzoso (2006) captures economies of scale as the value of products exported from a particular industry. Following his practice, we define industry-level economies of scale as the value of exports from a particular industry.

4.3.3.3 Capital intensity (CI): In the horizontal differentiation model, capital to labor ratio (K/L) at industry level either is ignored or assumed to be homogenous across countries. The nature of the horizontal differentiation model requires that capital intensity for industries be similar for different countries, in order to produce horizontally differentiated products. It thus is expected that diverging capital intensity for industries between countries tends to reduce the basis for horizontal IIT (Stanely & Clark, 1999). Considering the fact that the Zambia is relatively more Labor intensive, its trading partners should be labor intensive too if they are to produce similar products. The K/L data is readily available from the World Bank's World Development Indicators (WDI) computed using labor and gross fixed capital formation data.

4.3.3.4 Factor Endowments (FE): Another determinant of intra industry trade is comparative advantage which is determined by factor endowments. This concept was first presented by David Ricardo which is considered as theoretical foundations of international trade. After Ricardo, This theory was examined and evolved by economists such as Balassa (1965), and today is still valid within the framework of free trade among countries.

To measure comparative advantage, the revealed comparative advantage (RCA) index is used. It is necessary to explain that few studies like Bernatonyte and Normantiene (2009) have used these variables to explain IIT. However, these studies also have been conducted for non-agricultural sectors. Based on Balassa method, relative export advantage (RXA) is measured as follows.

$$RXA=\frac{X_j^p / \sum_p X_j^p}{\sum_j X_p^j / \sum_j \sum_p X_j^p} \text{..Equation 3.3.5}$$

In this relationship X_j^p is the industrial export by country J, $\sum_p X_j^p$ is total export of country j, $\sum_j X_p^j$ world export in that particular industry and $\sum_j \sum_p X_j^p$ is the total world export.

The index of comparative advantage based on Volrath index (1991) (RMA) is the same as Balassa method but is based on imports, as follows:

$$RMA=\frac{M_j^p / \sum_p M_j^p}{\sum_j M_p^j / \sum_j \sum_p M_j^p} \text{..Equation 3.3.6}$$

In this relationship, M_j^p is the industrial import by country j, $\sum_p M_j^p$ is the total import of country J, $\sum_j M_p^j$ is world import in that particular industry and $\sum_j \sum_p M_j^p$ is the total world import.

The main difference between RMA and RXA comes from the difference in the industrial exports and industrial imports of a country. In addition, the trade statistics reported by WITS revealed that there was a minor difference in the world exports and world imports. In a perfect statistical world, the exports of all countries must equal imports of other countries after adjusting for the cost of insurance and freight (known as c.i.f. factor) and other factors (such as exchange rate changes during transit, method of converting trade values to a common currency such as the U.S. dollar known as exchange conversion practices, etc.). As far as international trade is concerned, the world is a closed system so that there is an objective method of estimating the size of measurement errors related to bilateral trade statistics. If discrepancies between the exports and imports of all trading countries grossed up to the world are supposed to be zero in a perfect statistical world, it stands to reason that deviations away from zero would largely capture underlying statistical issues in measurement. However, the difference in world exports and imports were minor, thus these differences need not to invalidate our research results.

Revealed comparative advantage index is calculated as the difference between relative import advantage (RMA) and relative export advantage (RXA): RCA=RXA-RMA

4.4.5. Categorical aggregation (CA)

Empirical evidence shows that IIT is roust for different levels of data aggregation, However, the share of IIT does tend to fall as classification goes to a finer level. As an implication, the more products aggregated in an industry, the more likely for a higher share of IIT to exist. Categorical aggregation thus is expected to have a positive effect on both types of IIT. Following previous studies like Marvel and Ray (1987), and Clark and Stanley (1999), we calculate categorical aggregation as the number of individual products in an industry divided by the total number of subgroups that make up an SITC Rev 4 industry.

4.4 Data sources: The study utilized annual secondary data for the period 1990-2015. Bilateral trade flows values were extracted from COMTRADE (the United Nations Commodity and Trade Database) with Zambia as the reporter country. The GDP, PCI, capital intensity, population & tariffs data set for South Africa and Tanzania was extracted from the World Banks world development indicators (WDI). The GDP & PCI for Zambia was sourced from the Bank of Zambia (BOZ) while population and consumer price index for Zambia was sourced from the Central Statistical Office (CSO). Dissimilarity in per capita income was computed using the PCI data set while trade intensity, economies of scale and relative comparative advantage were computed after collecting exports and imports data from the world integrated trade solutions (WITS).

Zambia was used as a reporter country for uniformity because both South Africa and Tanzania reported different figures with regards to their total volume of trade with Zambia compared to what Zambia reported. Inaccurate reporting of trade data is a major problem among African nations. This however does not need to invalidate our research results because the country has made tremendous strides in recording trade statistics.

4.5 Estimation Technique

The use of panel data methodology in this study can be justified based on its advantages;

1) Panel data analysis allows control of heterogeneity of cross-sectional units.
2) Generates more variability, more degrees of freedom and at the same time reduces multicollinearity problems thereby improving the efficiency of the econometric estimates.

4.6 Estimation Models

There is a distinction in the literature between static and dynamic panel data models. Static panel data models include the fixed effects and the random effects methods, while dynamic panel data models are those that include a lagged dependent variable as an explanatory variable. This study, however, considers the static panel data models as opposed to the dynamic panel data models because in the dynamic panel data models, the lagged dependent variable is correlated with the error component which complicates estimation and therefore yields biased and inconsistent estimates.

CHAPTER FIVE

RESULTS AND DISCUSSOINS

5.1 Diagnostic Test Results

The following is a brief description of the diagnostic tests conducted. It briefly describes the consequences of each problem, and ways of identifying and solving it. Stata Version 13 was used to carry out these tests.

Testing for multicollinearity using the correlation matrix shows that there are a number of correlations greater than 0.8 (Results are shown in Appendix 1). Most of the correlations are caused by the Per capita Income (PCI), dummy variable for common boarders (D1) and trade intensity (TI) variables. With the presence of exact multicollinearity, the least square estimator is not defined. With nearly exact multicollinearity, some of the variances, standard errors and covariances of least squares estimators may be large. This may lead to high sampling variability, an estimated coefficient that is unstable to small changes in the sample or model misspecification, interval estimates that are wide, and relatively imprecise information provided by the sample data but with unknown parameters. Moreover, estimates may be very sensitive to the addition or deletion of a few observations. In this study, multicollinearity has been identified using two different methods: examining matrix correlations between variables, (as rule of thumb a correlation coefficient greater than 0.8 indicates the presence of collinearity), running auxiliary regressions; and calculating the variance inflation factor (VIF) which tells us how much larger the standard errors of a slope have grown because of the presence of collinearity, (as a rule of thumb, a variable whose VIF values are greater than 10 may have a collinearity problem).

Therefore, trade intensity, dummy variable for common boarder and per capita income variables have to be dropped from our model to correct for multicollinearity. The distance variable was found to be collinear with the interaction variable between distance and tariffs; as a result distance was not included in the model after the interaction variable was introduced.

Results from the likelihood ratio test for heteroskedasticity shown in appendix 3.1, 4.1 and 5.1 indicate the presence of heteroskedasticity across panels in all the three industries. Under heteroskedasticity, estimators remain unbiased and consistent; however, the estimated variances and standard errors for the estimates of the coefficients (betas) are biased and inconsistent. Therefore, a hypothesis testing is no longer valid under heteroskedasticity. Heteroskedasticity is tested in this study using the Breusch-Pagan/Cook- Weisberg Test. This tests the null hypothesis that the error variances are all equal against an alternative that the error variances are a multiplicative function of one or more variables. A large chi-square would indicate that heteroskedasticity is present. Where the null hypothesis is rejected, the feasible generalized least square method was used to correct for heteroskedasticity.

The study tested for autocorrelation using the wooldridge test for autocorrelation in panel data and the results are presented in appendix 3.2, 4.2, 5.2 for the three industries. The null hypothesis of no first order autocorrelation was rejected at 10% levels of significance in favor of the alternative hypothesis in all the three industries. Since autocorrelation is regarded as a very big problem it has to be corrected, in this study autocorrelation is corrected by the estimation method used which is the feasible generalized least square method.

5.2 Model Specification

This study uses the random effects model as opposed to pooled and the fixed effects estimation methods. The reasons for this model choice are the following: The Breusch-Pagan test shows that individual effects do indeed exist and therefore pooled OLS is not ideal for all the models (appendix 2). In addition the pooled estimation method has a tendency of giving biased results by ignoring country effects.

This implies that a fixed effects or a random effects model should be chosen. However the fixed effects estimation method does not take time invariant variables such as distance, categorical aggregation and common border into account therefore rendering the Hausman Specification test inappropriate to this study. Lastly, the use of a dummy for each cross-sectional unit in the fixed effects model creates losses in degrees of freedom. It is for the above reasons that the random effects model is the most appropriate for this study.

Given the results from the diagnostic tests for heteroskedasticity and autocorrelation, which shows that the disturbance variance of the country-specific effects varies across countries (heteroskedastic) and the errors are serially correlated over time (autocorrelation), it is important to control for both heteroskedasticity and autocorrelation. Therefore, in order to obtain consistent and efficient estimators the model is estimated by the Feasible Generalized Least Squares (FGLS) in the random effects model. The assumption behind FGLS is that all aspects of the model are completely specified; here that includes that the disturbances have different variances for each panel and are constant within panel. The advantage of FGLS estimation in the random effects model is that it is able to handle both heteroskedasticity and serial correlation.

5.3 Model Estimation and Discussion of Results

The empirical results from the regression using Feasible Generalized Least Squares (FGLS) in the random effects model are reported in this subsection.

Table 4.1 Estimation results for the three industries

Variable	Food and live animals Industry	Chemicals and related products Industry	Manufactured goods classified chiefly by material Industry
Joint market size (l_gdp* l_gdp)	0.9973***	7.2**	0.366**
Dissimilarity in per capita income (l_dpci)	-0.01389**	-0.197	-3.396***
Inflation rate (l_inf)	-0.00011	-0.831	-0.427
Trade orientation (l_to)	0.00738	2.699**	-0.286
Tariff rates (l_tar)	-0.0138	-0.809	-0.278

Product differentiation (l_pd)	-0.00564**	-0.106	0.94*
Economies of Scale (l_es)	0.00212	-4.667**	0.136
Capital intensity (l_ci)	0.00768	-5.740***	0.620
Factor endowments (l_fe)	0.00405**	-0.4939	-3.018***
Categorical aggregation (l_ca)	-0.00070	-0.517	0.173
Interaction Variable between distance and tariffs (DT)	-0.0164*	-3.345**	0.938

* denotes significance at 10%, ** denotes significance at 5%, *** denotes significance at 1%.
Number of observations = 52
Number of groups = 2
Time periods = 16

Joint market size is found to be statistically significant in all the three industries and positively related to IIT, which suggests that the larger the size of the market the larger the IIT across countries. The results show that an increase by 1 percent of the market size will increase the proportion of IIT between that trading partner and Zambia by 0.99 % in the food and live animals industry, 7.2 % in the chemicals and related products industry and 0.3% in the manufacturing industry.

These results are consistent with the theoretical predictions of Lancaster (1980) and Falvey and kierzkowski (1987), as well as with the empirical findings of Rose (2004). A country with a small domestic market has limited opportunities to take advantage of economies of scale in the production of differentiated goods (Lancaster & Helpman, 1981). However, the larger the joint market size of two trading countries, the larger the opportunities for domestic firms in these two countries to take advantage of economies of scale and to produce more varieties of a good which ultimately will lead to an increase in intra-industry trade.

Dissimilarity in per capita income is statistically significant in the food and live animals industry and in the manufacturing industry but not significant in the chemicals and related products industry. The results show that an increase by 1 percent of the difference in per capita income will reduce the proportion of IIT between that trading partner and Zambia by 0.013% in the food and live animals industry and 3.3% in the manufacturing industry. Dissimilarity in per capita income in this study reflects the Linder hypothesis which asserts that tastes of consumers are strongly influenced by their income levels; the per capita income level of a country will yield a particular pattern of tastes. A country's ability to export depends on domestic demand, so that countries that demand similar goods will trade more with each other than will countries with dissimilar demands (Linder, 1961). Thus as the difference in per capita income increases, the level of IIT should decrease.

Intra-industry trade is negatively correlated with DPCI in the two industries, indicating differences in demand structures and/or differences in resource endowments. If is interpreted as an indicator of demand structure, a greater difference in PCI implies that demand structures have become more dissimilar. This indicates that the potential for intra-industry trade decreases. For trade to exist between two countries, there must in each country be a demand for products of high quality produced by the other. Therefore, when the difference between the per capita incomes of two trading partners is greater, the scope for intra-industry trade tends to be smaller. These results are consistent with other empirical findings by (Helpman & Krugrnan 1985).

Trade orientation is statistically significant only in the chemicals and related products industry. The results show that an increase by 1 percent of the trade orientation will increase the proportion of IIT between that trading partner and Zambia by 2.69% in the chemicals and related products industry. This result is contradictory to what theory posits. A number of empirical results for the impact of trade barriers are generally consistent with the conclusion that these impediments to trade are negatively correlated with IIT. The general consensus is that trade orientation is not an important factor in determining the level of IIT among the three countries.

Product differentiation was found to be significant in the food and live animals industry and the manufacturing industry. The results show that an increase by 1 percent of the product differentiation will reduce the proportion of IIT between that trading partner and Zambia by 0.005% in the food and live animals category and increase the proportion of IIT by 0.94% in the manufacturing industry. Product differentiation has a positive effect on IIT in the manufacturing industry because manufactured goods are easily differentiated compared to agricultural products. PD is a demand-side factor that accounts for IIT because differentiated products can satisfy consumer demand for variety. The more differentiated the goods of an industry, the larger the IIT flows in these goods (Krugman, 1979, 1980; Lancaster, 1980; & Helpman, 1981).

Product differentiation for the food and live animals industry was found to be negatively related to IIT which is contrary to what theory posits. Empirical tests involving product differentiation in a given industry have been made very difficult by the ambiguity and complex nature of the concept (Byun and Lee, 2005). This is because products that are made up of a diverse and extensive set of attributes present researchers with a challenging measurement problem with respect to their individual degrees of product differentiation. Furthermore, the problem may be compounded where products comprise a mixture of horizontal and vertical differentiation, or a mixture of horizontal and technological differentiation. Indicative of the problem may be the fact that although the majority of empirical studies pursue the hypothesis that IIT is positively related to the degree of product differentiation, some have found that this determinant is negatively related to IIT. These latter include Caves (1981) and Marvel and Ray (1987).

The economies of scale variable is only significant in the chemicals and related products industry. The results show that an increase by 1 percent of the economies of scale will reduce the proportion of IIT between that trading partner and Zambia by 4.6% in the chemicals and related products industry. The theoretical expectations is that there is supposed to be a positive relationship between economies of scale and IIT, however Caves (1981) and Milner (1984) have shown that there is a negative relationship between economies of scale and extent of IIT when an industry's minimum efficient scale of production is small relative to the total market size. In such cases, this outcome stems from the wide range of differentiated product varieties that are produced within each country by a large number of firms in an industry. As a consequence, there will be little or no need for IIT. Conversely, if the minimum efficient scale were large relative to the size of the market, this would result in a few dominant firms in an industry deterring the entry of new firms and producing more standardized than differentiated products. In this case, the impact on IIT would be negative. This explains why economies of scale have a depressing effect on IIT in the chemicals and related products industry.

Capital intensity was found to be significant only in the chemicals and related products industry. The results show that an increase by 1 percent of the economies of scale will reduce the proportion of IIT between that trading partner and Zambia by 5.7% in the chemicals and related products industry. These results are in line with the findings of (Stanely & Clark, 1999) who conclude that the nature of the horizontal differentiation model requires that capital intensity for industries be similar for different countries, in order to produce horizontally differentiated products. It thus is expected that diverging capital intensity for industries between countries tends to reduce the basis for horizontal IIT.

The factor endowment variable which was proxied by the revealed comparative advantage (RCA) index was found to be significant in the food and live animals industry and the manufacturing industry meaning Zambia's foreign trade in the two industries is determined by comparative advantage. The results show that a 1 percentage increase in factor endowment will increase the proportion of IIT between that trading partner and Zambia by 0.0045% in the food and live animals category and reduce the proportion of IIT by 3.018% in the manufacturing industry. The coefficient of the revealed advantage variable is negative and statically significant in the manufacturing industry. Based on this result, it seems that the comparative advantage has a negative effect on the IIT. This result is not surprising because the manufacturing industry is characterized by high competition (Rasekhi & Shojaee, 2006).

The interaction variable between distance and tariffs was significant in the food and live animals industry and the chemicals and related products industry. The results show that a 10 percentage increase in the transportational/ transactional costs of trading partners measured by the interaction variable between tariffs and distance (DT) will reduce the proportion of IIT by 0.164% in the food and live animals industry and by 33.3% in the chemicals and related products industry. This is in line with what theory posits-that trade liberalization reduces trade costs thereby increasing trade flows among liberalizing countries (Falvey, 1981). The level of both tariff and non-tariff trade barriers has been shown to affect IIT flows. Specifically, as the level of transportational/transactional costs decreases, the amount of IIT between trading partners increases (Ibid). It has been suggested that an increase in transportational/transactional costs will result in an increased demand for domestic varieties of the goods concerned due to the increase in the price of the foreign varieties. Decreased IIT must therefore ensue.

Categorical aggregation, tariffs and the Inflation rate were found to be insignificant across the three industries. It is not surprising that the proxy for multilateral trade resistance (inflation) was insignificant because multilateral trade resistance is said to have a minimal impact on small countries like Zambia. This is in line with Behar (2012) who argues that except for the largest countries, the dampening due to MR effects is small for bilateral changes in trade costs. One implication is that most analyses of trade agreements between two countries (and by extension a handful of countries) can ignore MR effects for practical purposes.

5.4 Robust test of Results

A robust test was carried out for the country specific determinants of IIT and the results are shown in appendix 6. The intra-industry trade index was calculated for each industry using the formula in equation 3.3.1 and a weight was assigned to the overall IIT depending on the volume of trade in a particular industry as a ratio of the total trade flows. The results from the robust test support our earlier findings on the impact of joint market size and transactional costs on IIT.

CHAPTER SIX

CONCLUSION AND POLICY IMPLICATIONS

This study has presented the econometric results from the random effects model (REM) in the three industries namely the food and live animals industry, the chemicals and related products industry and the manufacturing industry. The empirical results establish the extent of the existence of IIT between Zambia and its trading partners in the southern African region (Tanzania and South Africa) in the three industries of interest. The results suggest that both country specific and industry specific factors are important in explaining intra industry trade flows. The significant factors in explaining IIT between Zambia and its trading partners in the southern African region are; Joint market size, dissimilarity in per capita income, trade orientation, the interaction variable between tariffs and distance acting as a proxy for transactions costs, product differentiation, economies of scale, capital intensity and the revealed comparative advantage variables.

The multilateral price resistance term (inflation), tariffs and categorical aggregation variables are statistically insignificant. Apart from the positive sign of the trade orientation variable, the results are consistent with other empirical studies by Balassa (1986), Clark and Stanely (1999), Ekanayake (2001), Chidoko, et al. (2006) and many others. The results give policy makers insights to design strategies for improving overall trade in the region.

The estimated results reveal that the larger the joint market size of Zambia and its trading partners, the greater the total IIT flows that are generated in all the three industries. This indicates that, through intra-industry trade, Zambian firms have the scope to utilize economies of scale through increased production runs that enable unit costs to be reduced. It also allows the number of varieties of goods consumed in Zambia to be increased because Zambian consumers enjoy the benefits of foreign produced varieties.

The findings concerning the dissimilarity in per capita income were that it is negatively related to the IIT. A bigger difference in PCI implies that demand structures have become more dissimilar. This indicates that the potential for intra-industry trade decreases. For trade to exist between two countries, there must in each country be a demand for products of high quality produced by the other. Therefore, when the difference between the per capita incomes of two trading partners is greater, the scope for intra-industry trade tends to be smaller.

The overall effect of product differentiation on IIT was found to be ambiguous since it was negative for the food and live animals industry and positive for the manufacturing industry. Empirical tests involving product differentiation in a given industry have been made very difficult by the ambiguity and complex nature of the concept (Byun and Lee, 2005). This is because products that are made up of a diverse and extensive set of attributes present researchers with a challenging measurement problem with respect to their individual degrees of product differentiation and there is no consensus among economist on how product differentiation is measured. Furthermore, the problem may be compounded where products comprise a mixture of horizontal and vertical differentiation, or a mixture of horizontal and technological differentiation. Thus it is difficult to predict how product differentiation affects IIT.

The findings concerning economies of scale was that it is negatively related to IIT in the chemicals and related products industry. A negative relationship between economies of scale and extent of IIT is expected when an industry's minimum efficient scale of production is small relative to the total market size. In such cases, this outcome stems from the wide range of differentiated product varieties that are produced within each country by a large number of firms in an industry. As a consequence, there will be little or no need for IIT. Conversely, if the minimum efficient scale were large relative to the size of the market, this would result in a few dominant firms in an industry deterring the entry of new firms and producing more standardized than differentiated products (Caves, 1981).

The findings concerning capital intensity was that it is negatively related to IIT in the chemicals and related products industry. Thus Zambia imports high quality capital intensive products from its trading partners and exports lower quality labor intensive products falling under the same industry classification.

The overall effect of the reveled comparative advantage on IIT was found to be ambiguous since it was positive for the food and live animals industry and negative for the manufacturing industry. The general consensus however, is that the revealed comparative advantage affects the level of IIT but we cannot specifically pin point the direction of the causality

The relevant finding concerning the transactional costs (interaction variable between tariffs and distance) was that they are negatively related to Zambia's IIT. To enhance IIT in the region, Southern African countries should pursue further reduction in tariffs and improve road and rail networks in the region in order facilitate swift trade.

6.1 Policy Implications

The results of this study summarized above give us the following policy implications:

Firstly, joint market size has been found to be one aspect that can increase IIT. Therefore policy must be aimed at encouraging economic growth and integration through expanding the production sectors of the economy and entering into regional trading blocs. In order to achieve this, this study recommends that policy makers put in place stabilization policies and an attractive business environment which will attract Foreign Direct Investment and spur economic activities and ultimately increase the gross domestic product in the region.

This study has also established that transactional costs depress IIT. It is therefore recommended that trade costs should be reduced further through reduction in tariffs and improving road and rail networks in the region in order facilitate swift trade. Reduction in transactional costs is also very important because it leads to improved resource allocation, more choices for consumers and producers, emergence of relatively more rational market structures, transfer of technology and various other dynamic benefits. Therefore, this study recommends the simplification of import procedures, reduction or elimination of quotas, and rationalization of the tariff structures in the Southern African Region.

The Linder hypothesis has also been upheld as one of the variables that decreases IIT due to differences in tastes and demand structures across countries. Therefore, this study recommends that Zambian firms should invest in research and development (R&D) in order to develop new and better varieties in the existing lines of production to meet the demands of advanced consumers with higher incomes like South Africa.

Product differentiation has been found to be statistically significant and one aspect that can increase IIT in the manufacturing industry. Therefore, this study recommends that firms in this industry should try to convert their ordinary products into brand royalty products. The objective is to establish brand equity. Consumer tastes differ in innumerable ways, more so than the varieties of products manufactured by any given country and Zambian firms can maximize on this aspect and attempt to get a decent share of the foreign market.

It has also been established that economies of scale in the chemicals and related products industry reduces the level of IIT. Thus the industry might be enjoying diseconomies of scale which are the cost disadvantages that firms accrue due to increase in firm size or output, resulting in production of goods and services at increased per-unit costs. This typically follows the law of diminishing returns, where further increase in size of output will result in even greater increase in average cost. This concept is the opposite of economies of scale. It is therefore recommended that government should step in and assess the performance of the Nitrogen Chemicals of Zambia which is the biggest firm in this industry to ensure that it's operating at its lowest average output cost and try to recognize any external diseconomies of scale. In addition, on reaching the lowest average cost, it must either expand to other countries to increase demand for its products, or seek new markets or produce new products that do not compete with its original products.

Capital intensity was found to be negatively related to IIT in the chemicals and related products industry. Therefore the study recommends that Zambia should strike a balance between producing labor intensive goods and capital intensive products. If an economy has a rigid pattern of specialization, then, in the long term, when the labor force reserve has been exhausted, the level of output will be lower than if specialization had relied on capital-intensive commodities with higher labor productivity (assuming that the labor surplus has been indeed absorbed). Over specialization in labor-intensive goods also means that total wages would be high, which in turn leads to greater consumption and, therefore, lower savings and investment coefficients. With this, the investment process, or capital accumulation, is limited, and economic growth can be hampered. Specialization in labor-intensive goods could also have a negative effect on technological progress. Frequently, the technology generating industries have a long maturing process. It is precisely for this reason that it is necessary to start them in the relatively early stages of industrialization. Lastly, over specialization in labor-intensive products results in the loss of competitiveness and the resulting reduction in export dynamics in an economy. This is allegedly due to the fact that income and price elasticity of demand for these products on world markets are small, which is itself the reason for the slow growth of exports (Prebisch, 2005). It is for these reasons that Zambia should not solely focus on labor-intensive products.

6.2 Limitations

In any research project there are inevitably some limitations that need to be acknowledged.
The present study is no exception. In particular, the outcomes of this study were limited by the method of research chosen, as well as by time restrictions and data availability. However, these limitations need not invalidate the research results. Rather, they involve factors that are relevant but that have not been incorporated into the present study for one reason or another. Nonetheless, it is appropriate that the limitations are taken into consideration when interpreting these results and making related policy decisions. The key limitations are discussed below.

Several issues can be raised in connection with the Grubel-Lloyd Index in calculating intra industry trade, despite its common use. One of the problems is classification difficulties. Many countries classify data differently, which introduces arbitrariness or randomness. This can be exacerbated by the level of aggregation of the SITC groupings. The intra-industry trade measure may be a function of the level of aggregation and thus suffer from categorical aggregation problems as it is a weighted average of the indexes for the next most dis-aggregated groups.

Another problem is that it is difficult to offer a precise policy implication based on intra-industry trade as calculated from the index. For example, if intra-industry trade is high, it does not necessarily imply that the country should increase its export or imports. The same applies when the intra-industry trade is low. Based on this, calculating intra-industry trade can thus be more interesting as an academic exercise rather than for its policy implications.

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APPENDICES

Appendix 1

Results for multicollinearity tests

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. corr l_iit l_pci l_dpci l_ti l_dis l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT d1
(obs=52)
```

	l_iit	l_pci	l_dpci	l_ti	l_dis	l_gdp	l_inf	l_to	l_tar	l_pd	l_es	l_ci	l_fe	l_ca
l_iit	1.0000													
l_pci	0.5085	1.0000												
l_dpci	0.3707	0.7653	1.0000											
l_ti	0.9186	0.4598	0.2910	1.0000										
l_dis	0.5937	0.8445	0.6209	0.5064	1.0000									
l_gdp	0.5015	0.8514	0.7303	0.4404	0.7339	1.0000								
l_inf	0.0925	-0.0195	0.0001	0.0891	-0.0366	-0.0262	1.0000							
l_to	-0.2384	-0.1933	-0.3224	-0.3004	-0.1832	-0.0497	0.0232	1.0000						
l_tar	-0.0837	-0.1751	-0.0504	-0.1186	-0.2585	-0.0248	0.0785	0.1483	1.0000					
l_pd	0.5923	0.9687	0.6782	0.5538	0.8841	0.8080	-0.0506	-0.2562	-0.2206	1.0000				
l_es	-0.1271	0.1734	0.0962	-0.1739	0.1423	0.1047	0.1180	0.2742	-0.0222	0.1172	1.0000			
l_ci	0.9976	0.5127	0.3781	0.9117	0.5994	0.5101	0.0892	-0.2254	-0.0651	0.5948	-0.1214	1.0000		
l_fe	0.5938	0.8447	0.6211	0.5064	1.0000	0.7341	-0.0366	-0.1832	-0.2584	0.8843	0.1423	0.5994	1.0000	
l_ca	-0.3075	-0.5046	-0.6114	-0.1945	-0.5910	-0.4436	0.2995	0.3589	0.2072	-0.5010	0.0025	-0.3149	-0.5910	1.0000
DT	-0.8550	-0.7086	-0.4818	-0.7782	-0.7079	-0.6839	-0.0409	0.0745	0.1470	-0.7556	0.0736	-0.8517	-0.7081	0.3515
d1	-0.6108	-0.9324	-0.7526	-0.5281	-0.9443	-0.8407	-0.0145	0.1942	0.1976	-0.9386	-0.1296	-0.6176	-0.9444	0.5849

Appendix 2

Results for the Breusch-Pagan Test

```
. xttest2

Correlation matrix of residuals:

         __e1      __e2
__e1   1.0000
__e2  -0.0081   1.0000

Breusch-Pagan LM test of independence: chi2(1) =     0.002, Pr = 0.9670
Based on 26 complete observations

. xttest2

Correlation matrix of residuals:

         __e1      __e2
__e1   1.0000
__e2  -0.0081   1.0000

Breusch-Pagan LM test of independence: chi2(1) =     0.002, Pr = 0.9670
Based on 26 complete observations
```

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        l_iit[country,t] = Xb + u[country] + e[country,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                   l_iit |   .6577193       .8109989
                       e |   .0029092       .0539366
                       u |          0              0

        Test:   Var(u) = 0
                             chibar2(01) =     0.00
                          Prob > chibar2 =   1.0000
```

Appendix 3

Results for the food and live animals industry

3.1 Test for heteroskedasticity

```
. * 2 Heteroskedasticity Test (BP)
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of l_iit

         chi2(1)      =     3.18
         Prob > chi2  =   0.0746
```

3.2 Test for Autocorrelation

```
. * 3 Wooddridge Autocorrelation Test
. // installs wooldridge test into STATA
. net sj 3-2 st0039

------------------------------------------------------------------------------
package st0039 from http://www.stata-journal.com/software/sj3-2
------------------------------------------------------------------------------

TITLE
      SJ3-2 st0039.  Testing for serial correlation in linear ...

DESCRIPTION/AUTHOR(S)
      Testing for serial correlation in linear panel-data models
      by David M. Drukker, Stata Corporation
      Support:  ddrukker@stata.com
      After installation, type help xtserial

INSTALLATION FILES                               (type net install st0039)
      st0039/xtserial.ado
      st0039/xtserial.hlp

ANCILLARY FILES                                  (type net get st0039)
      st0039/xtserial.do
------------------------------------------------------------------------------

. net install st0039
checking st0039 consistency and verifying not already installed...
all files already exist and are up to date.

. .

. xtserial l_iit l_dpci l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,       1) =    237.166
           Prob > F =      0.0413
```

3.4 Regression results for the Food and live animals industry

```
. xtgls l_iit l_dpci l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT, igls panels(heteroskedastic)
Iteration 1: tolerance = .02108055
Iteration 2: tolerance = .01689972
Iteration 3: tolerance = .00741027
Iteration 4: tolerance = .00275531
Iteration 5: tolerance = .00099079
Iteration 6: tolerance = .00035322
Iteration 7: tolerance = .00012559
Iteration 8: tolerance = .00004461
Iteration 9: tolerance = .00001584
Iteration 10: tolerance = 5.626e-06
Iteration 11: tolerance = 1.998e-06
Iteration 12: tolerance = 7.096e-07
Iteration 13: tolerance = 2.517e-07
Iteration 14: tolerance = 8.935e-08


Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   no autocorrelation

Estimated covariances      =         2          Number of obs      =        52
Estimated autocorrelations =         0          Number of groups   =         2
Estimated coefficients     =        12          Time periods       =        26
                                                Wald chi2(11)      =  31024.59
Log likelihood             =  104.7564          Prob > chi2        =    0.0000
```

l_iit	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
l_dpci	-.0138853	.0067061	-2.07	0.038	-.027029	-.0007416
l_gdp	.9973797	.0175291	56.90	0.000	.9630233	1.031736
l_inf	-.0001171	.0221457	-0.01	0.996	-.0435219	.0432877
l_to	.0073862	.0123556	0.60	0.550	-.0168304	.0316027
l_tar	-.0138992	.0181335	-0.77	0.443	-.0494403	.0216419
l_pd	-.0056467	.0028397	-1.99	0.047	-.0112125	-.0000809
l_es	.0021243	.0030489	0.70	0.486	-.0038514	.0081
l_ci	.00768	.0054175	1.42	0.156	-.0029382	.0182982
l_fe	.0040514	.0019745	2.05	0.040	.0001814	.0079214
l_ca	-.0007032	.0026223	-0.27	0.789	-.0058429	.0044364
DT	-.016412	.008825	-1.86	0.063	-.0337086	.0008846
_cons	-1.626123	.8893853	-1.83	0.067	-3.369286	.1170403

Appendix 4

Results for the chemicals and related products Industry

4.1 Test for heteroskedasticity

```
. * 2 Heteroskedasticity Test (BP)
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of l_iit

         chi2(1)      =    48.95
         Prob > chi2  =   0.0000
```

4.2 Test for Autocorrelation

```
. * 3 Wooddridge Autocorrelation Test
. // installs wooldridge test into STATA
. net sj 3-2 st0039
-------------------------------------------------------------------------------
package st0039 from http://www.stata-journal.com/software/sj3-2
-------------------------------------------------------------------------------

TITLE
      SJ3-2 st0039.  Testing for serial correlation in linear ...

DESCRIPTION/AUTHOR(S)
      Testing for serial correlation in linear panel-data models
      by David M. Drukker, Stata Corporation
      Support:  ddrukker@stata.com
      After installation, type help xtserial

INSTALLATION FILES                               (type net install st0039)
      st0039/xtserial.ado
      st0039/xtserial.hlp

ANCILLARY FILES                                  (type net get st0039)
      st0039/xtserial.do
-------------------------------------------------------------------------------

. net install st0039
checking st0039 consistency and verifying not already installed...
all files already exist and are up to date.

. .

. xtserial l_iit l_dpci l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,       1) =    131.663
           Prob > F =      0.0553
```

4.3 Regression Results for the chemicals and related products industry

```
. xtgls l_iit l_dpci l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT, igls panels(heteroskedastic)
Iteration 1: tolerance = .12890487
Iteration 2: tolerance = .0387488
Iteration 3: tolerance = .01199555
Iteration 4: tolerance = .00362029
Iteration 5: tolerance = .00108545
Iteration 6: tolerance = .00032484
Iteration 7: tolerance = .00009716
Iteration 8: tolerance = .00002906
Iteration 9: tolerance = 8.689e-06
Iteration 10: tolerance = 2.598e-06
Iteration 11: tolerance = 7.769e-07
Iteration 12: tolerance = 2.323e-07
Iteration 13: tolerance = 6.948e-08


Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   no autocorrelation

Estimated covariances      =         2          Number of obs      =        52
Estimated autocorrelations =         0          Number of groups   =         2
Estimated coefficients     =        12          Time periods       =        26
                                                Wald chi2(11)      =     37.73
Log likelihood             = -144.3238          Prob > chi2        =    0.0001
```

l_iit	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
l_dpci	-.1974131	.6523565	-0.30	0.762	-1.476008	1.081182
l_gdp	7.219789	3.517125	2.05	0.040	.3263504	14.11323
l_inf	-.8314732	.9521584	-0.87	0.383	-2.697669	1.034723
l_to	2.699346	1.282614	2.10	0.035	.1854679	5.213224
l_tar	-.8094897	.534566	-1.51	0.130	-1.85722	.2382403
l_pd	-.1062394	.4929063	-0.22	0.829	-1.072318	.8598393
l_es	-4.667438	1.628723	-2.87	0.004	-7.859677	-1.475199
l_ci	-5.740221	1.743088	-3.29	0.001	-9.156611	-2.323831
l_fe	-.4939074	.3332115	-1.48	0.138	-1.14699	.1591752
l_ca	-.5179522	.4526008	-1.14	0.252	-1.405033	.3691289
DT	-3.345591	1.244272	-2.69	0.007	-5.784319	-.9068635
_cons	257.8291	81.21522	3.17	0.002	98.65019	417.008

Appendix 5

Results for the manufactured goods classified chiefly by material Industry

5.1 Test for heteroskedasticity

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of l_iit

         chi2(1)      =     6.34
         Prob > chi2  =   0.0118

. outreg2 using myreg.doc
myreg.doc
dir : seeout
```

5.2 Test for Autocorrelation

```
. // installs wooldridge test into STATA
. net sj 3-2 st0039

-------------------------------------------------------------------------------
package st0039 from http://www.stata-journal.com/software/sj3-2
-------------------------------------------------------------------------------

TITLE
      SJ3-2 st0039.  Testing for serial correlation in linear ...

DESCRIPTION/AUTHOR(S)
      Testing for serial correlation in linear panel-data models
      by David M. Drukker, Stata Corporation
      Support:  ddrukker@stata.com
      After installation, type help xtserial

INSTALLATION FILES                               (type net install st0039)
      st0039/xtserial.ado
      st0039/xtserial.hlp

ANCILLARY FILES                                  (type net get st0039)
      st0039/xtserial.do
-------------------------------------------------------------------------------

. net install st0039
checking st0039 consistency and verifying not already installed...
all files already exist and are up to date.

. .

. xtserial l_iit l_dpci l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,       1) =    142.913
           Prob > F =      0.0531
```

5.3 Regression Results for the manufacturing Industry

```
. xtgls l_iit l_dpci l_gdp l_inf l_to l_tar l_pd l_es l_ci l_fe l_ca DT, igls panels(heteroskedastic)
Iteration 1: tolerance = .02160129
Iteration 2: tolerance = .01016194
Iteration 3: tolerance = .00485952
Iteration 4: tolerance = .00234238
Iteration 5: tolerance = .00113341
Iteration 6: tolerance = .00054944
Iteration 7: tolerance = .00026659
Iteration 8: tolerance = .00012941
Iteration 9: tolerance = .00006283
Iteration 10: tolerance = .00003051
Iteration 11: tolerance = .00001481
Iteration 12: tolerance = 7.194e-06
Iteration 13: tolerance = 3.494e-06
Iteration 14: tolerance = 1.697e-06
Iteration 15: tolerance = 8.239e-07
Iteration 16: tolerance = 4.001e-07
Iteration 17: tolerance = 1.943e-07
Iteration 18: tolerance = 9.434e-08


Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   no autocorrelation

Estimated covariances      =         2          Number of obs      =        52
Estimated autocorrelations =         0          Number of groups   =         2
Estimated coefficients     =        12          Time periods       =        26
                                                Wald chi2(11)      =    207.46
Log likelihood             = -92.10599          Prob > chi2        =    0.0000
```

l_iit	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
l_dpci	-5.596119	1.623448	-3.45	0.001	-8.778018	-2.41422
l_gdp	.3661824	.1954464	1.87	0.061	-.0168855	.7492503
l_inf	-.4277041	.4198454	-1.02	0.308	-1.250586	.3951778
l_to	-.2867466	.2045603	-1.40	0.161	-.6876774	.1141842
l_tar	-.2780664	.2192472	-1.27	0.205	-.707783	.1516502
l_pd	.9418394	.3916072	2.41	0.016	.1743034	1.709375
l_es	.1560657	.1362757	1.15	0.252	-.1110296	.4231611
l_ci	.6205553	.5019192	1.24	0.216	-.3631881	1.604299
l_fe	-3.018309	.4320811	-6.99	0.000	-3.865172	-2.171445
l_ca	.1753153	.2129983	0.82	0.410	-.2421538	.5927844
DT	.9588338	.5453638	1.76	0.079	-.1100595	2.027727
_cons	185.0595	24.95773	7.41	0.000	136.1433	233.9758

Appendix 6

Robust Test for IIT for all the industries

```
. xtgls l_iit l_gdp DT l_inf l_dpci l_ti d1 l_tar, igls panels(heteroskedastic)
Iteration 1: tolerance = .19667187
Iteration 2: tolerance = .02757204
Iteration 3: tolerance = .00445587
Iteration 4: tolerance = .00073527
Iteration 5: tolerance = .00012174
Iteration 6: tolerance = .00002017
Iteration 7: tolerance = 3.341e-06
Iteration 8: tolerance = 5.536e-07
Iteration 9: tolerance = 9.170e-08


Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   no autocorrelation

Estimated covariances      =         2          Number of obs      =        52
Estimated autocorrelations =         0          Number of groups   =         2
Estimated coefficients     =         8          Time periods       =        26
                                                Wald chi2(7)       =  25413.55
Log likelihood             =  102.8402          Prob > chi2        =    0.0000
```

l_iit	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
l_gdp	.9490308	.0291812	32.52	0.000	.8918367	1.006225
DT	-.0153781	.0062411	-2.46	0.014	-.0276103	-.0031458
l_inf	-.1209431	.4331138	-0.28	0.780	-.9698306	.7279444
l_dpci	.0425375	.0258045	1.65	0.099	-.0080383	.0931134
l_ti	.0094668	.0088003	1.08	0.282	-.0077816	.0267151
d1	-.0121239	.0085996	-1.41	0.159	-.0289788	.0047311
l_tar	.8911204	3.168207	0.28	0.779	-5.318452	7.100693
_cons	-2.337494	.134918	-17.33	0.000	-2.601928	-2.073059

Appendix 7

Standard International Trade Classification, Rev.4

0 - Food and live animals

- 00 - Live animals other than animals of division 03
- 01 - Meat and meat preparations
- 02 - Dairy products and birds' eggs
- 03 - Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof
- 04 - Cereals and cereal preparations
- 05 - Vegetables and fruit
- 06 - Sugars, sugar preparations and honey
- 07 - Coffee, tea, cocoa, spices, and manufactures thereof
- 08 - Feeding stuff for animals (not including unmilled cereals)
- 09 - Miscellaneous edible products and preparations

1 - Beverages and tobacco

- 11 - Beverages
- 12 - Tobacco and tobacco manufactures

2 - Crude materials, inedible, except fuels

- 21 - Hides, skins and furskins, raw
- 22 - Oil-seeds and oleaginous fruits
- 23 - Crude rubber (including synthetic and reclaimed)
- 24 - Cork and wood
- 25 - Pulp and waste paper
- 26 - Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)
- 27 - Crude fertilizers, other than those of Division 56, and crude minerals (excluding coal, petroleum and precious stones)
- 28 - Metalliferous ores and metal scrap
- 29 - Crude animal and vegetable materials, n.e.s.

3 - Mineral fuels, lubricants and related materials

- 32 - Coal, coke and briquettes
- 33 - Petroleum, petroleum products and related materials
- 34 - Gas, natural and manufactured
- 35 - Electric current

4 - Animal and vegetable oils, fats and waxes

- 41 - Animal oils and fats
- 42 - Fixed vegetable fats and oils, crude, refined or fractionated
- 43 - Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.

5 - Chemicals and related products, n.e.s.

- 51 - Organic chemicals
- 52 - Inorganic chemicals
- 53 - Dyeing, tanning and colouring materials
- 54 - Medicinal and pharmaceutical products
- 55 - Essential oils and resinoids and perfume materials; toilet, polishing and cleansing preparations
- 56 - Fertilizers (other than those of group 272)
- 57 - Plastics in primary forms
- 58 - Plastics in non-primary forms
- 59 - Chemical materials and products, n.e.s.

6 - Manufactured goods classified chiefly by material

- 61 - Leather, leather manufactures, n.e.s., and dressed furskins
- 62 - Rubber manufactures, n.e.s.
- 63 - Cork and wood manufactures (excluding furniture)
- 64 - Paper, paperboard and articles of paper pulp, of paper or of paperboard
- 65 - Textile yarn, fabrics, made-up articles, n.e.s., and related products
- 66 - Non-metallic mineral manufactures, n.e.s.
- 67 - Iron and steel
- 68 - Non-ferrous metals
- 69 - Manufactures of metals, n.e.s.

7 - Machinery and transport equipment

- 71 - Power-generating machinery and equipment
- 72 - Machinery specialized for particular industries
- 73 - Metalworking machinery
- 74 - General industrial machinery and equipment, n.e.s., and machine parts, n.e.s.
- 75 - Office machines and automatic data-processing machines
- 76 - Telecommunications and sound-recording and reproducing apparatus and equipment
- 77 - Electrical machinery, apparatus and appliances, n.e.s., and electrical parts thereof (including non-electrical counterparts, n.e.s., of electrical household-type equipment)
- 78 - Road vehicles (including air-cushion vehicles)
- 79 - Other transport equipment

8 - Miscellaneous manufactured articles

- 81 - Prefabricated buildings; sanitary, plumbing, heating and lighting fixtures and fittings, n.e.s.
- 82 - Furniture and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
- 83 - Travel goods, handbags and similar containers
- 84 - Articles of apparel and clothing accessories
- 85 - Footwear
- 87 - Professional, scientific and controlling instruments and apparatus, n.e.s.
- 88 - Photographic apparatus, equipment and supplies and optical goods, n.e.s.; watches and clocks
- 89 - Miscellaneous manufactured articles, n.e.s.

9 - Commodities and transactions not classified elsewhere in the SITC

- 91 - Postal packages not classified according to kind
- 93 - Special transactions and commodities not classified according to kind
- 96 - Coin (other than gold coin), not being legal tender

- 97 - Gold, non-monetary (excluding gold ores and concentrates)
- I - Gold, monetary
- II - Gold coin and current coin