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An econometric analysis of Botswana's sectoral export trade flows

by

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Albert Makochekanwa

SUMMARY

An econometric analysis of Botswana's sectoral export trade flows

By

Albert Makochekanwa

Supervisor	**Professor André C. Jordaan**
Co-supervisor	**Doctor Francis Kemegue**
Institution	**University of Pretoria**
Department	**Economics**
Degree	**Doctor of Philosophy (Economics)**

The main objectives of this thesis study were to analyze Botswana's exports from the diamond, textile, and meat and meat products sectors for the period 1999 to 2006. The objectives were three-fold. Firstly, the study examined the extent to which either intra–industry trade (IIT) or inter–industry trade (INT) dominates Botswana's sectoral exports. Secondly, the research investigated the determinants of the country's sectoral exports, with the third objective being the identification of destination markets with unrealized potential for the country's three sectoral exports. Two statistical methodologies were employed, the Grubel-Lloyd (G-L) index and panel data econometrics. The former technique was used to investigate the extent to which the sectoral exports were either IIT or INT driven, while the latter methodology was employed to analyze the determinants of sectoral exports and also for identifying destination markets with untapped export potential.

The main findings are as follows:

IIT and INT

Results for the textile, and meat and meat products sectors show that export trade for these two sectors between Botswana and its major trading partners were INT driven for the period under study. This emanates from the relative abundance of textile and meat resources in Botswana compared to its trading partners. On the other hand, Botswana's diamond trade with its major trading partners is found to be IIT driven, as evidenced by the simultaneous exports and imports of diamonds by Botswana to and from its trading partners. A further decomposition of IIT into either horizontal IIT (HIIT) or vertical IIT (VIIT) is also done. The simulated results show that HIIT, as opposed to VIIT, dominated Botswana's IIT for the period reviewed.

Determinants of exports

The following are the conclusions that emanated from the empirical evidence obtained on these three sectors.

i. In all the three sectoral results, the respective sectoral GDPs for Botswana and the importing countries were positive and statistically significant determinants of Botswana's sectoral exports. This implies that growth in the GDP or economic activities in mining, manufacturing and agriculture enhanced Botswana's diamond, textiles, and meat and meat products, respectively.

ii. With the exception of diamond exports, results from the sectoral gravity estimations indicate that distance retarded exports and this is expected from theory. This negative correlation implies that, as distance increase from Botswana to any of its trade partners, the country's export trade from both textiles and meat and meat products sectors declined.

iii. Regional trade arrangements contributed positively to the country's exports in all the three sectors for the period under review. For instance, in the case of textiles, the AGOA trade preference in the form of duty-free-quota-free (DFQF) resulted in Botswana's textiles entering the USA market freely since 2000 than was the case before the arrangement was initiated. This has increased exports of textiles.

iv. The statistically significant positive signs on the IIT trade variable in the diamond gravity equation, and INT variables in both textiles, and meat and meat products indicate that the product differential in the diamond sector; and factor endowments in the other two sectors promote sectoral exports.

v. The relationship between exchange rate on one hand, and exports from the sectors on the other hand was found to be positive and statistically significant. This implies that currency devaluation leads to increase in exports across these three sectors.

Unrealized export potential

The analysis found a number of countries in which Botswana has unrealized trade potential in diamond; textile, and meat and meat products export sectors. The results indicate that Israel, South Africa and Switzerland are export destinations for which there is still untapped export potential for Botswana's diamond, and as such, the country should increase its diamond export to these countries. Countries such as Canada, Denmark, Ghana and Mozambique, among other countries, have unrealized export markets for textile products from Botswana, while Italy, Mauritius, Namibia and Norway are the export destinations in which Botswana should increase its export of meat and meat products, as these countries have untapped market potential for this sector.

Causes of unrealized export trade potential

i. *Stringent rules of origin (RoO)*

Although tariffs applied by most of Botswana's export partners have generally declined over the years, stringent rules of origin (RoO) continue to present challenges to the country's exports. For instance, in the case of textiles, whilst the USA's AGOA allows even for global cummulation under the "Special Rule"; the European Union (EU) only allows regional and diagonal cummulation, thereby limiting the ability of Botswana's manufacturers to source textile inputs from potentially cheaper countries. Thus, these RoO have limited Botswana's exports to the EU, especially those from the textiles sector, resulting in the actual exports being less than the predicted or simulated exports.

ii. *Non-tariff barriers (NTBs)*

Most countries, especially from the developed world, have over the years developed sophisticated NBTs which are arbitrary, difficult and costly to meet, especially for developing exporting countries. In the case of the EU, the application of Sanitary and Phyto-sanitary Standards (SPS) measures whose main objective is to safeguard damages to health, animal and plant life have become disguised trade barriers. SPS standards have affected agricultural exports including meat products not only of Botswana but also for most African, Caribbean and Pacific (ACP) countries. EU SPS measures require that for any exporter to export to the EU member states, they must be certified, and for them to be certified they must meet some 'standards' set by EU bodies. In the case of meat products, the SPS requires that the abattoirs must be certified; the animals to be slaughtered, e.g. cattle, should be traced to their origin, i.e. from which farm, area or region within any country they originated from. Meeting these requirements is costly and cumbersome and this has resulted in less meat products being exported to some developed trade partners, especially the EU.

iii. Animal diseases

Botswana's meat and meat export products have been limited due to a plethora of diseases, chief among them being the foot and mouth. With outbreak of the foot and mouth disease, all meat exports are abruptly brought to a halt until health officials are fully satisfied that the disease has come under control or been eradicated. Owing to the lengthy procedure involved in arriving at the conclusion that the disease has been brought under control, the country ended up exporting less that its potential meat products in the years where such a disease occurred.

iv. Unrecorded informal trade

Another possible cause of unrealized export trade potential is the fact that informal trade exports figures were not recorded. A case in point, as an illustration, is the fact that more than 80% of Zimbabweans have been importing their groceries from their neighbouring countries including Botswana (South Africa, Zambia and Mozambique) for nearly a decade. Given that these imports were mostly done in small amounts or informally, i.e. groceries of around US$150 per month per individual, both Botswana customs and Zimbabwean customs were not officially recording these 'small figures'. However, if these small figures are aggregated, they run into millions of US dollars. Thus, the existence of untapped trade potential may also be significantly influence by the fact that informal trade figures were not recorded, resulting in the actual recorded trade figures being less than the predicted potential figures.

v. Inadequate international marketing

Effective trade, especially with international consumers is underpinned by rigorous marketing of the products on offer. Botswana's National Export Strategy

(NES) alludes to the fact that the country's exports have not been vigorously marketed at international fora. Whilst it may be difficult to single out the effect of marketing on a country's exports, the fact remains that marketing contributes positively towards exports, especially given the continued growth in competition from other countries in most products offered on the international market by Botswana.

vi. Relatively low quality

Low quality, especially in the textiles sector has contributed towards reduced exports of Botswana's products from this sector. In particular, the study noted that although the rules of origin (RoO) for yarn under the AGOA have been enhanced, the sector has not adequately taken advantage of that gesture by ensuring that it procures the better quality fabric required by regional garment manufacturers producing for the USA market. As a result, relatively low quality fabric has been used in manufacturing resulting in relatively low quality garments which faced fierce competition on the international market on quality terms.

Policy suggestions

IIT and INT

Botswana's engagements in trade liberalization will result in changes in trade, i.e. increase and/or decrease in exports, and increased and/or decreased imports. These changes in exports and imports will involve shifts in resources between sectors. Given that two of the three sectors analyzed, i.e. textile, and meat and meat products, are INT driven, any increase in imports of competing or similar goods, especially from the developed countries, will hurt these sectors, and may result in closure of some companies in these sectors. This possible sectoral negative impact stems from the fact that imports from developed countries will be of high quality, due to these countries having advanced

and better production technologies, as well as being relatively cheaper, given that producers from developed countries have economies of scale and do mass production. In addition they are given both production and export subsides by their governments for agricultural production. The increase in imports will thus result in loss of employment, due to structural changes brought about by increased competition emanating from trade liberalization, and re-allocation of capital to other surviving sectors. For labour, it may mean that those formally employed in the closing sectors will have to find jobs in other industries where their experiences may not match the job requirements and this may involve re-training, normally at a cost. At the same time, relocated capital, especially specialized machinery and equipment may end up being redundant.

Since some of these trade liberalization arrangements in which Botswana has (is) engaged itself are still to be implemented, e.g., the EPA with EU and WTO liberalization arrangements, the country needs to formulate and implement policies to deal with these possible negative impacts of trade liberalization on the meat and meat products and textile sectors. Possible defensive strategies would be product differentiation within the same sectors with more emphasis on value addition production. For instance, rather than concentrating on production and exportation of raw meat, the country can improve and value-add meat production in the form of caned meat. The same applies to the textiles, value addition can entail shift into production of shirts, t-shirts, jeans, as opposed to production and exportation of rolls of cloth or un-knitted garments.

Determinants of exports

i. Given that higher GDPs for importing partners promote Botswana's export trade, the country needs to continue its engagement especially with those partners with higher GDPs. This can be easily achieved if the country remains committed in such trade arrangements as the envisioned Economic Partnership Agreement (EPA) with the EU, and the AGOA trade arrangements with the USA. Continued engagement with high income countries can also be enhanced if the country implements the various agreed trade liberalizations promulgated by the WTO so

that it can get reciprocal treatment and trade preferences from some of the high income and developed WTO members

ii. The fact that distance retards exports especially in textiles, and meat and meat products means that the country should increase its trade with proximity countries as much as possible. Botswana, besides being a full member of the already advanced and highly integrated Southern African Customs Union (SACU), should also move together with other member states of the Southern African Development Community (SADC) in their endeavour to move from the current Free Trade Area (FTA) to higher stages of regional integration such as the Customs Union (CU), Common Market (CM), Monetary Union (MU) and Economic Union (EU). These higher stages of integration, especially with geographically close countries will also mean enlarged markets for Botswana's exports, among other benefits.

iii. To continue increasing its exports, the country needs to remain in its current trade arrangements, ranging from bilateral, regional (for instance with SACU and SADC), inter-regional (with EU) and multilateral (at WTO level). The country can also consider entering into new preferential trade arrangements not only with the current rich countries, but also with emerging and fast growing economics such as China, India and Brazil, among others, as they provide huge future potential in terms of markets for Botswana's exports.

Unrealized export potential

i. *Analyze export barriers*

Botswana policy analysts need to do an investigation of the factors that hinder the country's sectoral export to countries with untapped export potential. Such an investigation will help to identify hindrances to the export of sectoral products to

these countries. With that information policy markers will be in a better position to design relevant policies to capitalize on those unrealized export markets and export more.

ii. *Increase export promotion activities*

Effective trade, especially with international consumers is underpinned by rigorous marketing of the products on offer. Botswana's National Export Strategy (NES) (Republic of Botswana, 2008) alludes to the fact that the country's exports have not been vigorously marketed at international fora. The country should therefore increase trade promotional activities of its foreign services and consulates, especially in countries where there is untapped export potential. These consulate offices abroad can provide more information on how one can import from Botswana as well as what products can be imported. If possible, the country can put new consulate offices in a trade partner country where there were no such services before. Setting up of new consulate services which also provides trade information, among other services, may encourage imports from Botswana. According to Rose (2005), ceteris paribus, "each additional consulate placed abroad is associated with a rise of bilateral exports of between 6% and 10%".

iii. *Negotiate for better trade preferences*

Given that the Botswana is still in the process of negotiating a number of free trade arrangements, for instance with EU countries and also with WTO member countries, the country can try to ensure that it gets the most in terms of liberal trade preferences and better market access for its sectoral exports, especially with countries from these two groups with which it has untapped sectoral trade potential.

iv. Seek technical assistance to meet NTBs

The country needs to work closely and in collaboration with its developed trade partners, especially in the EU, with the aim of getting technical assistance in meeting some of the SPS and RoO requirements. Meeting and satisfaction of these measures will positively enhance the country's sectoral exports to its EU trade partners, hence exhausting any currently existing untapped potential within these markets.

v. Enhance diseases monitoring mechanisms

The success of Botswana's meat and meat products, among other agricultural products, is underpinned by the country's ability to eradicate perennial diseases such as the foot and mouth timely and effectively. Whilst the country is highly endowed with a larger head of cattle, failure to control diseases means the country will not be able to maximize its exports from this sector. Thus, the country should consider enhancing disease monitoring mechanisms to ensure that should there be an outbreak of any animal disease; the country will be able to swiftly put it under control or totally eradicate it.

vi. Improve product quality

It is important to note that importers, and hence consumers, do not simply consider price when importing any product, but also consider other issues, among them being the quality of the product. Most importers, especially from the developed world are particular on the quality of the products they purchase and they generally prefer products of high quality. Thus, Botswana's manufacturers can enhance the possibility of increasing their exports, especially those from the textiles sector if they use high quality yarn and fabric in their manufacturing processes.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF DIAGRAMS

LIST OF ACRONYMS

ACP	African, Caribbean and Pacific (group of countries)
AGOA	African Growth Opportunities Act (of USA)
CU	Customs Union
DFQF	Duty-Free-Quota-Free
EPA	Economic Partnership Agreement
FTA	Free Trade Area
G-L	Grubel-Llyod Index
H-O	Heckscher-Ohlin
IIT	Intra-industry trade
INT	Inter-industry trade
NTB	Non tariff barriers
PTA	Preferential Trade Arrangement
RCAI	Revealed comparative advantage index
RoO	Rules of Origin
SACU	Southern African Customs Union
SADC	Southern African Development Community
SPS	Sanitary and Phyto-sanitary Standards
UK	United Kingdom
USA (US)	United Stated of America
WTO	World Trade Organization

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

This chapter presents a brief background about sectoral exports for Botswana, with special emphasis on three sectoral export products namely: diamond, textiles, and meat and meat products. This information is paramount for the discussion in subsequent chapters which includes investigating the extent to which these sectoral exports are either intra-industry trade (IIT) or inter-industry trade (INT) driven; an analysis of what determines these exports to the various country destinations; and finally, in determining some of the destination countries with unrealized export potentials for these sectoral exports. This chapter also presents the justification and objectives of the study, hypotheses to be tested and an outline of the thesis research.

1.2 Background

The impact of exports to the exporting country is largely accepted to be positive (Blumenthal, 1972; Ragin and Delacroix, 1979; and Jaffee, 1985), although in some cases, negative effects can also be experienced (Lall, 2002; Shafaeddin, 2005 and Cruz, 2008). Considering the positive impacts, the importance of exports to any country or region emanates from its supposed positive contribution to the economic growth of that country/region. This export-growth nexus becomes very important to a developing country such as Botswana, as well as other developing countries, given its quest to economically grow to higher levels. This positive effect of export on the level of economic activity is understood to work both through the demand and supply sides of any economy. On the demand side, an increase in exports will cause induced consumption, investment and government expenditure (in the Keynesian framework[1]) and this will further call for the supply side to positively respond through induced

[1] The Keynesian framework expresses: GDP = Consumption + Investment + Government expenditure + **Exports** – Imports

changes in technology and the endowed resources, so as to satisfy the requirements of the induced demand.

According to Blumenthal (1972) and Jaffee (1985), the total impact of exports can be broadly divided into four parts. Firstly, there is a direct effect. Since the value added by exports is a part of the gross domestic product (GDP), an increase in the former implies a rise in the latter. Secondly, export industries affect growth through their effect on other backward and forward industries. That is, for industries to produce for exportation they require raw materials and inputs from other industries, i.e., the backward linkage. At the same time the export industry supplies intermediate inputs to other domestic industries, i.e., the forward linkage, besides exporting. Because of these linkages, the export sector will provide a positive impact on the growth of the domestic economy. Thirdly, since exports are the source of foreign exchange, they affect growth via imports, especially of vital production inputs and raw materials. Given that most developing countries' production activities depend on imported inputs and capital equipment, such imports purchases can be done using foreign currency earned from exports, among other sources. Lastly, Jaffe (1985) argued that there is a broader theoretical point that suggests a positive correlation between export dependence, as measured by their contribution to GDP and export revenue, and the growth of an economy.

In the case of Botswana, statistical data from the country's Central Statistical Office (CSO) shows evidence of a positive relationship between export and economic growth. For instance, in 1980 total exports were US$645 million, while GDP was US$1.1 billion; in 1990 exports increased to US$2 billion with a corresponding increase in GDP to a value of US$3.8 billion. This positive relationship continued over the years, with total exports of US$3 billion being associated with an increased GDP figure of US$6.2 billion in 2000, while the 2008 export value of US$5.3 billion was correlated to a GDP figure of US$13.9 billion (see Figure 3). Jaffe's (1985) line of thinking suggests that involvement in world trade is a commonly employed indicator of integration into, and expanded production for the capitalist world-economy. This integration is argued to provide a platform for transforming the mode of production from primitive to high technology techniques. This transformation results in an economy that can effectively and efficiently produce for the

contemporary world market. More openness and involvement in world export trade by any country will increase its chances of attaining and sustaining high economic growth rates (Ragin and Delacroix, 1979).

Possible negative impacts of exports on the exporting country can also be experienced. Shafaeddin (2005) and Cruz (2008) argue that in a scenario where exports are mostly done by multinational companies (MNCs) who use imported raw materials instead of local inputs, expansion of exports in such a case where there is limited backward linkages with local producers will not necessarily result in the expected growth in local production activities. In addition, in the absence of relevant investment policies and regulations, competition in the exporting sector between large foreign firms and small domestic firms may result in the latter firms either disappearing or being swallowed by the big foreign firms, with the end result being the creation of new foreign monopolies (Lall, 2002). Given that in most countries non-utility monopolies are discouraged, mainly because they tend to exploit consumers by charging prices which are above their marginal cost of production and also that they tend to produce less output when compared to firms in imperfect or perfect markets, this will be a negative impact coming from the export sector.

Literature on the effects of exports on a country considers the positive effects to be more common than the negative consequences. Thus, given the background on the positive impacts of exports, it follows that export policy could become an important tool to achieve economic growth. Therefore, to come up with sound and objective sectoral export policies, there is need for an analysis which addresses three issues.

Firstly, the investigation should determine the extent to which either intra-industry trade (IIT) or inter-industry trade (INT) dominates sectoral trade. The former results in simultaneous export and import of the same product as advocated by product differential trade models; while the latter is a result of different factor endowment as postulated by the Hecksher-Ohlin (H-O) trade models. The decomposition of sectoral trade into these two parts is important since both parts explain trade.

Secondly, the analysis should also investigate the determinants of sectoral exports with regards to destinations. This analysis should provide an understanding and

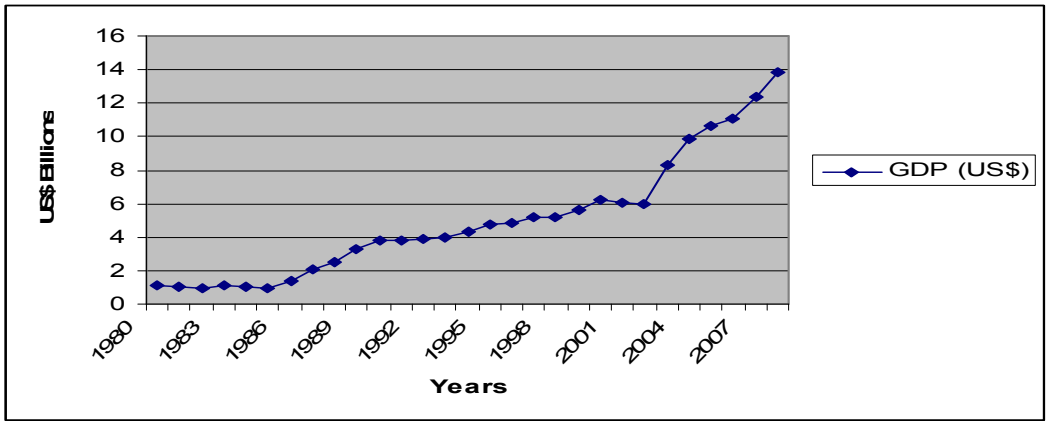
potential reasons, for instance, as to why a larger proportion of a given sector's exports go to country *A* while only a small percentage of the same sector's exports are destined for country *B*.

Lastly, the inquiry should include the various sectoral export destinations with untapped market potential. In this last examination, both current and potential sectoral export destinations are important with regards to harnessing the process through which exports can contribute to economic growth. As will be detailed in the thesis, sectoral export destinations of Botswana have evolved, among other factors from the codes of colonial attachments (especially when trading with the EU), comparative advantage, preferential trade agreements, specialized market arrangements, as well as from the advantages of proximity (Allen *et al*., 2007 and Republic of Botswana, 2008).

1.3 Brief Country Background

Botswana's economic growth trend since independence in 1966 has been remarkable. Available data from the International Monetary Fund's (IMF) online database, which is also plotted in Figure 1, indicates that while the country's GDP was US$1.1 billion in 1980, the figure increased by more than three-fold ten years later reaching a value of US$3.8 billion in 1990. The growth trend continued over the years as shown in the figure and the GDP value was US$13.8 billion by end of 2008. The same positive GDP growth trend, in log form, is depicted in Figure 2.

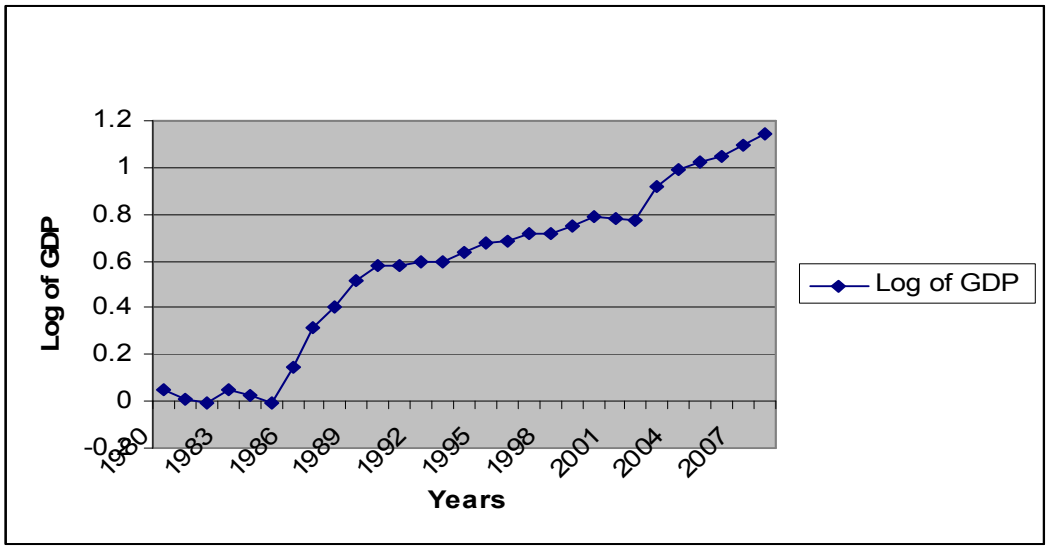
Figure 1: Botswana's GDP trend in level form



Source: Constructed using figures from the IMF online database

Thus, contrasting the periods soon after independence and today, significant differences can be noted. For instance, at independence, the country was one of the poorest nations whose developmental and recurrent expenditures were dependent on foreign aid. On the other hand, over the years, the contemporary Botswana has experienced self-sustainable economic growth, with a GDP per capita of above US$11 000 as of 2008, making it an upper middle income country by World Bank classification. In fact, it is considered the richest non-oil producing country in Africa with even greater per capita income than Turkey, Thailand, or Brazil (Todaro and Smith, 2006).

Figure 2: Botswana's GDP trend in log form



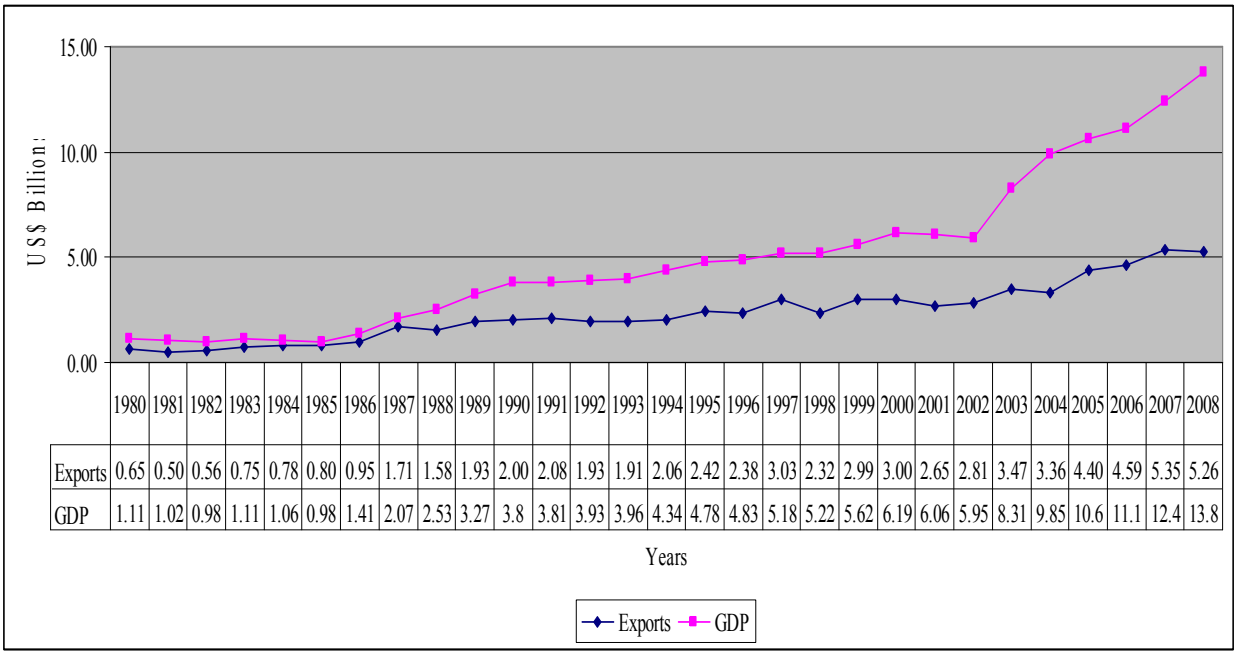
Source: Constructed using figures from the IMF online database

The relationship between Botswana's GDP and export trends is shown in Figure 3. According to Figure 3, for the period 1980 to 2008, for which statistical figures were available, data trends indicate that the two series were positively related and this positive relationship is confirmed by the Granger causality tests presented in Section 1 of the Appendices. For instance, in 1980, when exports were around US$650 million, the GDP figure was US$1.1 billion. As exports increased over the years, GDP figures also increased such that in 1990 when exports were US$2 billion, the corresponding GDP was US$3.8 billion. Whilst trend lines indicate that the GDP increased at a

relatively rapid rate, especially since 2002 as shown by the steep upward trend line, exports were also growing, albeit at an average rate.

In terms of sectoral contributions to the country's GDP, historical economic activity indicates that in 1966, 40% of the economy's GDP and 90% of employment were mainly from the agriculture sector. This agricultural sector's contributions have however declined sharply over the years such that the sector only contributed about 4% towards GDP and 16% towards employment by mid–1990s. These contributions further declined to less than 3% and 8%, respectively by end of 2006. On the other hand, the mining sector has taken an important role of contributing towards the country's economic activities, especially beginning from the 1990s. Specifically, since the early 1990s to date, diamond has been contributing an average of above 35% to the GDP, accounting for more than 70% of Botswana's export revenues and contributing around 53% towards total government income.

Figure 3: Botswana's GDP and export trends



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Exports	0.65	0.50	0.56	0.75	0.78	0.80	0.95	1.71	1.58	1.93	2.00	2.08	1.93	1.91	2.06	2.42	2.38	3.03	2.32	2.99	3.00	2.65	2.81	3.47	3.36	4.40	4.59	5.35	5.26
GDP	1.11	1.02	0.98	1.11	1.06	0.98	1.41	2.07	2.53	3.27	3.8	3.81	3.93	3.96	4.34	4.78	4.83	5.18	5.22	5.62	6.19	6.06	5.95	8.31	9.85	10.6	11.1	12.4	13.8

Source: Constructed using figures from the IMF online database and the Botswana Central Statistical Office (CSO)

Table 1 provides the percentage contributions of each of the country's nine export sectors towards Botswana's total export revenue. As shown from the table, the major contributor over the years has been diamond, which accounted for over 70% per annum until 2006. Since 2007, the mineral's contribution has relatively declined to less than 66% per year. This clearly indicates the mono-export characteristic of the country. Besides diamond, the other two important export sectors analyzed in this thesis are the textiles, and meat and meat products[2]. Textile exports on the other hand have maintained an average contribution of below 5% towards export revenue for the period until 2006. Since 2007, the sector's contribution started increasing, which is encouraging given the country's endeavour to diversify away from diamond exports. At the same time, although the proportional export revenue shares of meat and meat products have been dwindling from an average of around 2.5% to slightly less than 1% for the ten year period 1996 to 2006, since 2007 the sector's contribution seems to have started increasing.

Table 1: Principal exports by percentage of total export value

Year / Sector	1996-1999+	2000	2001	2002	2003	2004	2005	2006	2007	2008
Diamonds	73.3	82.6	84.8	82.1	76.8	75.4	74.9	79.1	63.2	65.2
Textiles	2.6	1.7	1.3	1.8	1.8	3.4	5.0	3.2	6.9	5.7
Meat & meat prod	2.5	1.8	2.5	1.7	2.1	1.5	1.7	0.8	2.2	1.9
Sub total	**78.4**	**86.1**	**88.6**	**85.6**	**80.7**	**80.3**	**81.6**	**83.1**	**72.3**	**72.8**
Copper, Nickel, Matte	4.9	5.8	4.1	4.4	9.6	9.6	10.3	10.7	21.4	18.6
Vehicles & Parts	10.5	2.1	2.0	3.3	3.5	3.4	2.5	0.9	0.5	0.7
Live animals	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hides & Skins	0.3	0.3	0.4	0.2	0.2	0.2	0.1	0.1	0.2	0.1
Soda Ash	1.0	0.7	0.9	0.5	0.6	0.6	0.5	0.2	0.4	0.1
Other goods	4.9	5.0	3.9	6.0	5.4	6.0	5.0	4.9	5.3	7.6
Overall Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Calculations using data from the Botswana Central Statistical Office (CSO).

Note: '+' Means four-year average

[2] **Note**: In the Harmonized Commodity Description and Coding System (HS) code, this product is normally written as "meat & meat products". This author decided to use "and" as it seems to be more formal than "&".

The diamond sector is analyzed by virtue of being the country's major export revenue earner, while the other two sectors are investigated to provide in-depth analysis which may be helpful to the country's "proposed initiatives that will lead to diversification of the economy thereby reducing the vulnerability of over-reliance on the mining sector… to achieve internationally competitive sustainable economic diversification." (Republic of Botswana, July 31, 2008). These sectors are also a rough representation of each of the major production sectors, which are mining (represented by diamond), agriculture (represented by meat and meat products) and manufacturing (represented by textiles). These three sectors, besides the contribution they make towards the country's export revenue, also provide a large percentage of both formal and informal employment to the country and generate more than half of Botswana's annual GDP. Overall, the above three sectoral exports contribute more than 80% towards the country's total export revenue.

Thus, given the explanation above and the sectoral snapshot presented in Table 1, it can be concluded that these three sectors are very important to Botswana, hence warranting detailed study.

1.4 Justification and motivation for the research

Literature, for example, Sentsho (2003) argues that Botswana has followed an export-led-growth strategy for more than a century, since 1885 to date. Also statistical evidence as shown in Figure 3, and confirmed by the Granger causality test presented in Section 1 of the Appendices, indicates that exports have played and continues to play a very significant role in the economic growth of the country. Specifically, exports contribute over 50% towards the country's annual GDP, more than 60% towards government revenue as well as a significant percentage towards employment levels.

Whilst the above information shows a clear testimony of the importance of exports to the economy of Botswana, the following contributions can be done. Firstly, no systematic study has been done yet towards understanding the nature of sectoral

exports; whether they are dominantly driven by intra-industry trade (IIT) or inter-industry trade (INT) theories.

Secondly, analysis of the determinants of these exports at sectoral level provides important information to policy makers, given that any meaningful exports promotion strategies are done at sectoral (or product) level, as opposed to aggregate level. In addition, no study has been done in this direction on the country. Thus, this study will contribute invaluable information by providing an investigation of these determinants.

Thirdly, although knowing the sectoral exports determinants is important, an understanding of the various potential export destinations for the country's sectoral exports is another imperative knowledge needed for the purpose of designing destination country-specific export promotion strategies. To this end, the research is also motivated by the need to enumerate these unrealized sectoral export destination countries which have unrealized export potential for Botswana's exports.

1.5 Problem statement

Following the justification and motivation presented above, this thesis will attempt to answer the following important questions with regards to Botswana's sectoral export trade.

i. What is the structure of Botswana's sectoral trade pattern?

ii. What determines the country's sectoral trade?

iii. With which trading partners does Botswana trade?

iv. Which export destination countries still have unrealized export potential for the country's sectoral exports?

1.6 Objectives of the thesis

The study motivation and problem statement presented above led to the following specific objectives in the case of Botswana. These objectives are to:

1. Examine the extent to which either intra–industry trade (IIT) or inter–industry trade (INT) dominates sectoral exports;

2. Investigate the determinants of the country's sectoral exports;

3. Identify destination markets with unrealized potential for Botswana's sectoral exports; and

4. Come up with relevant sectoral export/trade policy conclusions drawing from the outcome and findings from this thesis research.

1.7 Hypotheses of the study

In this study a number of hypotheses will be tested, albeit with emphasis placed on those that relate to export trade. The hypotheses to be tested are as follows.

i. Hypothesis 1

The following factors affect the degree of sectoral export product specialization:

- Natural resource base

- Export trade policy

ii. Hypothesis 2

Determinants of exports at sectoral level which contribute to export supply are:

- The cost of production as proxied by revealed comparative advantage index.
- Domestic demand pressure (vent-for-surplus theory).

iii. Hypothesis 3

The physical and psychological distances (and other resistors) between trade partners determine the direction and volume of trade.

iv. Hypothesis 4

The supply for the export market is driven by certain qualitative determinants that motivate firms to sell globally.

1.8 Contribution of this thesis study

This thesis endeavours to contribute in four dimensions which are: (i) analysis of the structure of sectoral exports in terms of intra-industry trade (IIT) and inter-industry trade (INT), and the introduction of a variable in the respective gravity models to represent either IIT or INT as the case maybe; (ii) investigation of the determinates of sectoral exports, (iii) analysis of unrealized export potentials, and (iv) provision of sectoral results.

Firstly, the study will start by analyzing the extent to which either IIT, which arises because of the product differential trade theory; or INT, which is a consequence of factor endowment differences and the resultant product specialization supported by the Heckscher-Ohlin trade models, dominate the exports in each of the three sectors. Once a sector is said to be driven by any one of the two theories, then an explanatory variable to take into account that respective theory will be included in the gravity

trade model for that sector as a possible new explanatory variable. Thus, the contribution in this regard will be the introduction of a variable which will serve the purpose of taking into account the trade structure of a given sector in the gravity trade model.

Secondly, the research will investigate the various respective determinants of exports from each of the three sectors under study. Analysis of these factors is paramount as it will help in the crafting of possible offensive export strategies.

Thirdly, the research will indicate and analyze the various export destination countries with unrealized potential markets. In this thesis, an export destination is considered as having unrealized markets potential for Botswana if actual annual sectoral exports are less than the annual figure provided by the model forecast. This contribution is important since country-specific export promotions can be enhanced for sectoral exports. Whilst this procedure has been employed before, it has mainly been used at aggregate level for other countries and no evidence of such a study on Botswana could be found in the literature.

Lastly, given the absence of a systematic study on sectoral exports for Botswana, this thesis' other contribution will be to provide sectoral results. In this dimension, the research study will add valuable and policy informative contributions by carrying out an empirical research on Botswana's sectoral export using relevant and appropriate econometric methodology.

1.9 Scope of the study

The research is a study on the small, open and developing country, Botswana. The focus of this thesis is on the determination of the country's exports factors at a micro sector level for the period 1999 to 2006. The three micro export sectors[3] covered are: (i) diamonds, (ii) textiles, and (iii) meat and meat products.

[3] Micro export sectors because they are subsets of broad export sectors. For instance, diamond is a subset of the broad sector, mining; while textiles, is a subset of the broad manufacturing sector; and meat and meat products, a subset of the broad agriculture sector.

1.10 Analytical procedure of the study

To accomplish the stated objectives, the thesis study takes an eclectic approach drawing on historical, theoretical and empirical analysis.

Specifically, the procedure of this study comprises:

i. Analyzing the trends of Botswana's sectoral exports;

ii. Investigating the dominance of either IIT or INT in each of the three sectors under study;

iii. An investigation of the theories of trade that help in understanding the factors that determine the country's sectoral exports;

iv. An application of panel data econometrics and the gravity trade model, firstly in analyzing the determinants of sectoral exports, and secondly in investigating both current and potential sectoral export destinations;

v. Use of the results from the above empirical techniques to identify a set of policy recommendations to positively improve Botswana's sectoral export performance.

1.11 Outline of the theis research

The thesis is divided into the following chapters. **Chapter 1** provides the introduction, justification, objectives as well as hypothesis of the thesis research. **Chapter 2** presents the literature review, which is further divided into two categories: theoretical and empirical reviews. **Chapter 3** provides the study's methodology, while **Chapter 4** provides an overview of Botswana's economic and trade trends. Specifically, Chapter provides a detailed profile of the three export sectors in terms of their contributions to export revenue, employment and GDP, among other contributions to

the economy of Botswana. Furthermore, respective sectoral trade arrangements are also detailed in this chapter.

Chapter 5 investigates the extent to which the three sectoral exports under study are either dominantly IIT or INT driven. Further decomposition of the IIT into horizontal and vertical is also done in this chapter. The study of both INT and IIT is important in that it provides a better platform for formulating policies which deal with trade adjustment costs caused by increased trade liberalization (Abd-el-Rahman, 1991, Greenaway *et al.,* 1995). Given that Botswana continues to open its trade regime, from the bilateral[4] to the multilateral trade level[5], increased trade, either in the form of INT or IIT, will result in cost adjustments. Through increased trade, the size of most economic sectors will change. Some will experience increased (or decreased) exports, others increased (or decreased) imports, while others will experience increased (and/or decreased) exports and imports, simultaneously. The changes in exports and imports will involve shifts in resources between sectors (Al-Mawali, 2005). In the case of INT sectors, increased imports of competing or similar goods will hurt these sectors, and may result in closure of some companies in these sectors. In the case of IIT, simultaneous increases in exports and imports is likely to cause marginal, if any, shift of resources between sectors.

Whilst Chapter 5 dichotomizes exports into IIT and INT, **Chapter 6** provides an analysis of the factors which determines why a larger proportion of the country's sectoral exports are exported to country *A* while a smaller percentage of the same products are destined for country *B*. The investigations presented in this chapter are achieved through the application of the sectoral gravity trade models. By extending the analysis of the gravity trade model from Chapter 6, **Chapter 7** investigates the country's export destinations with unrealized potential for Botswana's sectoral exports. In pursuit of achieving its objective, this chapter's analysis will attempt to answer the following three questions:

[4] Besides having bilateral trade agreements with countries such as Zimbabwe, Botswana is also a member of a number of regional trade blocs including the Southern Africa Customs Union (SACU), Southern African Development Community (SADC), and the African, Caribbean and Pacific (ACP) group of countries with long term trade relationships with the European Union (EU). All these arrangements aim to continuously liberalize trade, among other objectives.

[5] The country is a member of the World Trade Organization (WTO) whose main objectives include trade liberalization

i. With which trading partners has Botswana reached its trade potential in these three sectoral products?

ii. With which trading countries has Botswana gone beyond its trading potential in these three sectoral products?

iii. With which partner countries does Botswana have untapped (or unrealized) trade potential in these three sectoral products?

Drawing from the thesis research findings in the previous chapters, **Chapter 8** concludes the thesis and presents a set of policy proposals, suggestions and recommendations that can positively influence and enhance Botswana's sectoral exports.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents both theoretical and empirical review with the aim of investigating the theoretical underpinnings of the two main issues which are analyzed in this thesis. These two issues are the structure of sectoral exports (IIT or INT) and the determinants of sectoral exports. The empirical review will focus on three issues, which are the structure of exports, determinants of exports and unrealized export potential destinations.

2.2 Theoretical literature review

This section discusses the theoretical literature that seeks to explain the structure of exports and also the determinants of exports. The section addresses theories that have been advanced in explaining these two issues.

2.2.1 Inter-industry trade (INT) and Intra-industry trade (IIT)

This part of the study will provide theories that explain why exports from one sector are considered as INT driven while exports from another sector are seen as IIT dominated.

2.2.1.1 Inter-Industry Trade (INT)

INT involves the exportation and importation of products from different industries, mainly as a result of those industries producing different goods due to their respective countries having different factor endowments. A good example of INT will be Botswana exporting diamonds from its mining sector, because it has abundant diamonds endowment, to Nigeria, which does not have diamonds endowment, and

conversely importing oil from Nigeria, which is not available in Botswana but in Nigeria.

The absolute advantage theory of Smith and the comparative advantage theories of Ricardo and Hechscher-Ohlin (H-O) are the main theories behind the INT. According to Adam Smith (1776), trade between two nations, say *A* and *B*, with *A* producing good *X products* only and *B* producing good *Y products* only is based on absolute advantage. When one nation is more efficient, or has an absolute advantage, than the other in the production of one commodity but less efficient in producing another, then both nations can gain by each specializing in the production of the commodity of its absolute advantage and exchanging part of its output with the other nation for the commodity of its absolute disadvantage. Arguing for free international trade, Smith says:

> *It is the maxim of every prudent master of family, never to attempt to make at home what it will cost him more to make than to buy… What is prudence in the conduct of every private family can scarcely be folly in that of a great kingdom. If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it off them with some part of the produce of our own industry, employed in a way in which we have some advantage (Smith 1776: 424)*

Thus, according to Smith, one of the reasons for INT is the fact that factors of production (natural resources, labour, capital and entrepreneurship) are not evenly distributed among nations of the world. For instance, in the case of natural resources the basic reason for trade is often quite simple – all countries do not possess every natural resource. For Smith, this uneven distribution will cause the respective endowed countries to be low cost producers, in terms of output per worker, while countries without these endowments tend to be high cost producers. Thus, the latter countries will import from the former countries.

Ricardo (1815) on the other hand explains INT to be the result of comparative advantage, where he considers the differences in opportunity costs of production, or relative prices, between countries as the main factors driving trade. According to Recardo's (1951) law of comparative advantage, even if one nation is less efficient, or

has an absolute disadvantage, than the other nation in the production of both commodities, there is still a basis for mutually beneficial trade. The first nation should specialize in the production and export of the commodity in which its absolute disadvantage is smaller, i.e. the commodity of its comparative advantage, and import the commodity in which its absolute disadvantage is greater, i.e. the commodity of its comparative disadvantage.

Ricardian trade models assume that only labour is used to produce goods and services, with a given fixed coefficient between labour and output for a particular product in each country. According to Magee (1980), Ricardo used the labour theory of value[6] to construct his theory of comparative advantage. Put differently, his theory states that a country will produce and export products that use the lowest amount of labour time relative to foreign countries and import those products that have highest amount of labour time in production relative to foreign countries. Furthermore, only relative amounts of labour time matter. Thus, through this specialization, INT will occur with one country specializing and exporting commodity *X* while another country specializes and exports commodity *Y*.

2.2.1.2 Intra-Industry Trade (IIT)

IIT refers to the simultaneous export and import of similar products from the same industries. A good example of IIT will be Botswana exporting germs (or unprocessed) diamonds from its diamond industry to the United Kingdom (UK) and in turn importing processed diamond products, e.g. diamond rings, crowns, etc., from the UK.

Whilst the theories behind IIT remain controversial, Grubel and Lloyd (1975) consider economies of scale and monopolistic competition as the main theories behind IIT. Other succeeding theoreticians added imperfect competition and product differentiation effects to the list of the main theories propagating IIT.

[6] The labour theory of value states that the value of any product is equal to the value of the labour time required to produce it. For example, if a car requires two worker-years worth of labour to construct and a truck requires six worker-years, then the price of a truck will be three times as high as that of a car.

Economies of scale: IIT, especially between the large and small countries is underpinned by the fact that the former partners in most cases export products requiring relatively large plant sizes while the latter countries specialize in production of products which require small plant sizes (Hufbauer, 1970). As such, the ability of an economy to mass-produce and export goods is more closely related to the degree of automation of the economy than with the absolute size of its industrial sector/country (Al-Mawali, 2005). In this case, countries with high technology and big manufacturing plants will specialize in the manufacturing and exportation of high value products, e.g. diamond rings and crowns, while countries with low technology and small manufacturing plants will mainly export raw or semi-processed products, e.g. diamond germs, (Kandogan, 2003a).

Monopolistic competition: Another variant of models explaining IIT is based on product differentiation under conditions of monopolistic competition. This theory assumes that in each of the two countries, firms produce differentiated manufactured goods under conditions of increasing returns to scale (Hummels and Levinsohn, 1993). Consumers value both diversity and low prices. Therefore, there is a basic trade-off; more varieties are good for consumers, but they imply shorter production runs, which raises unit costs. The market will find a solution which is likely to be characterized by some variety. Furthermore, the larger the economy, the more varieties will be economically viable. Thus, in the absence of international trade, consumers in a larger economy will find more varieties than consumers in a smaller economy (Helpman and Krugman, 1985).

2.2.1.2.1 Horizontal IIT and vertical IIT

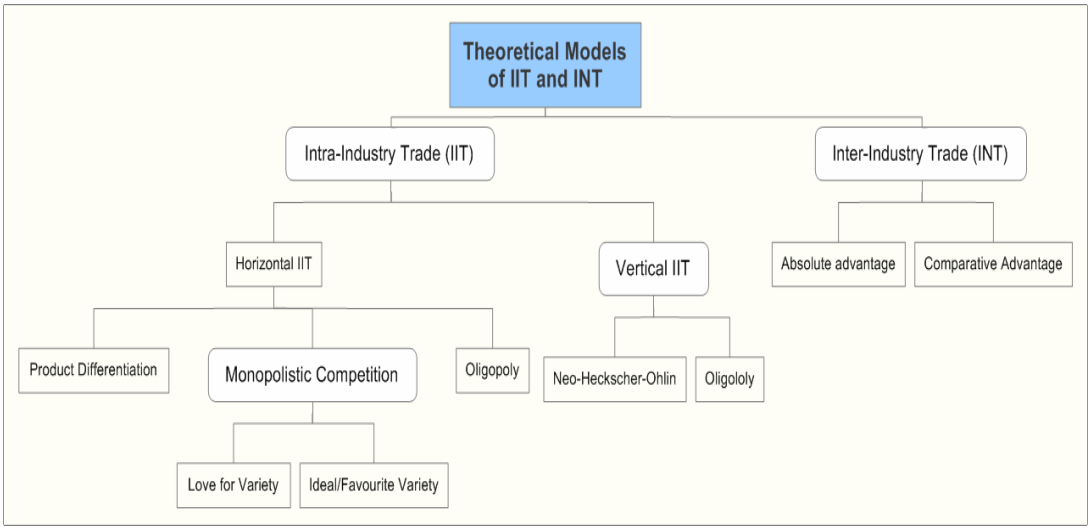
In both theoretical and empirical literature, IIT is further decomposed into horizontal and vertical components. Horizontal IIT (HIIT) refers to the simultaneous importation and exportation of similar products with the same quality but having "different characteristics relating to style and consumer", or simply as a result of product differentiation. Horizontal IIT trade is described by Dixit and Stiglitz (1977) as the 'love for variety', and by Lancaster (1979) as the 'favourite variety'. Conversely,

Grubel and Lloyd (1975) defined vertical IIT (VIIT) as the simultaneous export and import of products in a similar production sector but with differences in quality at different stages of production. Kandogan (2003a and 2003b) provides another version of horizontal and vertical IIT based on the different stages of production. The author defines horizontal IIT as "similar products that are simultaneously exported and imported at the same stage of production, and is mainly due to product differentiation". In contrast, the author defines vertical IIT as "the simultaneous exports and imports of goods in the same industry, but at different stages of production and is mainly due to varying factor intensities within an industry".

Theoretically, horizontal IIT models are mainly underpinned by economies of scale and monopolistic competition, while vertical IIT is due to Hechsher-Ohlin and oligopoly models. According to Al-Mawali (2005), the theoretical underpinnings of HIIT are drawn from neo-Chamberlinian models. See for example Dixit-Stiglitz, (1977), and Krugman (1979, 1980, 1982), and neo-Hotelling models like the Lancaster (1979, 1980). The former postulates the "love for variety" approach where consumers are assumed to consume many different varieties of a given product. In the latter, also known as the "ideal variety or favourite variety" approach, consumers are assumed to have different preferences for alternative varieties of a given product, with each rational consumer consuming only the variety that he/she considers as ideal/favourite.

The schematic presentation of the theoretical models of INT and IIT, with IIT further categorized into horizontal IIT and vertical IIT, is depicted in Diagram 1.

Diagram 1: Theoretical classification of IIT and INT models



Source: author compilation

2.2.2 Determinants of exports

Within the gravity trade model framework there are a number of theories which explain the determinants of a country's exports. Anderson (1979) and Helpman (1987) consider the differentiated product model as the main determinant of exports. Taking the Armington assumption that products are differentiated by country-of-origin as the point of departure, the authors argue that countries export (import) to (from) other countries because each country produces different products. Thus, for one country to get the products that it does not produce, it has to import such products, and at the same time export the different products that it produces to other countries which do not produce such products. Helpman's (1987) theoretical exposure also assumed monopolistic competition as the other determent of exports. According to Helpman (1987), different countries specialize in the production of different varieties of differentiated products due to the existence of economies of scale at the firm level which enhances the incentives for foreign trade.

Krugman and Helpman (1985) identified the relationship between the bilateral export trade flows and the product of two trading countries' gross domestic products (GDPs)

by utilizing the differentiated products trade model. According to Krugman and Helpman, under the imperfect substitute model, where each firm produces a product that is an imperfect substitute for another product and has monopoly power in its own product, consumers show preference for variety. When the size of the domestic economy (or population) doubles, consumers increase their utility, not in the form of greater quantity only but also in greater variety. Thus, to satisfy this increased consumption, a country will be forced to import (trade).

The "Vent for surplus doctrine" considers foreign trade among trading nations mainly as emanating from the respective countries' surplus of particular products above domestic consumption requirements. Thus each country is considered as exporting goods in which it has a surplus in exchange for commodities which it could not itself produce in sufficient quantities to meet domestic demand, or could not produce at all (Bloomfield, 1938). An important assumption underpinning this trade theory is that goods that are in surplus supply in one country are apparently regarded as in short supply in another country. In the vent for the surplus philosophy, the main benefit of foreign trade is to provide a market or 'vent' for surplus production. The pattern and composition of world trade would in turn depend mainly on the availability and extent of surpluses, and the nature of the particular commodities in surplus.

The following are the statements of the 'vent for surplus' theory.

> *When production exceeds the needs of domestic consumption, foreign trade is born (Hamal, 1844, p. 143).*
>
> *To exchange the surplus of its commodities against objects which the country cannot produce in sufficient quantities, this must be the sole employment of foreign trade (Saint-Chamans, 1824, p. 55).*
>
> *Trade between two nations is a free exchange of a superfluous thing for another thing which they need (Page, 1801, I, pp. 285-86).*

This theory fits well with Botswana's exports from the three sectors under investigation. Given the country's population of close to 1.6 million in 2008 (IMF, 2009 online database), the country's local demand cannot absorb all the goods produced from these threes sectors and the country end up exporting the surplus.

2.3 Empirical literature

This section reports on empirical literature that seeks to explain the structure of exports, determinants of exports and unrealized potential export destinations. Thus, the section is divided into three parts. The first part presents literature that investigates the structure of exports, as either falling into INT or IIT trade. The second segment discusses literature on the determinant of exports, while the last part contains literature on unrealized potential export destinations.

2.3.1 Literature on INT and IIT

Kalbasi (2003a) employed the unadjusted Grubel and Lloyd's (1975) index in investigating IIT between Iran and its selected major Organization for Economic Co-operation and Development (OECD) trading partners for the period covering 1997 to 2001. The IIT indices were calculated both for Iran's total aggregate trade and also for selected major products. The selected products included food and live animals, manufactured goods, machinery and transport equipment, chemicals, miscellaneous manufactured goods, etc.

The calculated IIT indices from Kalbasi (2003) between Iran and the selected OECD countries were zero for more than half of the years investigated. For instance, there was no intra industry trade between Iran and Spain for the whole five-year period given that all the IIT index values were zero. The indices were also zero for more than three years for countries like Australia, Japan, Korea and Sweden. Overall, the study concluded that trade between Iran and most of the selected OECD countries at aggregate total level was INT driven during the 1997 to 2001 period.

At disaggregated product level, there was no IIT at all for the whole period in goods such as beverages and tobacco, and animal and vegetable oil. For products such as chemicals, manufactured goods, machinery and transport equipments, there was a sequential flow of IIT, with one year trade being intra-industry trade driven, i.e., with IIT values above 50, and the following year trade being inter-industry trade dominated, with IIT values below 50. IIT was consistently evidenced in miscellaneous manufactured goods, but only for the last two years 2000 and 2001.

The Kandogan (2003b) study focused on the decomposition of trade into either IIT or INT for 22 transition economies' trade with 28 developing and developed states for the period 1992 to 1999. The study employed the method proposed by Kandogan (2003a), firstly to decompose exports into IIT and INT, and secondly to categorize IIT into either horizontal or vertical components. Besides decomposing total trade into INT or IIT, the other objective of the research was to investigate the determinants of IIT.

The above study found out that more than 50% of trade in both machinery and manufacturing sectors were IIT driven, with the share of horizontal IIT and vertical IIT being approximately equal. Specifically, the IIT results indicated that horizontal IIT was most common in sectors where there was significant product differentiation such as manufacturing, while it was insignificant in sectors where standardized products were produced, e.g. natural resources, which were mostly underpinned by INT. On the other hand, crude materials, fuels, and animal and vegetable oils sectors were highly specialized and INT driven.

On the determinants of IIT, the study results showed that GDP values of both transition and partner countries were promoters of horizontal IIT, with vertical IIT not responding to GDP value increases. Other variables which proved to be positive determinants of IIT, especially horizontal IIT, were trade liberalization and increasing returns to scale. On the other hand, Hecksher-Ohlin and geographic distance variables were considered to have negative effects on IIT.

IIT was also analyzed by McCorriston and Sheldon's (1991) study. The study employed the Grubel-Lloyd measure to investigate whether trade between the United States of America (USA), the European Commission (EC) and the remainder of the OECD countries on one hand, with the rest of world on the other hand, in processed agricultural products for the year 1986 was either INT or IIT driven. The research also calculated the IIT indices for the EC countries excluding intra-EC trade. The processed agricultural products included meat, cheese, cereals, fruits, vegetables, sugar, both alcoholic and non-alcoholic beverages, and tobacco products.

The results from the above study show that total EC trade, including intra-EC, in all processed products was IIT driven since the Grubel and Lloyd indices were more than 70. Nevertheless, in the case where only EC external trade, i.e. excluding intra-EC trade, was considered, values of the index for seven of the ten processed products fell below 50, signifying that the EC's external trade, excluding intra-EC trade, with the rest of the world was INT in nature. These results also support the notion that high intra-industry trade is normally expected in an integrated trading bloc such as the EC.

The indices for USA's trade with the rest of the world indicated that the country's overall trade was INT in nature with six values of the index being less than 50. Nevertheless, four products, namely cereal preparations, processed fruit, processed vegetables and chocolate products were IIT driven with indices above 50. Indices for the rest of the OECD showed than all the products, with the exception of processed fruit, had values of above 50, thus testifying that this group of countries' trade with the rest of the world was IIT driven.

The study by Sharma (2000) investigated the trend patterns of IIT in the Australian manufacturing sector for the period 1979 to 1993. The research used the Grubel-Llyod's (1975) index in an attempt to study IIT trend patterns. The calculated results showed that there was evidence of an increase in the share of IIT, from 28% in 1979 to 37% in 1993. This increased share of IIT in the country's manufacturing products was underpinned by an increased shift towards IIT in products such as textile, garments, rubber products, and machinery and equipment. Investigations at product level show that the total share of IIT rose from 7% in 1979 to 22% in 1993 in rubber products, while it grew from 17% to around 31% for motor vehicles and parts during

the same period. Comparing the end points for the period covered, in 1979 approximately 19% of Australian manufacturing industries had lower levels of IIT which ranged between 0 and 10%, and this group of industries fell to around 5% by 1993, indicating that manufacturing industries have over the years become IIT dominated.

Al-Mawali's (2005) paper employed a gravity trade model in a panel data scenario to analyze both new and existing country-specific determinants of IIT for South African data for the period covering 1994 to 2000. The study experimented with a number of gravity model estimations including the constant coefficient approach, the basic gravity, the augmented gravity model, the fixed effects approach, the between effects approach, and the country-specific fixed and between effects model. The overall results from all these estimation techniques were approximately the same.

The research found evidence of IIT between South Africa and its developed trading partners. In line with the presence of IIT between South Africa and its trading partners, the study recommended the former country to "pursue its intra-industry trade by concentrating on industries that produce the most competitive varieties, absorbing labour and other resources from the production of other varieties". This recommendation was also based on the fact that IIT production adjustments are assumed to be easier to achieve than INT adjustments.

The above study also found out that the market size was among the most important determinants of total IIT and its sub-components, HIIT and VIIT. Specifically, the more IIT, HIIT and VIIT were conducted, the larger the market size of South Africa and its major trading countries grew. More IIT, HIIT and VIIT were also witnessed in the presence of a larger combined GDP per capita as was shown by the product of South Africa's GDP per capita and that of its trading partners. On the other hand, less IIT was conducted between South Africa and its trading partners, the greater the geographical distance between them. Furthermore, variables such as political risk and technology gap were found to be not important determinants of South Africa's IIT, HIIT, or VIIT.

2.3.2 Literature on determinants of exports

Marques' (2008) paper investigated unequal regionalism in the European Union (EU) whereby the economic group is composed of member countries with varying degrees of heterogeneity, especially following the group's May 2004 and January 2007 enlargements. The main objective of the study was to empirically demonstrate that in a mixed trade bloc such as the EU-27, the different determinants of trade will result in an asymmetric effect depending on the direction of the trade flows. The heterogeneity, especially between the old EU-15 and the new EU (mostly Central and Eastern European Countries (CEEC-10)) is with regards to differences in income levels, factor endowments, size, spatial and non-spatial trade costs in industries with different degrees of economies of scale and factor-intensity.

To achieve its objective, the study made use of the generalised gravity equation proposed by Bergstrand (1989). The main advantage of this formulation, according to the author, is that it integrates "in one reduced form equation both increasing returns to scale with monopolistic competition and the factor-proportions theory of trade". In the econometric estimation procedure, the research estimated both import and export gravity equations through the Prais-Winsten regression with country-specific autoregressive (AR (1)) terms and correlated Panel Corrected Standard Errors (PCSEs). The advantage of this technique, according to the study is that it assumes that the error terms are heteroskedastic (i.e., each country has its own variance) and contemporaneously correlated across countries (i.e., each pair of countries has their own covariance). Thus, the research estimated gravity models of both import and export trade flows between old EU-15 and new EU-10[7]. The gravity equations for both the old and new EU were done for the following eight sectors: chemicals, leather products, machinery, metals, minerals, textiles and clothing, transport equipment, and wood products.

The estimations showed that results from import and export equations are different. The results indicate that market sizes have a significant and positive effect on total trade and that, overall, the enlarged EU bloc tends to trade more than proportional to

[7] Because of data availability problems on 2 of the new EU-12, the study estimated gravity models for the new EU-10, instead of the EU-12.

its market size. The coefficient of GDP per capita, which was intended to measure the purchasing power of the importing country, was not significant in some sectors, while in other sectors it was inconsistent with the theoretical expectation of a positive coefficient. For instance, in the case of EU-15 importers, the GDP per capita variable was significantly positive in three sectors; machinery, textiles and clothing, and wood products, while significantly negative in three other sectors; chemicals, leather and footwear, and minerals. In the case of the EU-10 (CEEC-10) importers, higher GDP per capita increased imports in two sectors; chemicals and metals, whilst negatively affecting imports in four industrial sectors; leather and footwear, machinery, transport equipment and wood products.

The study also includes factor endowment variables, namely human capital and physical capital, with the theoretical expectation that a given country's sectoral exports will increase, the more that country has more of a given factor endowment. Generally, the results indicate that for the EU-15, there was a positive correlation between exports on one hand, and both human and physical capital endowment on the other hand. This positive relationship was evidenced especially for physical capital in sectors such as chemicals, machinery, metals and transport equipment. A negative relationship between exports and capital endowments was however witnessed in the leather and footwear sector. On the other hand, the EU-10's results on the impact of capital endowments were mixed. Human capital was positively correlated with total exports while physical capital endowments, on the other hand, affected exports from different sectors differently. For instance, machinery, textiles and clothing, and wood products sectors' exports were positively affected, while chemicals, leather and footwear, and minerals sectors were negatively affected by physical capital endowments.

The results for distance and borders were also found to be plausible and according to theoretical expectations. Distance was found to be significantly negative, thus reaffirming the theory which predicts a decline in trade due to a larger distance between trading partners under the assumption that the spatial variable increases transport costs. The study also found the distance impact to be higher for the EU-10 countries, by virtue of them being relatively less developed countries in comparison to the more developed EU-15 countries.

Molinari (2003) employed a gravity trade model for eight broad EU trade sectors with the main objective of investigating the level and trends of sectoral integration effects within the economic bloc's member countries as well as to analyze both the level and the evolution of the region's integration since the 1970s. The eight trade sectors analyzed were *textiles* (textile, wearing apparel and leather industries), *wood* (manufacture of wood and wood products, including furniture), *paper* (manufacture of paper and paper products, printing and publishing), *chemicals* (manufacture of chemicals and rubber products), *non-metals* (manufacture of non-metallic mineral products, except products of petroleum and coal), *basic metals* (iron and steel basic industries, and non-ferrous metal basic industries), *metals* (manufacture of fabricated metal products, machinery, electrical machinery apparatus, appliances and supplies, and transport equipment), and *other manufactures* (manufacture of jewellery and related articles, musical instruments, sporting and athletic goods, and industries not elsewhere classified). The study's sectoral approach was motivated by the need to explicitly capture the border effects applicable to different sectors. This is mainly because border controls and import duties that were applied and levied were not the same across the eight imported sectoral products.

The study adopted the gravity formulation of Bergstrand (1989), though modified to fit different sectors. The main determinants of the sectoral bilateral trade were categorized into four groups, namely barriers to trade, production and income, integration effects, and transaction costs. Barriers to trade determinants included both geographical and measures of trade resistance, with the former composed of distance and transportation costs, and the latter consisting of tariffs and non-tariff barriers (NTBs). These barriers were expected to be negatively related to trade. Production and income variables reflected exporters' productive capacity and the purchasing power of the importer country, respectively. Trade integration effects in the form of preferential trade arrangements such as the European Union (EU), European Free Trade Area (EFTA) and North American Free Trade Area (NAFTA) were considered as important positive trade determinants. Two types of transaction costs were used in the equation, bilateral link and bilateral currency. Transaction costs were expected to be lower in the case where two countries had mutual bilateral links between them. Thus, the presence of bilateral trade was expected to reduce transaction costs, hence

boost trade between the countries involved. At the same time a favourable bilateral currency (or relatively weaker currency) was expected to improve a country's terms of trade, resulting in the country's exports becoming more competitive.

The paper estimated the gravity trade equation for the period 1977 to 1999 by employing two panel data models: the fixed (within) estimator[8] and the random (Generalized Least Squares - GLS) estimator. These two estimation techniques were used because of their ability to capture the unobserved individual and time effects. The transaction costs variables results show that bilateral tariffs were important determinants of trade, with a 1% increase in bilateral tariff causing a decrease in imports of 2%, while a real exchange rate currency appreciation of 1% increased import trade by 0.06%.

The time effects were generally significant for paper, chemical and basic metals sectors for most of the time period, while it was only significant from 1985 and 1986 onwards for the textiles, wood and metals sectors, respectively. For the other sectors, time effects were oscillating from being significant to being insignificant. Generally, the study concluded that unobservable time effects were important. In terms of the effect of EU integration on trade, the study found out that, on average textiles was the most integrated sector. That is, membership to EU in this case increased bilateral textiles trade by 43% as opposed to non-EU membership. On the other extreme, membership to EU increased trade by only 9% for the chemical and the non-metallic products sectors, suggesting that these sectors were the least (significantly) integrated. On the intermediate case, other manufacturers were considered to be mildly integrated, with EU membership increasing trade by 13%.

The aim of Marques and Metcalf's (2005) study was to investigate the relative importance of different determinants of sectoral trade, such as location and endowments, in shaping the trade patterns of the heterogeneous trade bloc, the enlarged EU. This objective was achieved by estimating a gravity model of trade flows between country groups with different skilled/unskilled labor ratios and

[8] The major drawback labeled against the fixed effects model is that it does not allow the isolation effects of distance, adjacency and common language on bilateral trade. This mainly emanates from the fact that the within estimator looks at the effects which are independent from the time-means, and hence all the time invariant determinants of trade will be captured by the individual effects.

different spatial and non-spatial trade costs, in sectors with different degrees of economies of scale and skill-intensity.

The study's results are summarized as follows. Firstly, income and size were not significant determinants of Spain's trade, irrespective of the fact that the country was the richest and largest in the Southern part of the EU. Secondly, size was found to be a significant determinant of trade than income in the central EU, whereas exactly the opposite was true for the eastern peripheries. Thirdly, income catching-up was found to impact on the enlarged EU internal trade patterns. The results indicated that economic distance increases center–periphery trade, but decreases periphery–periphery trade. Lastly, along with size and income, human capital endowments were found to be important determinants of trade. These endowments revealed a different type of relationship between the center and each of the peripheries: human capital endowments increased Eastern trade, but decreased Southern trade.

The main objective of Ciuriak and Kinjo's (2005) study was to try and address the criticism leveled against the gravity model that it does not take into account comparative advantage. The study considered this criticism as critical, given that comparative advantage forms the bedrock of economists in their understanding of international trade. To address this problem, the study introduced a trade specialization index (TSI) as an additional variable into the gravity model to capture the degree of complementarity of the trading partners' comparative advantages. The study's main general finding was that the TSI clearly distinguished countries that were generally believed to be "most similar" from those that were believed to be "most different". According to the study, the TSI's explanatory power in the gravity equation was good, comparing well with other established variables and it improved the overall goodness of fit of the gravity equation.

Chan-Hyun's (2001) study empirically analyzed Korea's sectoral trade patterns based on the gravity model. Among the sectors analyzed was the mineral sector. The paper's findings indicated that the country's mineral exports were positively related to the products of GDPs (of Korea and its respective trading partners). Specifically, a 1% increase in the product of GDPs increased mineral exports by 1.1%. Two factors which negatively affected exportation of minerals were products of GDP per capita

and distance. A 1% increase in the product of GDP per capita reduced exports by 0.93%, while a 1% increase in distance resulted in a 0.5% fall in exports.

2.3.3 Literature on unrealized export potential

The paper by Ram and Prasad (2007) investigated trade potential for Fiji using an augmented gravity model in which cross section data for the year 2005 was analyzed using the ordinary least squares (OLS) estimation technique. The investigation was based on the maximum possible coverage of world trade flows for which data was readily available. The study found out that the estimated gravity equation fitted the data relatively well and provided accurate and reasonable income and distance elasticities as well as estimates for other geographical and historical characteristics. Generally, all the three traditional "gravity" variables namely, the exporter GDP, importer GDP and distance, were found to be intuitively reasonable, with statistically significant t-statistics. That is, the higher economic size as represented by GDPs of a country pair and geographical proximity was positively propagating Fiji's bilateral export trade flows.

In terms of Fiji's trade potential, the study revealed that the country had unrealized trade potential, first with the Asia-Pacific region and then with Western Europe and North America. At partner level, untapped trade potential for the Fiji's prospective trade expansion was highest with countries like Australia, New Zealand, Thailand and the United States. In particular, after comparing the actual trade values and the gravity simulated potential trade values, the study found that Fiji could potentially achieve ten times more potential trade than the actual level of trade with countries like Samoa, Vanuatu, Tonga, Papua New Guinea and Solomon Islands. Overall, the study concluded that most of Fiji's Pacific trading partners presented possibilities of expanding trade with Fiji.

In an attempt to investigate India's global trade potential, Batra (2004) examined India's bilateral trade with its major trade partners. The study employed an augmented gravity model equation with maximum possible geographical coverage of world trade flows. The research estimated India's natural trade with its trading partners by

including variables that represent such determinants as geographic, culture and historical proximity of bilateral trade pairs, together with respective partner economic size (as represented by GDP). The paper managed to enumerate India's trade partner countries, regions and regional groupings with maximum potential for expansion of the country's export trade.

The estimates obtained using the augmented gravity model specification indicated that, at national level, India had a huge export trade potential with Pakistan amounting to US$ 6.5 billion, while there was also remarkable untapped export potential with the Philippines, Cambodia and China. The study argued that export trade with China was masked by a number of barriers, which if removed; exports to this destination country could double. At regional level, the paper found that India's trade potential was highest with the Asia-Pacific region followed by Western Europe and lastly, North America.

Eita and Jordaan's (2007) study, besides investigating the determinants of South African export of leather products, also analyzed the extent to which there was unexploited trade potential in the exportation of raw hides and skins (other than fur skins) and leather with the country's trade partners. The investigation was done on South Africa's 32 trading partners in hides and skins, and leather products, and for the period covering 1997 to 2004. To achieve its objective, the study employed the gravity trade model.

After simulating the results from the estimated gravity trade model, the analysis indicated that South Korea, United Kingdom, USA, Zambia and Zimbabwe were some of the trading partners that had unexploited export potential at least from 2002 to 2004. The study argues that such an analysis of untapped export potential was important for trade analysts and policymakers as it help the policy makers to focus efforts on the policies and strategies which can help the country to capitalize on the unexploited trade potential, thus contributing towards acceleration of growth and alleviation of poverty in South Africa.

2.4 Conclusions

The literature review presented in this chapter falls into two parts. The first part presents theoretical review that focuses on factors which explain why some exports are classified as following INT while other exports follow INT. In both INT and IIT trade models, factor endownment, economies of scale and monopolistic competition were some of the main trade theories which explain why some exports fall into INT, while others fall into IIT. On the other hand, product differentiation and monopolistic competition were some of the determinants of exports. Economic size (GDP) and/or population size were also other determinants of exports.

The second part of the literature review focuses on past studies which have analyzed the above factors, including studies on untapped export potential destinations. Studies on INT/IIT were mainly concerned with calculations to investigate the extent to which export products that were being studied were either INT or IIT driven. Empirical literature on the determinants of exports identified economic activity (GDP) of both the exporting and importing countries as two of the factors which promoted export trade. Distance between the respective trading partners was seen as negatively affecting export trade. Other factors were also included in the various gravity models as potential determinants of exports and their effects on export trade depended on other variables that were also included in the respective gravity trade models.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter presents the theoretical framework and empirical models used in this thesis. Given that there are three issues, i.e. structure of exports, determinants of exports and export destinations with unrealized potential, being investigated in this research, the chapter is also divided into three main sections. Section 3.2 discusses the theoretical framework as well as the empirical model employed in investigating both inter-industry trade (INT) and intra-industry trade (IIT). The theoretical framework and empirical models used in investigating the determinants of export trade are presented in Section 3.3, while those dealing with export destinations with unrealized trade potential are the subject matter of Section 3.4.

3.2 Analyzing INT and IIT

This section analyses both INT and IIT. The significance of INT and IIT as well as the analytical framework used to analyze these two phenomena are presented in this section.

3.2.1 Introduction

Total trade is composed of both INT and IIT (Al-Mawali, 2005). The former is a result of different factor endowments across trading countries and the consequent specialization as envisioned by both absolute advantage and comparative advantage trade theories. INT theory is considered as the main reason behind trade between developed and developing countries. On the other hand, IIT is underpinned by both increasing returns and product differentiation trade theories, and is known to dominate trade among developed countries (Al-Mawali, 2005; Jayanthakumaran, 2004; and McCorriston and Sheldon, 1991).

For nearly 200 years, and since Adam Smith's "Wealth of Nations" book in 1776, theories of absolute advantage and Ricardo's comparative advantages (or factor endowments) have been the main reasons explaining international trade. These theories postulate that countries with different resources or factor endowments will trade with each other and they are behind what has been termed INT in trade literature, which is defined as the export and import of products from different industries.

On the other hand, increased observations of simultaneous export and import of similar products from the same industries, witnessed since the late 1950s indicated that traditional factor-endowment theories such as those of Smith, Ricardo, and H-O were not able to provide a comprehensive and sufficient explanation of the volume of international trade which took place between same, rather than dissimilar, products. This gave rise to a new phenomenon called IIT. In the contemporary world, statistical trade data shows that approximately one-quarter of world trade is IIT in nature (Kalbasi, 2003a).

3.2.2 Significance of INT and IIT in international trade

The study of both INT and IIT is important in that it provides a better platform for formulating policies which deal with trade adjustments costs caused by increased trade liberalization (Abd-el-Rahman, 1991; and Greenaway *et al*. 1995). Given that Botswana continues to open its trade regime, from bilateral to multilateral trade levels as detailed in Chapter 4, increased trade, either in the form of INT or IIT will result in cost adjustments. Through increased trade, the sizes of most economic sectors will change; some will experience increased (or decreased) exports, other increased (or decreased) imports while others will experience an increase (and/or decrease) in exports and imports, simultaneously.

The changes in exports and imports described above will involve a shift in resources between sectors (Al-Mawali, 2005). In the case of INT driven sectors, increased imports of competing or similar goods will hurt these sectors, and may result in closure of some production entities in these setcors. The assumption is that increased imports of competing products especially from developed countries will be of better

quality, due to these countries' better production technologies, and relatively cheaper, due to developed countries' efficiencies gained through economies of scale and mass production (Kalbasi, 2003b). Thus, these imports will likely dislodge local producers and this will result in loss of employment in a developing economy like Botswana (mainly as a result of structural changes brought by trade liberalization) and re-allocation of capital to other surviving sectors. For labour, it may mean that those formally employed in the closing sectors will have to find jobs in other industries where their work (occupational) experiences may not match the job requirements and this may involve re-training, which in turn will be done at a cost. At the same time, relocated capital, particularly specialized capital such as machinery and equipment, may end up being redundant. Overall, in the case of INT sectors, increased imports will result in relatively large adjustment costs.

In the case of IIT, simultaneous increases in exports and imports is likely to cause marginal, if any, shift of resources between sectors. According to Grimwade (1989), "Intra-industry specialization is likely to give rise to fewer adjustment problems than Inter-industry specialization necessitates a movement of resources from import-competing to export competing industries". Resources adjustment difficulties, especially for labour, happen where resources are geographically and occupationally immobile in the short term, resulting in large-scale structural employment. In the case of intra-industry specialization, adjustment is normally accomplished without the necessity for workers to leave a particular industry or region. As such, the possibility of structural unemployment is reduced (Grimwade, 1989).

3.2.3 Analytical framework

The Grubel and Lloyed (G-L) Index is the mostly used framework in analyzing IIT and INT. Thus, this framework is presented in this sub-section and will be the one adopted by this study to analyze both INT and IIT.

3.2.3.1 The G-L Index

Balassa (1966) was the first to provide the numeric measurement of IIT when he proposed that IIT be measured by the extent to which exports of a given product are offset by imports of the same product. The following is his formulation:

$$INT_j = \frac{|x_j - m_j|}{x_j + m_j} \qquad (1)$$

where x_j and m_j are the values of the export and import of a commodity j by a given country. In this formulation, INT_j is considered as inter – industry trade (INT) and shows trade in different products. The drawback of this equation is that in the absence of IIT, the index will be one and in the case where there is "perfectly matching" IIT, the index value takes a value of zero. As a result of this problem, this index has not been used in empirical research. This resulted in Grubel and Lloyd (1975) proposing a new method of measurement whose application has dominated empirical literature on IIT/INT.

The G-L index has been the workhorse on empirical literature dealing with IIT measurement. The index computes the proportion of IIT as a component of balanced trade which shows the overlap of export and import trade between country *i* and its *j* partners for a given sector *k*. The formulation used by Grubel and Lloyd's (1975) study takes the following algebraic format:

$$IIT = \frac{(x_i + m_i) - |x_i - m_i|}{(x_i + m_i)} = 1 - \frac{|x_i - m_i|}{(x_i + m_i)} \qquad (2)$$

where IIT is the intra-industry trade index, and the other variables, x_i and m_i, are as defined earlier.

The above G-L index has however been criticised mainly on two grounds. Firstly, the index has been criticised as having bias due to the fact that it ignores trade imbalances, and secondly, the bias problem of selecting the 'correct' data disaggregating level (Isemonger, 2000).

To overcome the above drawbacks levelled against the G-L index, a number of adjusted G-L indexes have been devised, and among them is one by Aturupane *et al*. (1999). The adjusted G-L index, according to Aturupane *et al*. (1997) and modified to represent sectoral flows is represented by the equation:

$$IIT_{ijk} = \left\{1 - \left[\frac{\sum_i \left|x_{ijk} - m_{ijk}\right|}{\sum_i \left(x_{ijk} + m_{ijk}\right)}\right]\right\} x100 \quad , \qquad (3)$$

where,

IIT_{ijk} = intra-industry measure of trade between country i and country j in sector k;

x_{ijk} = exports from country i to country j in sector k;

m_{ijk} = imports to country i from j countries in sector k

The index for IIT in the above formula varies from 0 and 100, where complete INT is indicated by 0, and complete IIT indicated by 100[9]. Since extreme values (that is, 0 and 100) are rare to find in actual computations of the index, values of 50 and below will be interpreted as indicating INT and values above 50 indicate IIT.

Once a given sector is known to be IIT driven, then the next step will be to further decompose it into either horizontal IIT (HIIT) or vertical IIT (VIIT). Although there are a variety of formulae used to define both HIIT and VIIT, the formula by Greenaway *et al*. (1995) will be the one adopted in this study. Thus, HIIT will be

[9] In the case where equation (3) is not multiplied by 100, complete INT will be indicated by 0, and complete IIT will be indicated by 1.

assumed to exist for the simultaneous export and import of a given product in sector *k* between country *i* and its trading *j* partners when the following formula criterion is satisfied:

$$1-\alpha \leq \frac{UVx_{ijk}}{UVm_{ijk}} \leq 1+\alpha \qquad (4)$$

VIIT exists when the following criterion is met:

$$\frac{UVx_{ijk}}{UVm_{ijk}} < 1-\alpha \quad \text{or} \quad \frac{UVx_{ijk}}{UVm_{ijk}} > 1+\alpha \qquad (5)$$

where, UV = unit value; and x_{ijk} and m_{ijk} are as defined before.

The distinction into either HIIT or VIIT is made possible by the use of relative unit values (UV) of exports and imports. According to Aturupane *et al.* (1997), the assumption underpinning the use of UV is that relative prices are able to reflect quality differences, implying that "a variety sold at a higher price must be of higher quality than a variety sold more cheaply" (Greenaway, 1995).

In terms of interpretation, trade in any sector's products is considered to follow HIIT (variety difference) in the case where relative unit values fall within the range defined by Equation (4). By contrast, goods are considered to follow VIIT (quality difference) when Equation (5) is satisfied. Although in literature there are mainly two values of α, i.e. 0.15 and 0.25, which have been used, this study will follow Abde-el-Rahman (1991), Greenaway *et al.* (1995) and Aturupane *et al.* (1997) by employing a dispersion value of 15% (that is, α = 0.15) for the analysis, and use α = 0.25 for robustness check. Over and above the robustness check using this value of α = 0.25 as done in the above studies, this thesis will introduce three other values of α, which are 0.10, 0.20 and 0.30 to increase robustness.

3.2.4 Empirical model

Following from the framework presented above, the study will empirically investigate whether the sectoral exports are either IIT or INT driven, by computing the index in Equation (3). If a given sector's exports are discovered to be IIT, then Equations (4) and (5) will be employed to further ascertain whether they follow HIIT or VIIT models.

3.3 Analyzing the determinants of export trade

3.3.1 Introduction

One of the most successful and popular empirical trade device used for more than four decades is the gravity trade model. Applied to a wide range of variety of goods and factors moving over regional and national borders under different circumstances, it has been used to study a whole range of spatial interactions in economics (Ghosh and Yamarik, 2004). In particular, the model has been applied to study the determinants of bilateral trade flows and to assess the impact of various forms of regional economic integration, such as the creation of a customs union as well as the adoption of a common currency (Cieslik, 2007 and Marques, 2008).

Gravity models utilize the gravitational force concept as an analogy to explain the volume of trade, capital flows, and migration among different countries of the world. The basic tenet of the gravity trade model is derived from the gravity theory in physics. Ideally, a flow is regarded as the resultant of the interaction between two objects, and these two objects in international trade are the exporting and importing countries. The 'masses' of the countries are their economic sizes from which potential trade takes place. Thus, the larger the economies of the relevant countries, the larger will be the trade among these countries. However, distance between the trading partners causes resistance to trade due to factors such as transport costs and time spent during shipment. Other potentially relevant factors which may impede trade are import duties, border controls, quantity restrictions, language, and in the contemporary world, subtle non-tariff barriers (NTBs) such as sanitary and

phytosanitary standards (SPS) are also common trade hindrances. Overall, in many empirical applications, gravity models have proved to have significant explanatory power, leading Deardorff (1998) to refer to these models as the "fact of life."

The popularity of the gravity equation as one of international trade 'toolkit' used in examining foreign trade patterns among countries stems from its advantages. Paas (2000) pointed out two advantages of using this model. Firstly, the data needed for the model is in most cases easily accessible and reliable. This advantage is especially favorable when modeling developing (e.g. African) countries given that lack of reliable and internationally comparable statistical data is the most significant obstacle in modeling such economies. Secondly, the theoretical considerations for using these models to explore international trade flows are well discussed and developed in literature (Tinbergen, 1962; Linnemann, 1966; Bergstrand, 1985, 1989 and 1990; Deadorff, 1995 and 1998; Evenett and Keller, 1998; Evenett and Keller, 2002; Mathur, 1999).

Another advantageous dimension of the gravity trade model is its ability to explain more than trade theory. Trade theory, as a canon of trade, explains why countries may trade in different products but does not explain why some countries' trade links are stronger than others and why the level of trade between countries tends to increase over time. This emphasizes the limited applicability of trade theory in explaining the size of trade flows. Consequently, while trade theory can explain why trade occurs, it cannot explain the extent of trade. However, the gravity model, by allowing more factors to be taken into account, can explain the extent of trade as an aspect of international trade flows.

3.3.2 The gravity model analytical framework

Whilst the gravity model has been used in a number of fields of studies such as human migration and investment flows across countries, its application in international trade seems to dominate its overall use. The gravity trade model borrows from Isaac Newton's (1687) "Law of Universal Gravitation" which postulates that the force of attraction, F_{ij}, between two separate entities i and j is a positive function of the

entities' respective masses, m_i and m_j, and inversely related to the squared distance, d_{ij}^2, between the objects. This law is formalized as:

$$F_{ij} = G\frac{M_i M_j}{D_{ij}^2} \tag{6}$$

where:

F_{ij}	= the force of attraction,
M_i and M_j	= are the respective two countries' masses,
D^2_{ij}	= the distance between the two objects, and
G	= a gravitational constant depending on the units of measurement for mass and force.

In the mid 19th century, Carey (Principles of Social Science, 1858 -1859, as quoted in Pass (2000)) observed the presence of the gravitational force in social phenomena, alluding to the fact that the force was in direct ratio to masses and inverse to the distance. The application of the gravity models in social sciences considered the mass as an economic region or country.

In the second quarter of the 20th century, Reilly (1929) proposed a law of retail gravitation, which among other things, stated that a given city attracts retail trade from customers in its vicinity in proportion to the hinterland's size (population) and in inverse proportion to the square of the distance separating the customer from the centre of the city. The frontier separating the market areas of two cities *i* and *j* competing for customers in the hinterland is thus defined as the locus of points for which:

$$\frac{P_i}{d_{xi}^2} = \frac{P_j}{d_{xj}^2} \tag{7}$$

where:

d^2_{xi} and d^2_{xj} = distance of cities *i* and *j,* respectively, from any point *x* on the boundary,

P_i = population of city "*i*", and

P_j = population of city "*j*".

Nearly twenty years latter, Stewart (1948) pointed out that similar forces might underlie the interaction between social units, such as people. Following the above mentioned Newtons' gravitational force formula, Stewart defines the demographic force as the result of a constant times the product of two masses divided by the squared distance (d_{ij}) separating the masses. Taking P_i and P_j as representing the respective populations of the cities (similar to Reilly's approach), the demographic force, DM_{ij}, is mathematically presented as follows:

$$DM_{ij} = G\frac{P_i P_j}{d_{ij}^2} \tag{8}$$

where,

G = a constant corresponding to the gravitational constant.

In empirical studies mass has been measured in a variety of ways, depending on the subject matter being studied. For instance, Isard and Freutel (1954) used income as a measure of mass and developed the concept of income potential to parallel Stewart's concept of population potential. On the other hand, if migration is to be studied, it may be appropriate to use employment or income as a more significant index of mass than population. Likewise, when the marketing problem for manufactured products is being assessed, the total volume of retail and wholesale sales tends to be the most appropriate and significant measure of mass. Thus, it can be argued that the measure of mass depends on the problem to be studied, available data, and related considerations. According to Isard (1960), the array of possible measures range from total investment in facilities, number of car registrations, hospital beds, investment in tractors and farm equipment, commodity output, value added in manufacture, etc (Disdier, 2009). Therefore economic mass is weighted differently.

In a like manner, distance has been and can be measured in a number of ways related to various aspects of the problem and the state of transport technology. For example, in a metropolitan traffic study, travel time is the most appropriate measure of distance. The other possible measures of distance which have been used in empirical literature are mileage along a specific transport route (waterway, highway, airline, and railway), fuel (energy) in transportation, number of gear shifts, stops, etc. (Isard, 1960).

Summarizing the historical development of the gravity theory, it can be noted that the theory has primarily been centered on fields where distance plays a significant role. To this end, the gravity theory has proven to be useful in describing social phenomena in space such as population migration, flow of goods, money, and information, traffic movement and tourist travel.

One can therefore specify a gravity theory to describe the above social phenomena following Nijkamp's (1975) formulation:

$$t_{ij} = Ko_i^{b1} d_j^{b2} f\left(s_{ij}\right) \tag{9}$$

where,

t_{ij} = the volume of flows between two points,
K = a constant,
o_i = volume of flows from the points of origin,
d_j = volume of flows at the points of destination,
$b1, b2$ = weighted geometric averages of o_i and d_j respectively,
$f(s_{ij})$ = distance friction, a decreasing function of s_{ij}.

In analyzing trade, the basic gravity trade model which has been used in empirical work over the years was originally specified by Tinbergen (1962) and Poyhonem (1963) as follows:

$$Trade_{ij} = \alpha \frac{GDP_i^{\beta_1} GDP_j^{\beta_2}}{(D_{ij})^{\beta_3}} \quad (10)$$

where $Trade_{ij}$ represents bilateral trade between countries i and j, while GDP_i and GDP_j denote countries i and j's respective gross domestic products. D_{ij} is used as a proxy of bilateral distance between the two trading countries. In the formula above, the α and β's are parameters and the signs of β_1 and β_2 are expected to be positive, while that for β_3 will have *a priori* negative sign. Thus, comparing Equations (6) and (10), it can be seen that in analyzing trade using the same gravity principle, the entities in Equation (6) are replaced by a pair of countries in Equation (10), while the countries' masses in Equation (6) are proxied by the respective GDP in Equation (10) with distance replaced by a variable representing resistance, which in most cases is the actual distance between the trading countries.

Rewriting Equation (10) in logarithmic format, a linear version of the model can be represented as follows (Batra, 2004; and Ghosh and Yamarik, 2004):

$$\ln(Trade_{ij}) = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j - \beta_3 \ln(D_{ij}) + \mu_{ij} \quad (11)$$

where α, β_1, β_2 and β_3 are coefficients to be estimated. The disturbance error term (μ_{ij}) captures random events which may have an impact on bilateral trade between the two trading countries and is assumed to be stationary, with a mean of zero and a constant variance. Thus Equation (11) is the core gravity equation which has been used in all empirical studies, albeit with added right hand side (RHS) variables, with each RHS variable added depending on the particular facet of trade being analyzed, the objectives to be achieved and availability of data. In this basic gravity theory, a positive correlation is expected between trade and GDPs, while a negative relationship will be expected between trade and distance.

3.3.2.1 Theoretical foundations of gravity models

Despite the extensive use of gravity equations in economics until recently they have tended to lack strong theoretical foundations. Currently, due to theoretical

developments that have been done since Anderson's (1979) work, the gravity equation in its basic form can be derived from a variety of competing theoretical models, based on either neoclassical or monopolistic competition assumptions. As pointed by Frankel (1998:2) the gravity equation has recently "gone from an embarrassment of poverty of theoretical foundations to embarrassment of riches".

There are broadly two competing models of international trade that provide theoretical justification for the gravity model. They are the differentiated products model and the Heckscher-Ohlin (H–O) model. Anderson (1979) popularized the differentiated product model. His point of departure was the use of the Armington assumption that products were differentiated by country-of-origin. Thus, Anderson (1979) demonstrated how to derive a gravity equation by employing the properties of a Cobb-Douglas expenditure system in a case where each commodity was produced by one country. Helpman's (1987) theoretical exposure also assumed monopolistic competition and product differentiation among firms in all industries rather than countries. The monopolistic competition approach was viewed as a stylish way of endogenizing product differentiation and explaining formally the basis for the Armington assumption. The main purpose of monopolistic competition in Helpman's (1987) model was to ensure that different countries specialize in production of different varieties of differentiated products due to existence of economies of scale at the firm level which enhance the incentives for foreign trade.

Empirically, Krugman and Helpman (1985) identified the relationship between the bilateral trade flows and the product of two trading countries' GDPs by utilizing the differentiated products trade model. According to Krugman and Helpman, under the imperfect substitute model, where each firm produces a product that is an imperfect substitute for another product and has monopoly power in its own product, consumers show preference for variety. When the size of the domestic economy (or population) doubles, consumers increase their utility, not only in the form of greater quantity but also in the form of greater variety. International trade can provide the same effect by increasing consumers' opportunities for even greater variety. According to Linder (1961), when two countries have similar technologies and preferences, they will naturally trade more with each other in order to expand the number of choices available for consumption. The association between the gravity equation and the

differentiated products model was empirically proven by Helpman (1987) when he applied his test on OECD countries' trade data. His results supported the argument that the gravity equation can be applied to the trade flows among industrialized countries where IIT and monopolistic competition are well developed.

In contrast, Deardorff (1995) has shown that the gravity trade model can be derived from several variants of the H-O model based on comparative advantage and perfect competition if it is properly considered. He found out that the absence of barriers to trade in homogeneous products causes producers and consumers to be indifferent to the trading partners, both domestic and foreign, so long as they buy or sell the desired goods. Based on this assumption, he derived expected trade flows that correspond exactly to the simple frictionless gravity equation whenever preferences are identical and homothetic. Hummel and Levinsohn (1995) conducted an empirical test with a set of non-OECD countries where monopolistic competition was not so plausible. Their results proved that the gravity equation was also efficient in explaining the trade flows among developing countries where inter-industry trade was dominant with scarce monopolistic competition. Their findings questioned the uniqueness of the product differentiation model in explaining the success of the gravity equation and proved that a variety of other models, including the H-O model, can serve as alternatives.

Evenett and Keller (1998) also emphasized that gravity prediction constitutes the most important result regarding the volume of international trade. They argued that little production is perfectly specialized due to factor endowment differences and that as long as the production is not perfectly specialized across countries, both models of the H-O and differentiated products are likely to account for the empirical success of the gravity equation. Deardorff (1998) and Feenstra (2004) have also noted the compatibility of the gravity equation with some structures of the H-O model, as well as the need for empirical evidence to distinguish among potential theoretical bases: product differentiation by country of origin; product differentiation by firm; and particular forms of the H-O-based comparative advantage. In each of these cases, the common denominator is complete specialization by countries in a particular commodity. Without this feature, Deardorf (1998) and Feenstra (2004) argued that bilateral trade tends to become indeterminate.

Following the aforementioned theoretical developments, it is generally accepted that a number of trade models are responsible for the empirical success of the gravity equation. While the H-O theory would account for the success of the gravity equation in explaining bilateral trade flows among countries with large factor proportion differences and high shares of inter-industry (the so-called 'North-South' trade), the differentiated product model would serve well in explaining bilateral trade flows among countries with high shares of intra-industry trade (the so called 'North-North' trade) in increasing returns with monopolistic competition. Thus, there is currently no single theoretical model which claims monopoly in explaining the success of the gravity model, as the exact theoretical model which best describes the empirical findings of the gravity model is still a matter of contention (Ram and Prasad, 2007).

Therefore, given that no single trade theory can claim monopoly in explaining the success of the gravity trade models, some of the possible theories are presented in Table 2 (See also Table A26 in Section 12 of the Appendices).

Table 2: Theories behind the gravity trade model

Type of model		**Technology Differences (Ricardian)**	**Increasing Returns to Scale**	**Heckscher-Ohlin**
1	Structural assumption: Identical homothetic demand, free trade etc	Technology differences with industry classes across countries	Increasing returns at the firm level, monopolistic competition, product differentiation	Homogenous goods and multi-country (large factor proportion differences)
	Consistent with absence of factor proportions differences?	Yes	Yes	No

2	Implication for Nature of Trade	Intra-industry trade (IIT) in goods with alternating technological superiority	Intra-industry trade (IIT) in product varieties with potentially identical technologies across countries	Inter-industry trade (INT)
	Consistent with trade in goods with identical factor requirements?	Yes	Yes	No

Source: Evenett and Keller (1998)

3.3.3 Empirical model

Although the basic gravity trade model used in most empirical studies has been developed from Equation (11), theoretical developments for sectoral gravity models are still scarce. One notable study which developed a theoretical sectoral gravity trade model is by Marques (2004) and is presented in Section 7 of the Appendices. From the model presented in the Appendices, sectoral gravity trade models for each of the three sectors, diamond, textile, and meat and meat products, can be represented by simplification of the formulations in Equations (A14) and (A15), as shown in Section 7 of the Appendices. To appropriately achieve this thesis' objective number 2, the sectoral gravity models estimated are further augmented and modified as shown in Equation (12). The model is "augmented" in that it includes a number of variables, besides the importer GDP, exporter GDP and distance, as presented in the basic gravity Equation (11), which account for other possible factors which may have an impact on bilateral trade. The model is also "modified" in the sense that it is formulated to take into account sectoral, as opposed to aggregate or total trade factors.

$$LnX_{ijk} = \alpha_0 + \alpha_1 \ln Y_{ik} + \alpha_2 \ln\left(K_{ik}/L_{ik}\right) + \alpha_3 PTA_{ijk} + \alpha_4 \ln Y_j + \alpha_5 \ln D_{ij} + \alpha_6 \ln P_j + \alpha_7 \ln \Pi_j + \alpha_8 \ln exr_{i,usa} + \varepsilon_{ij} \quad (12)^{10}$$

where,

X_{ijk} = value of sector k export trade flow from Botswana (country i) to country j,

Y_{ik} = is the GDP of sector k in country i (i.e., Botswana),

(K_{ik}/L_{ik}) = capital per unit of labour (capital labour ratio) in sector k in country i (i.e., Botswana),

PTA_{ijk} = Preferential trade arrangement (PTA) dummy variable between Botswana (i.e., country i) and partner j in sector k,

Y_j = GDPs of importing countries,

D_{ij} = physical distance from the economic centre of country i (i.e., Gaborone, Botswana) to that of country j,

Π_j = inflation of importing country,

$Exr_{i,usa}$ = exchange between Botswana Pula and US dollar

α_0 = a constant.

Sector specific preferential trade arrangements (PTA) dummies are:

- Diamond sectoral exports– UK De Beers Diamond Trading Company dummy
- Textile sectoral exports – AGOA dummy
- Meat and meat products exports – Cotonou trade agreement dummy[11]

[10] Where Variables Y_{ik} , K_{ik}/L_{ik} and PTA_{ijk} are sector specific

Given the empirical evidence to be presented in Chapter 5, which shows that the diamond sector is IIT driven while both textile, and meat and meat products are INT, the study is now at a position to extend Equation (12) and add new explanatory variables to capture both IIT and INT in the sectoral gravity models. The resulting equation thus becomes:

$$\ln X_{ijk} = \alpha_0 + \alpha_1 \ln Y_{ik} + \alpha_2 \ln\left(K_{ik}/L_{ik}\right) + \alpha_3 PTA_{ijk} + \alpha_4 \ln Y_j + \alpha_5 \ln D_{ij} + \alpha_6 \ln P_j + \alpha_7 \ln \Pi_j + \alpha_8 \ln exr_{i,usa} + \alpha_9 IIT(INT)_{ik} + \varepsilon_{ij} \quad (13)$$

The rationale for including either an IIT or INT variable in the gravity trade model is to see whether this new variable in Equation (13) can lead the study in concluding that the IIT/INT variable is also an important determinant of Botswana's sectoral exports or not. For the diamond sector where exports are IIT driven, a representative variable to capture product differentiation trade theory will be put where there is IIT (INT) in Equation (13). Literature, for instance, Hafbauer (1970) suggests the use of either the number of traded Hamonised Commodity Description and Coding System (HS) lines within the sector or the Hafbauer index, which is presented in Section 8 of the Appendices, as possible variables to represent IIT, or product differentiation theories. In the case of the textile, and meat and meat products sectors which are INT driven, as will be empirically tested in Chapter 5, an INT variable will replace IIT (INT) in Equation (13). The revealed comparative advantage index (RCAI), presented in Section 9 of the Appendices, has been one of the possible variables suggested in empirical literature (for instance Kandogan, 2003a) to capture INT or H-O trade theories in gravity equations. Thus, two gravity model equations for each of the three sectors will be estimated based on Equations (12) and (13). Following IIT/INT explanations in Chapter 5, the coefficient of IIT/INT is expected to be positive.

[11] In each of the three sectoral gravity models, there will be only one PTA dummy, hence no problem of dummy traps.

3.3.3.1 Selected factors that determine exports

With regards to factors that determine exports, as outlined in Chpater 2, there is a pool of potential variables, besides the three core variables of importer GDP, exporter GDP and distance, which explain direction of exports. In fact, Ghosh and Yamarik (2004) indicate that there are around 48 factors that have been used in gravity trade model literature which seek to explain the direction of exports[12]. This section therefore discusses some of the determinants found in literature and especially those that will be used to explain Botswana's sectoral exports.

3.3.3.1.1 GDP or economic mass

Overall, in the gravity models, trade is assumed to occur when domestic production is not equivalent to domestic demand. The sectoral GDP (Y_{ik}) of Botswana measures productive capacity in a given sector and can also be considered as a proxy for the range of product varieties available, which increase the availability of exports in that sector. The GDP values for Botswana's mining, manufacturing and agriculture sectors will approximate the sectoral GDPs used in the gravity trade model equation for diamond, textile, and meat and meat products, respectively. The GDP (Y_j) of the importing country measures absorptive capacity and represents potential demand for imports from Botswana. Thus, α_1 and α_4 in both Equations (12) and (13) are expected to have positive signs.

3.3.3.1.2 Distance between trade partners

Head (2003) alluded to the fact that distance in gravity models acts as a sort of tax "wedge," imposing trade costs, and resulting in lower equilibrium trade flows. Ram and Prasad (2007) consider the following five factors as the reasons for inclusion of distance as an explanatory variable in gravity trade models:

- distance acts as a better measure of transport costs,

[12] This thesis has experimented with a number of possible variables in each of the three sectoral gravity models and the ones presented in this section are the most significant ones.

- the time which elapsed due to shipment can be indicated by distance, with the probability of surviving intact for perishable goods diminishing with time in transit,

- distance is normally correlated with transaction costs in the form of searching for trading opportunities and the establishment of trust between potential trading partners,

- synchronization costs are positively related to increasing distance, i.e., the synchronization costs incurred in cases where production factories combine multiple inputs from different countries in order to prevent delays or emergence of bottlenecks; and

- distance captures cultural diversity, which can retard trade by inhibiting communication, differences in negotiating styles, etc.

Thus, as distance between trading partners increases, export flows are expected to decline. In this case, theory predicts a negative relationship between export trade and distance.

3.3.3.1.3 Factor endowment

The capital-labour ratio (K_{ik}/L_{ik}) characterises the sectoral technologies and their relative factor requirements. This variable captures the relevant supply-side characteristics of production which normally impacts on exports. A higher capital-labour ratio is expected to affect sectoral exports positively.

3.3.3.1.4 Preferential trade arrangement (PTA) dummy

The PTA_{ijk} is a vector of specific PTA dummies between Botswana and a trading partner in sector k. For the three sectors under study, the specific PTA dummies, as will be explained in Chapter 4, are the diamond's UK De Beers Diamond Trading

Company dummy, the textile African Growth Opportunities Act (AGOA) dummy, and the Cotonou Agreement's meat and meat products dummy. In all three cases, the dummy will take a value of 1 if a trading partner is a member described by the dummy and 0 otherwise. According to Carrere (2006); Silva and Tenreyro (2006); and Jakab *et al.* (2001), inclusion of PTA variables in the gravity model is useful in assessing whether the PTA among member states has been trade-creating or trade-diverting. In this thesis, membership to a trade preferential arrangement is expected to generate a significant increase in trade given that countries enter into such arrangements mostly with the aim of increasing trade among them. Thus, coefficients of all the trade related arrangement dummies are expected to be positive.

3.3.3.1.5 Population

Population is used as a measure of country size, and larger countries, as measured by population, are assumed to have more diversified production, a large domestic market, a high probability of self-sufficient and less need to trade (Nilsson, 2000). A negative correlation will be expected between population and export trade in such a scenario. However, Bergstrand (1985) pointed out that there is an inconsistency in this argument, as larger populations allows for economies of scale which are translated into higher exports resulting in a positive relationship between population and export trade. Therefore, the sign of the coefficient of the exporting country would be indeterminate. At the same time, a large population in the importing country can affect imports either negatively or positively due to the same reasons as given for the exporting country.

3.3.3.1.6 Inflation

Inflation measures the purchasing power of the importing countries. The sign for this variable is indeterminate. Both negative and positive signs are supported by theories from international finance. When an importing country is in an inflationary period, it means that citizens will try to avoid domestic inflation by importing (with the assumption that world imports prices will be relatively lower compared to domestic

prices). In this case, a positive relationship between inflation and imports will be expected. On the other hand, inflation means that most consumers will scale down their purchases, including imports, as their real purchasing power falls, thus resulting in a negative relationship between imports and inflation.

3.3.3.1.7 Exchange rate

To capture the impact of depreciation of Botswana pula against the US dollar, the gravity trade models for each of the three sectors were augmented by including exchange rate of dollar in terms of Botswana pula[13] following Bergstrand (1985)[14], and Soloaga and Winters (2001), among others. The relationship between exchange rate and export trade is expected to be positive. That is, an increase in the exchange between US dollar and Botswana pula implies depreciation (weakening) of the latter currency. This will encourage exports from the latter country as importers will be able to import more products with the same US dollars than if there was no depreciation.

3.3.4 Estimation Procedure

This subsection provides the procedure that is followed in estimating panel data econometrics in general and the gravity trade model in particular.

3.3.4.1 Pooled versus individual fixed effects

Generally, panel data regression differs from time-series or cross-section regressions in that its econometric representation contains double subscript on its variables. An illustrative representation can take the following form:

$$y_{it} = \alpha + X'_{it}\,\beta + \mu_{it}, \qquad i = 1, \ldots, N;\ t = 1, \ldots, T \tag{14}$$

[13] Direct exchange rate is used, that is, the rate at which US$1 is converted into Botswana pula (BWP)
[14] An exchange rate variable has first been formally introduced into the gravity equation by Bergstrand (1985).

with *i* denoting households, individuals, firms, countries, etc., and *t* denoting time. The *i* subscript, therefore, represents the cross-section dimension, whereas *t* denotes the time-series dimension. In Equation (14), α is a scalar, β is a *k x 1* matrix vector and X_{it} is the i^{th} observation on *K* explanatory variables. In empirical literature, most of the panel data estimations (e.g. Jayasinghe and Sarker, 2007; Marques *et al,* 2005; and Rojid 2006) utilize a one-way error component model for the disturbances, with

$$\mu_{it} = \psi_i + \varepsilon_{it} \qquad (15)$$

where ψ_i denotes the unobservable bilateral country-level individual specific effects and ε_i denotes the remainder disturbance which is assumed to be independently and identically distributed over *i* and *t*, with a mean of zero and constant variance, σ^2_ε. In the sectoral gravity equation, y_{it} (in Equation (14)) and represented by X_{ijk} in the actual empirical model Equations (12) and (13), will measure the value of exports from a given sector, whereas X_{it} (in Equation (14)), represented by applicable right-hand variables in Equations (12) and (13), contains a set of variables such as the respective GDPs and distance. On the other hand, ψ_i (in Equation (15)) (or ε_{ij} in Equations (12) and (13)) is time-invariant and accounts for any individual country-specific effects that are not included in the regression, such things as race, language, etc. The remainder disturbance, ε_{it} in Equation (15) is considered as a well-behaved white noise error term, with mean of zero and a constant variance.

In terms of the estimation procedure, one may assume that there are no individual country-specific effects present in the panel, thus assuming all the countries in the panel to be the same, and that the estimation will have one coefficient for μ_i. If such a route is chosen, a pooled estimation will be the model implemented. The second possible option is to estimate an equation where individual country-specific effects are assumed to be present in the panel, in which case a fixed effects model will be estimated. Nevertheless, in order to decide whether to estimate a pooled model or a fixed model, an econometric test for the joint significance of the individual effects to be estimated has been done. This is the so-called F-test and the results are presented in Section 5 of the Appendices. Given that the F-tests for all the three sectoral equations have rejected the null hypothesis of no individual effects in favour of individual fixed

effects, and also that Botswana's trading partners in all the three sectors investigated are heterogeneous, the analysis of this thesis will therefore be based on the fixed effects model (FEM) estimation procedure.

3.3.4.2 Fixed Effects Model (FEM) versus Random Effects Model (REM)

There are two different models which can be used to estimate the individual country specific effects, i.e., the FEM or the REM. Given these two possible estimation models, a decision regarding the treatment of these effects, either as fixed or random has to be made. Following Baltagi (2005:15), "the random effects model (REM) is an appropriate specification if we are drawing N individuals from a large population". On the other hand, Egger (2000:26) argues that the FEM model is appropriate when estimating trade flows between a predetermined selection of nations. Since this research is concerned with trade flows between Botswana and its main selected trading partners as opposed from drawing N trade partners from a large population, the FEM will be more appropriate than the REM specification for capturing the country–specific effects. As such, the FEM will be used in this thesis estimation.

3.3.4.3 Possible Endogeneity

Possible issues of endogeneity might involve the use of both revealed comparative advantage index (RCAI), in place of IIT/INT, and GDP on the right hand side of both Equations (12) and (13). This section addresses these issues. There should be no endogeneity problem emanating from the use of the RCAI since, although the RCAI is based in part on exports, all the information in it is based on the composition and not on the level of exports. Thus, the dependent variable has information on the level of exports which is different, with the information contained in the RCAI.

Although economic size (GDP) is treated as an exogenous variable in Equations (12) and (13), there is however theoretical and empirical support for the impact that exports can have on income. The possibilities of endogeneity of these variables, therefore, cannot be denied. To resolve this potential problem, Cyrus (2002), among

others, suggested the use of instrumental variables (IV), such as factor accumulation variables physical capital, human capital, and labor accumulation rates and population, as instruments for income since these instrumental variables are assumed to be uncorrelated with the error term in a gravity regression. Despite suggestions to use instrumental variables, most authors (including Cyrus 2002) have found no greater improvements in terms of results when one uses instrumental variables. This thesis has experimented with IV such as physical capital and arrived at the same conclusion, that is, the results do not change when IV are used in place of GDP.

3.3.4.3.1 Hausman test for exogeneity and misspecification

For this thesis, the Hausman test for both exogeneity and misspecification was conducted for each of the three sectoral gravity model formulations and the results are presented in Section 6 of the Appendices. Suffice to say that in each of the three gravity formulations, the null hypothesis of no misspecification (or no correlation between the dependent variable and regressors) is not rejected. The conclusion therefore is that the X-regressor in each of these three gravity models is exogenous, thus suggesting that there is no misspecification problem

3.3.4.4 Univariate characteristics of variables

The general procedure to be followed, according to Van Eyden (2007) and Baltagi (2005), in a case where a panel has enough time-series length, i.e., a panel with time length (T) of at least 10 years, is that the variables should be tested for stationarity before estimation.

Investigation of the univariate characteristics of the data which entail panel unit root tests is generally important given the fact that the unit root test is the first step encouraged in the determination of a potentially cointegrated relationship between variables. Normally, in the case where all the variables used in the estimation are stationary, then traditional estimation methods can be used to estimate the relationship between variables. On the other hand, in the case where variables are non-stationary, a

test for cointegration will be required. There are basically six potential panel unit root tests that can be employed for a panel stationarity test and these are summarized in Table A19 of Section 10 of the Appendices.

Given that the study's panel covers 1999 to 2006, which is 8 years, and less than the minimum panel length of 10 years required for unit root tests (Eyden, 2007 and Baltagi, 2005), this study will not perform panel root tests.

3.3.5 Limitations of the gravity model

Despite its celebrated empirical success, the gravity trade model has not been immune to criticism. Although initially the model's theoretical foundations were not strongly grounded, currently, the model's main regressors, namely income (mass) and distance, are actually supported by a wide range of theoretical models (Deardorff, 1998). Nevertheless, due to theoretical developments and using Frankel's (1998, p. 2) words, the gravity equation has recently "gone from an embarrassment of poverty of theoretical foundations to embarrassment of riches", thus settling the theoretical doubt of the model.

On the modeling side, Cyrus (2007) criticized the specification of the gravity models, especially when using Ordinary Least Squares (OLS) estimation techniques. The source of this specification problem is that 'the causality between income and trade is not clear-cut'. For instance, in the estimation, the gravity equation suggests that high income causes high trade, but he argued that perhaps it is trade that instead causes income to be high. At the same time the use of such policy measures as free-markets may push up both income and trade. In that case, as Cyrus argued, the gravity equation is mis-specified, for income will be correlated with the error term in the regression, so that the ordinary least squares will not provide consistent estimates. To this end, Cyrus (2007) suggested the use of instrumental variables such as factor accumulation variables physical capital, human capital, and labor accumulation rates, population and land area for size as instruments for income since these instrumental variables are assumed to be uncorrelated with the error term in a gravity regression. Despite suggestions to use instrumental variables, a number of authors (e.g., Ram and

Prasad, 2007; and Cyrus, 2007) have found no greater improvements in terms of results when one uses instrumental variables.

Another drawback which is important especially when using the model for analyzing potential export destinations emanates from the fact that historical data is used. It follows that should any structural break happens, for instance in the form of new innovations which result in other countries becoming cheaper competitors to a country's exports, discoveries of say large diamond reserves in another country[15], an import ban (by importing countries), establishment of import substitution industries (by importing countries) and an unexpected change in demand (against an exporting country's product) in particular export destination countries, will render the use of the gravity model's ability to predict export destination potential off trajectory. In these cases, simulated export potential destinations from the gravity model will be misleading.

Despite the above criticisms leveled against the gravity theory, overall, the advantages of using it have outweighed its weaknesses, thus cementing its continued widespread application in empirical trade work.

3.4 Analyzing export destinations with unrealized potential

This section of the thesis relies entirely on the gravity equations to be estimated in Chapter 6, whereby those estimations are considered as a first step, with some of the results further employed in analyzing potential export destinations in the second stage of analyzing the unrealized export trade potential. In terms of methodology and procedure, the estimated coefficients from gravity trade model estimations in Chapter 6 will be used to investigate Botswana's trade patterns in general and with some regional groupings in particular.

[15] New discoveries can happen. For instance, although South Africa used to be the country with largest gold reserves for more than 100 years, this has changed following large discoveries of gold reserves in China in 2007.

3.5 Data sources and description

3.5.1 Data sources

All export series in US dollars (USD) used for the empirical analysis in this study are obtained from South Africa's Trade and Industrial Policy Strategies (TIPS) database. This database provides a comprehensive interactive database for all trade categories in the Harmonized Commodity Description and Coding System (HS) from 2 digit level (HS-2) to 6 digit level (HS-6). The database shows the export amounts in USD as well as in the local currency (Pula), the various export destinations, and the export partners' shares in the country's total exports of a given product line. The data on distance are from the following website: *www.timeanddate.com*. Population data and national GDP series are from the International Monetary Fund's (IMF) World Economic Outlook (WEO). Botswana's Central Statistical Office (CSO) is the source for sectoral employment, sectoral GDP and sectoral capital investment data.

3.5.2 Descriptive statistics

Through provision of simple summaries of any information sample or population data, descriptive statistics are mainly used to describe the basic features of the data in any given research or study. By nature, descriptive statistics simply describe what is or what the data shows and no conclusion or inference can be made beyond the immediate data alone. In other words, descriptive statistics are employed to present quantitative descriptions in a manageable form. The descriptive statistics for all the variables used in each of the three sectoral analyses are shown in Table A20 through to Table A22 of the Appendices.

3.5.3 Correlation matrix

The correlation matrix, or table, shows the strength or degree of linear association of one variable with itself and/or between two variables (Gujarati, 2003). As shown in

Tables A23 through to A25, the entries in the main diagonal, i.e. those running from the upper left-hand corner to the lower right-hand corner, give the correlation of one variable with itself, which is (and should be) always 1 by definition. On the other hand, the entries off the main diagonal are the pair-wise correlations among X variables. In terms of interpreting the off–diagonal pair-wise correlation, high correlation figures suggest severe collinearity problems, while low correlation values indicate absence of the collinearity problem.

The correlation matrix for the data used in the three sectoral equations as presented in Table A23 through to Table A25 of the Appendices indicates absence of collinearity among the variables used in each of the three gravity equations. Absence of collinearity problems is evidenced by low off-diagonal pair-wise variables which are generally below 0.5 in each of the three sectoral correlation matrix tables.

3.6 Conclusion

In this chapter the methodologies used to achieve the objectives of this study have been discussed. The Grubel and Lloyd (G-L) Index has been presented as the analytical model that will be used to investigate the extent to which Botswana's sectoral exports are either inter-industry trade (INT) or intra-industry trade (IIT) driven. In analysing the determinants of these sectoral exports as well as export destinations with untapped potential, the gravity trade model will be used to achieve this type of investigation.

CHAPTER FOUR: QUALITATIVE SECTORAL ANALYSIS

4.1 Introduction

Botswana's economic growth trend since independence in 1966 has been remarkable. Contrasting the periods soon after 1966 and today, significant differences can be noted. For instance, at independence, the country was one of the poorest whose developmental and recurrent expenditures were dependent on foreign aid. On the other hand, over the years, the contemporary Botswana has experienced self-sustainable economic growth, with a gross domestic product (GDP) per capita of above US$11 000 as of 2008, making it an upper middle income country by World Bank classification. In fact, it is considered the richest non-oil producing country in Africa with even greater per capita income than Turkey, Thailand, or Brazil (Todaro and Smith, 2006).

Historical economic activity indicates that in 1966, 40% of the Botswana economy's GDP and 90% of employment were mainly from the agriculture sector. This agricultural sector's contribution has however declined sharply over the years to such an extent that the sector only contributed only about 4% and 16%, respectively by the mid 1990s. These contributions further declined to less than 3% and 8% respectively, by the end of 2006. On the other hand, the mining sector has taken an important role in contributing towards the country's economic activities, especially during the beginning of the 1990s. Other important sectors which provide meaningful contributions towards the country's export earnings are the textiles, and meat and meat products.

Whilst no firm empirical conclusions will be provided in this chapter, the major contribution of this chapter is to provide the main features of the three sectors under study. These sectors are: (i) diamond, (ii) textile, and (iii) meat and meat products. The sectoral profiles will help in that when empirical analysis is presented in the subsequent chapters the reader will be familiar with the main characteristics of these sectors. Thus, the main objectives of this chapter are to:

a) Provide detailed profiles of the three export sectors in terms of their contribution to export revenue, employment and GDP;

b) Present respective sectoral trade arrangements under which these exports are traded; and

c) Summarize the trade liberalization arrangements in which the country is involved.

Although the contribution from textiles, and meat and meat products sectors towards the country's export revenue has been relatively low or declining in the past few years, the country still considers them as important sectors (products) whose exportation need to be promoted. The country's recent 2008 national export strategy (Republic of Botswana, 2008), which sets strategies on how best to encourage traditional and non-traditional exports, also investigates these two sectoral products. Thus, in line with the importance that these products are given by Botswana in terms of its future export development, and the fact that they also contribute significantly to employment, and rural livelihood and food security when one considers meat and meat products, this study includes these products in its analysis, irrespective of the fact that their percentage contribution to export revenue might have been low or declining.

4.2 Mining Sector

The importance of the mining sector's activities towards the economy of Botswana can be traced back to the discovery of diamonds in the country's Opera region in 1967. This discovery resulted in the growth of mining activities, which at independence comprised only small-scale quarrying, into a multi-billion dollar venture. Although the slow recovery in the global economy in the late 1970s, following the 1973/74 oil shocks affected Botswana's mineral exports in the early 1980s, mining activities continue to be the backbone of the country's economy, providing export revenue and employing sizeable labour. For instance, the mining and

quarrying sector accounted for 8 300 jobs, or about 3% of the total formal sector workforce in 2008.

4.2.1 Diamond

The quantity and quality of the country's diamond reserves, especially from the Orapa, Letihakane and Jwaneng mines operated by Debswana, have resulted in Botswana becoming a powerful and the largest diamond producer in the world over the years. Although most countries that are endowed with abundant natural resources, and therefore exporters of products from those resources have suffered the Dutch disease[16], Botswana stands out to be one country which has never been cursed by such a disease.

The country's competitive edge in diamonds continues to be as sharper as before. Sales at the Debswana Diamond Company Limited, a 50 – 50 joint venture between the government of Botswana and DeBeers Centenary AG (Coakley, 2004); have maintained a constant level over the years. The relatively stronger United States (US) dollar in relation to the Botswana Pula, higher carat sales and increased diamond prices are some of the reasons behind Debswana's maintained stronger diamond sales.

In terms of contribution to the economy, the diamond sector continues to be the mainstay of the economy, accounting for above 35 per cent of the country's gross domestic product (GDP) and 53% of Government revenues. The sector directly employs more than 6 500 people and is considered to be the largest single employer in Botswana, second only to the government, employing a total of 25% (directly and indirectly linked to diamonds) of the total labour force of the country (http://www.diamondfacts.org).

Table 3 provides percentages of export earnings contributed by each of the three sectors under study. As shown in the table, diamonds account for more than 70% annually towards Botswana's export revenue.

[16] Dutch disease refers to the adverse effects on the manufacturing sector of mineral (natural gas, diamond, gold, etc.) discoveries through the subsequent appreciation of the real exchange rate (Coden, 1984).

Table 3: Export revenue by sectors (%) 1996-2008

Year / Sector	1996-1999+	2000	2001	2002	2003	2004	2005	2006	2007	2008
Diamonds	73.3	82.6	84.8	82.1	76.8	75.4	74.9	79.1	63.2	65.2
Textiles	2.6	1.7	1.3	1.8	1.8	3.4	5.0	3.2	6.9	5.7
Meat & meat prod	2.5	1.8	2.5	1.7	2.1	1.5	1.7	0.8	2.2	1.9
Sub total	**78.4**	**86.1**	**88.6**	**85.6**	**80.7**	**80.3**	**81.6**	**83.1**	**72.3**	**72.8**
All others	21.6	13.9	11.4	14.4	19.3	19.8	18.4	16.8	27.8	27.1
Overall Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: author percentage calculations using data from the Botswana Central Statistical Office (CSO).

Note: '+' Means four-year average

Whilst export revenue earnings from the diamond sector have contributed significantly to the country's budget, domination of diamonds in export earnings is generally considered as a drawback as it ties the country to one product for its economic growth and development. Thus, in an effort to diversify away from diamond, the country's National Export Strategy (NES) of 2008 envisioned "to make Botswana more internationally competitive and productive with an aim to diversifying the country's export base thereby boosting export performance and improving national competitiveness". The NES advocates for strategies which helps the country to diversify its production and export bases with the aim of reducing the vulnerability of over-reliance on the mining sector, especially diamonds[17].

The marketing of Botswana diamonds is strictly monitored and is done through the De Beers Diamond Trading Company, formerly the Central Selling Organization, in the United Kingdom (UK). Thus, although there could be a number of potential trading partners for Botswana's diamonds, a larger proportion of them are sold through UK by virtue of the latter country being the host to the De Beers Diamond Trading Company.

[17] Among the manufacturing sectors proposed for immediate diversification programmes are: Arts and Crafts, Hides and Skins, Garments and Textiles, Jewellery, Leather and Leather products, and Meat and Meat Products.

4.3 Textiles Sector

Allen *et al*. (2007) points out that the country's historical development of the modern textile sector has been incentivised by both international trade as well as domestic policies which have successfully lured both domestic and international investors to invest in this sector over the years. The country witnessed its first peak of activities in this sector in the late 1970s when firms relocated to its second largest city, Francistown, from Zimbabwe due to the following reasons. Firstly, there was active political and social unrest in the latter country which meant that firms were not able to properly do their business there. Secondly, shortages of foreign currency resulted in implementation of restrictive foreign currency policies making it difficult for companies operating in Zimbabwe to import capital equipment and essential raw materials to service their domestic market. Lastly, the fact that Zimbabwe had become independent in 1980 meant that workers were free and that they were beginning to strike for increased wages, better working conditions and an increased say in the management of the industry. This made some investors nervous and they decided to relocate to Botswana.

The second notable peak in the textile sector was experienced in the 1980s mainly due to the attractive Financial Assistant Programme (FPA) which was instituted by the government of Botswana in 1982 to attract investment in this sector, among other sectors. The FPA was basically a collection of financial and tax incentives for prospective investors or existing investors undergoing significant expansion programmes. The main incentive behind this package was a wage subsidy that started at 80% of workers' wages in the first year and declined over a period of five years. In addition there were capital purchase grants, tax holidays, and a training co-financing scheme. The FPA, among other things, consolidated growth in the textiles sector (Salm *et al.* 2004).

Following the problems encountered with the FPA, the Government of Botswana decided to phase it out and many companies were negatively affected, resulting in a sizeable number of firms either closing down or relocating. This saw the biggest

decline in textile activities and other manufacturing entities in the form of reduced employment and exports in 2000.

Nevertheless, revival of the textile activities after 2000 was stimulated by the inception of United States of America (USA)'s African Growth and Opportunities Act (AGOA), which will be discussed latter in the chapter. Due to AGOA, there has been a dramatic increase in exports to the USA. Also there appears to be a steady stream of investment in the sub-sector which, since it is not FPA led, is likely to be far more sustainable.

Salm *et al*. (2004) argues that the textile and apparel industry in Botswana is an ideal formal employment entry point for the poor. This industry can also absorb relatively large numbers of employees where they can make an economic contribution and earn a cash wage even if they are not particularly well educated or literate. Currently 24 000 workers are estimated to be employed in the manufacturing sector of the economy. Of these more than 8 500, or 35.4%, are currently employed in the textile and apparel sub-sectors.

In terms of contribution to export revenue, Table 3 shows that the sector's revenue contribution has been below 3% for most of the years reported. Nevertheless, signs of growth have been witnessed since 2004, with annual contributions above 3%.

4.3.1 Textile export markets

Botswana is fortunate in that it has preferential access to several important markets for garment and textile products. As an African, Caribbean and Pacific (ACP) country, it has duty and quota-free access for textiles and garments to the EU. As a member of the Southern African Customs Union (SACU), all its products can be sent to the largest regional market, South Africa, without duty or restriction. As a Southern African Development Community (SADC) member country, Botswana's products are given preferential duty treatment when exported to SADC countries outside the SACU. The country also has a bilateral free trade agreement with Zimbabwe that dates back to 1956 and most of its textile products enter into the latter country duty-

free. Finally, under the AGOA, Botswana qualifies as a developing country. This means that until September 2015, it can produce apparel from fabric purchased anywhere in the world and ship it to the United States duty-free under the AGOA trade regime.

4.3.2 Other issues affecting the textile sector

Despite the success of this sector over the years, a number of challenges remain. Firstly, the country's high HIV/AIDS rate has meant low labour productivity, high employee turnover and absenteeism. Secondly, lack of skilled labour has limited firms' ability to enter into high value-added stages of the textile production chain. Production inefficiencies have been witnessed due to lack of economies of scale and high input costs. Generally, most importers prefer to buy in large volumes, and Botswana has failed to seize that opportunity due to the firms' inability to do mass production. High input costs in the form of raw materials, electricity and water costs have resulted in the country being a relatively high cost producer. Another challenge has been the high road transportation costs related to this landlocked country, as opposed to the relatively cheaper sea transport.

4.4 Meat and meat products sector

Generally, the agricultural sector is relatively small in terms of contribution to the country's GDP, with annual contributions normally below 3%. Nevertheless, this sector is still relied upon by most people living in rural areas and dependent on agricultural activities for their livelihoods. FAO (2005:1) reports that agricultural activities in Botswana are a major source of income and employment. The agricultural sector employs around 44% of the country's labour force and around two third of the population depend directly or indirectly on the agricultural sector, mainly subsistence farming.

Historically, the meat and meat products sector used to be one of the important components of the economy, especially in the early years of the country's

independence. However, its significance has declined, especially in terms of contributions to the GDP and export revenues. For instance, at independence in 1966, its contributions towards the GDP and export revenue was around 30% and 70%, respectively. Currently, the sector has been overtaken by such sectors as mining. As of 2004, the meat and meat products sector's contributions to the GDP and export revenue were around 3% and 1.5%, respectively (ODI, 2007), with the contribution to export revenue rising marginally to 1.9% in 2008 as shown in Table 3.

Botswana's National Export Strategy (NES) points out that, "animal husbandry, particularly the ownership of beef cattle, has been at the heart and soul of Botswana for several generations". Current figures indicates that there are more than 2.15 million head of cattle and more than 2.5 million sheep and goats in the country. Also because of the traditional and cultural background of native citizens of Botswana, approximately every Motswana owns cattle or other animals or is related to someone who does.

Jefferis (2005) claims that although this sector's contribution at macroeconomic (GDP) level is currently marginal, the sector however, remains as a bedrock of economic activity in rural Botswana. Livestock rearing is the central agricultural activity in Botswana and an important contributor to poverty alleviation and rural development (BIDPA, 2006). Livestock rearing and sales are the main commercial activity and source of cash in the rural economy. WTO (2003.) claims that livestock production makes up 80% of the major income earner of the agricultural GDP, especially in rural areas. Specifically, there are around 60 000 cattle farming operations in the country, with approximately 37.5% of Botswana's households, or about 612 000 people, occupied in cattle rearing activities, either as owners or employees (HIES, 2003). An estimated 75% of these cattle owners are small-scale farmers with a herd size of 1-19 cattle (ODI, 2007).

In addition, cattle-rearing is considered the biggest industry in Botswana that is owned and controlled primarily by citizens. Moreover, the livestock sector is the only export industry that shows strong linkages to domestic sectors, ranging from rural supply of cattle, over urban demand for cattle to transport and finance (ODI, 2007).

4.4.1 Export markets for meat and meat products

In terms of export markets, the country has a long and well-established trade relationship with the European Union (EU) under the preferential Lomé and Cotonou Conventions. Its exports to the EU comprise, among other commodities, meat and meat products. The parastatal Botswana Meat Commission (BMC) is the state trading agency for beef from Botswana and has a statutory export monopoly on meat, canned meat and live cattle. About 80% of the BMC's total production is exported. The EU is Botswana's main export market receiving about 55% of total exports. In the highly protected EU market, Botswana benefits from an annual quota for boneless beef and veal of 18 916 tons under the Cotonou trade agreement. This volume has been exported at a preferential rate of zero tariff plus a duty (0%+24.2 €/100kg/net). Compared with the regular most-favoured-nation (MFN) tariff for boneless meat, which is 12.8% plus a duty of 303.4 €/100kg/net, this implies a 92% tariff reduction. That is, Botswana can export boneless beef and veal at 8% of the applied MFN tariff (Cotonou Agreement, 2000). Under these trade preferential arrangements, Botswana has been entitled to serve its quota throughout the years without undue restrictions. In the case that the country was not able to fulfill the quota, for example due to droughts, it was also allowed to expand its quota in the following years (ODI, 2007)

4.4.2 Other issues affecting the meat and meat products sector

On the downward side, the cattle and beef sector has been facing some problems. Firstly, the size of the national cattle herd has been shrinking, and, although data is poor, the herd appears to be well below the peak of 3 million animals that was reached in the early 1980s (Jefferis, 2005). Secondly, productivity has been relatively low compared to other regional countries like Namibia and South Africa. Lastly, lack of viability has also been a serious setback for most farmers. In the recent years, selling prices for meat products have not kept pace with rising costs, and for most small scale farmers with limited economies of scale, these selling prices have resulted in them experiencing cash flow problems, thus undermining the viability of this

industry. Moreover, the monopoly export abattoir, the BMC, has consistently made losses in recent years (*Ibid*).

4.5 Botswana's engagement in preferential trade arrangements

Botswana, besides bilateral trade arrangements, is engaged in a number of regional, inter-regional and multilateral free trade arrangements and negotiations. The aim of all these trade arrangements and negotiations is to liberalize trade, imports and exports, between Botswana and the participating countries. The most important trade arrangements in which Botswana is (and has been) involved are briefly highlighted below.

4.5.1 Southern African Customs Union (SACU)

SACU was established through the Customs Union Agreement of 1910 between the Union of South Africa and the three so-called High Commission Territories of Bechuanaland (now Botswana), Basutoland (now Lesotho), and Swaziland. The 1969 Customs Union Agreement between South Africa, Botswana, Lesotho and Swaziland replaced that Agreement. Namibia became a contracting party to the 1969 Agreement in 1990 upon its independence from South Africa. The customs union currently consists of five member countries which are Botswana, Lesotho, Namibia and Swaziland (also referred to as the BLNS-countries) and South Africa.

The main objectives for the establishment of the SACU were that of regional integration and trade facilitation between the members of the Agreement in order to improve economic development of the whole area, in particular the less developed members. The members are thus united in a customs free zone. This means that all import duties between members are abolished.

4.5.2 Southern African Development Community (SADC)

The SADC[18] has been in existence since 1980, where it was formed as a loose alliance of nine majority-ruled States in Southern Africa known as the Southern African Development Coordination Conference (SADCC), with the main aim of coordinating development projects in order to lessen economic dependence on the then apartheid South Africa. The transformation of the organization from Co-ordination Conference (SADCC) into a Development Community (SADC) took place on August 17, 1992 in Windhoek, Namibia when the Declaration and Treaty was signed. The region's vision is that of a common future, a future within a regional community that will ensure economic well-being, improvement of the standards of living and quality of life, freedom and social justice and peace and security for the peoples of Southern Africa.

Generally, the objectives of the SADC Windhoek Treaty do in principle commit SADC to regional economic integration on a wide and deep range of fronts. However, to give the regional trade integration process the attention it deserves, and in accordance to Article 22 of the Treaty, the Community signed a Protocol on Trade (hereinafter called "The Protocol") on the 24 August 1996, thoug its implementation started on 1st September 2000. The Protocol among other things resulted in the implementation of the tariff phase down structure since September 2000 until December 2007. The Protocol mainly deals with all the trade issues of the Community. The specific objective of this Protocol, which directly deals with intra-trade as stated in Article 2, is "To further liberalize intra-regional trade in goods and services on the basis of fair, mutually equitable and beneficial trade arrangements, complimented by Protocols in other areas".

The SADC region has been trading as a preferential trade area (PTA)[19] since its inception in 1980. However, based on the implementation of the agreed tariff phase

[18] The current SADC member countries are: Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

[19] PTA is the loosest form of economic integration, which liberates trade among member countries by *lowering* of trade barriers against imports from other member countries while trade barriers against non-member countries are maintained. As such, the PTA places non-member countries at a competitive disadvantage, and diverts trade from them towards member countries. This is because the duty–free,

down commitments, SADC attained free trade area (FTA)[20] status as of January 2008, although the formal FTA launch was done at a regional Head of State Summit, which was held in Johannesburg, South Africa in August 2008.

4.5.3 Botswana and European Union (EU)

Botswana's trade relationship with the EU over the last four decades has been based on the Lome Agreement from 1975 to 1999, and the Cotonou Partnership Agreement (CPA) from 2000 to 2007. Under these arrangements, Botswana, together with other African, Caribbean and Pacific (ACP) countries have been exporting some of their products, mostly unprocessed agricultural products, to the EU markets duty free. The CPA replaced the previous Lome agreements and lays the basis for a fundamental transformation of ACP-EU trade relations, especially starting from 2008. The non-reciprocal preferential trade arrangements characterized in the Lome agreements will be replaced with a reciprocal preferential trade regime envisioned under the Economic Partnership Agreement (EPA).

The new EPA framework consists of trade, development and political measures that will provide the basis for it to be agreed between Botswana, under the configuration of ACP states, and the EU. The objectives of this economic and trade co-operation is to improve the participation of ACP states in the multilateral trading system, therefore improving the benefits gained from the trading system. This is to be achieved with due regard to political and development priorities and should be consistent with the concept of sustainable development. Under this new framework, 'substantially all trade', that is around 90% of total trade (exports and imports) between Botswana, together with other ACP countries, and the EU will be liberalized.

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even with high production costs, imports from within members may become cheaper than duty-paid, but with lower production costs, imports from non-members.

[20] In an FTA, member countries *remove* both tariff and non-tariff barriers when trading with each other. Nevertheless, each member country retains its own set of trade barriers, including customs duties, against non-member countries; and these trade barriers normally vary from one member to another. Similarly, a member may retain a separate set of barriers against imports from different non-member countries.

Botswana, together with some SADC countries, has been negotiating an EPA under the CPA with the EU. The main outcome of these trade negotiations will be trade liberalization between Botswana, as well as other SADC states, and the EU member countries[21].

4.5.4 Botswana and the AGOA trade regime

The United States of America (USA)'s African Growth and Opportunity Act (AGOA) promulgated by the USA Congress in May 2000 provides market access preferences into the USA markets for 37 Sub-Sahara African (SSA) countries, including Botswana since 2002, by ensuring duty– and quota–free (DFQF) access on over 7000 product lines until 2015. The AGOA builds upon existing USA trade policies by expanding benefits previously available via the Generalized System of Preferences (GSP). The combined AGOA/GSP provisions cover 7000 product tariff lines, of which the AGOA accounts for 1800 of these. These lines include apparel and footwear, wine, certain motor vehicle components, a variety of agricultural products, chemicals, steel, etc. See www.agoa.info for more information. Specifically for Botswana, the textile and apparel sector is one of the three sectors with over 90% of export product lines qualifying for AGOA.

4.5.5 Botswana and the WTO

Botswana is a member of the World Trade Organization (WTO), a successor of the General Agreement on Tariffs and Trade (GATT). The main objective of the WTO is multilateral free trade among member states. To this end, WTO member countries have been negotiating free trade arrangements, especially through the Doha Development Agenda (DDA) round of negotiations which started in November 2001. Although these DDA negotiations have not progressed well since 2003, once they are

[21] An EPA was suppose to have entered into force begging January 2008, but due to extension of negotiations, it is now expected to be in force before the end of 2010.

finished, they will result in free trade among signatory member states in both agricultural and manufactured products, among other things.

4.6 Conclusion

The profiles of the three sectors under study, that is, diamond, textile, and meat and meat products have been summarized in the chapter, with the intention of providing a brief sectoral overview. Also trade liberalization arrangements in which Botswana is involved have been presented.

CHAPTER FIVE: STRUCTURE OF SECTORAL EXPORTS

5.1 Introduction

This section presents the empirical results of the structure of sectoral exports which are either inter-industry trade (INT) or intra-industry trade (IIT). This analysis is achieved by computing Equation (3) for the three sectors, and further simulating Equations (4) and (5) for the sectors where results from Equation (3) suggest the exports to be IIT driven. Computational results from Equations (4) and (5) decompose IIT further into either horizontal IIT (HIIT) or vertical IIT (VIIT). The study employs the Harmonized Commodity Description and Coding System (HS) data at 2-digit level, for the meat and meat products (HS 02) and the textiles (HS 50 to HS 63) sectors. On the other hand, for the diamond sector, this thesis employed the HS data at 4-digit level (HS 7102). This was necessitated by the need to explicitly single out diamond figures, while leaving out non-diamond statistics.

5.2 Diamond sector

The major trading partners[22] for Botswana's diamonds are Belgium, Israel, South Africa, United Kingdom (UK) and United States of America (USA). As shown in Table 4, IIT indices between Botswana and three of its major trading partners (Belgium, Israel and South Africa) are more than 50 in five of the eight year period analyzed. This shows that there is evidence of IIT between Botswana and these three major diamond trading partners. This means that Botswana normally exports unprocessed diamonds to these countries due to lack of proper technology to value-add, and these countries in turn do value-addition by producing manufactured diamond related products such as jewelry like rings, necklaces, etc. Botswana in turn imports these value-added diamond manufactured products. Presence of IIT indicates that Botswana's diamonds can compete in markets of these partner countries. That is,

[22] In analysing IIT and INT, major trading partners are countries in which Botswana and the respective partners have two-way flow of goods, that is, Botswana simultaneously exports and imports the same product to and from the partner countries.

manufacturers in Belgium, Israel and South Africa tend to use Botswana diamonds in their diamond related manufactured products.

Table 4: Diamond IIT indices for Botswana's major trading partners

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Belgium	97.57	90.12	69.48	5.58	89.78	1.50	0.00	79.77	**IIT**
Israel	97.80	80.51	75.17	57.47	0.00	0.00	0.00	59.05	**IIT**
South Africa	65.20	89.75	52.44	0.06	0.16	0.82	53.1	64.85	**IIT**
United Kingdom	0.44	2.46	1.54	0.23	0.01	0.00	0.00	0.06	INT
United States	0.00	0.00	0.00	30.62	0.00	0.00	na[23]	7.99	INT

Source: author calculations using data from TIPS database

On the other hand, INT dominates trade between Botswana and the other two trading partners, the UK and USA. For these two countries, the IIT indices are all below 50. Since trade with the majority of partner countries is IIT driven, it can be concluded that Botswana's diamond trade for the period 1999 to 2006 was IIT dominated.

5.2.1 Decomposition of IIT into HIIT and VIIT

Given that diamond trade between Botswana and its major trading partners is IIT driven, the next step will be to further decompose IIT into either HIIT or VIIT. The results of the decomposition are shown in Table 5. Tabulated results show that HIIT dominated trade in diamond between Botswana and its two trading partners, Belgium and Israel, only in 1999. Otherwise, for the other trading years and for all diamond trade with South Africa, VIIT was the main drive behind Botswana's diamond trade with these three trading partners. Panels A through D in Table A2 in Section 2 of the Appendices provide the decomposition of IIT into HIIT and VIIT, where both smaller and larger dispersion values of α have been used. Generally, comparing the results when either a smaller value of α, e.g. 0.10, is employed or a lager value of α, e.g.

[23] "na" implies that there was either exports (with zero imports) or imports (with zero exports) only between Botswana and the country in which "na" appears in the table.

0.30, is used, the results do not differ much with the results presented in Table 5 where the value of α used is 0.15.

Table 5: HIIT and VIIT in the diamond sector (α=0.15)

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	HIIT	VIIT	VIIT	VIIT	VIIT	VIIT	na	VIIT
Israel	HIIT	VIIT	VIIT	VIIT	na	na	na	VIIT
South Africa	VIIT	VIIT	VIIT	VIIT	VIIT	VIIT	VIIT	VIIT

Source: author calculations using data from the TIPS database

5.3 Meat and meat products sector

Trade in meat and meat products, as shown by the calculated IIT indices presented in Table 6, is INT driven given that overall IIT indices for 11 of the twelve countries are below 50 for all the years indicated in the table. This overall scenario testifies to the specialized nature of Botswana's meat and meat products mainly emanating from its cattle resource endowment, and thus following the dictates of the Heckscher-Ohlin (H-O) trade specialization. It is however important to note that the country's trade with South Africa in this sector is IIT driven. That is, Botswana normally exports unprocessed meat products to South Africa and due to the fact that the latter country has advanced technology, it value-adds meat products into products like canned meat, canned beef, veil, etc. Botswana, in turn imports these value-added manufactured meat and meat products from South Africa.

Table 6: Meat and meat products IIT indices for major trading partners

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Belgium	na	0.00	Na	na	0.00	0.00	na	Na	INT
Germany	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	INT
Greece	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	INT
Italy	0.00	0.00	0.00	0.00	na	0.00	na	0.00	INT

Mauritius	na	na	0.00	0.00	0.00	na	na	0.00	INT
Namibia	0.30	0.00	0.00	0.00	30.09	64.99	0.00	49.39	INT
Netherlands	0.00	0.00	Na	0.00	na	0.00	0.00	0.00	INT
Norway	0.37	0.00	0.00	0.00	0.00	0.00	na	Na	INT
Réunion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	INT
South Africa	74.56	61.24	28.07	36.77	55.81	56.97	19.0	64.50	**IIT**
United Kingdom	0.00	0.00	0.03	0.02	0.00	0.00	0.00	0.00	INT
Zimbabwe	0.00	na	0.00	na	0.00	0.00	na	0.00	INT

Source: author calculations

5.4 Textiles sector

Botswana's textiles sector, like the meat and meat products sector, is also INT driven as most indices presented in Table 7 show values below 50. Among the 34 major trading partners for these sectoral products, only trade with Namibia and South Africa is IIT driven.

Table 7: Textiles IIT indices for major trading partners

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Angola	na	0.00	0.00	na	3.15	0.00	0.00	10.89	INT
Austria	na	0.00	Na	0.00	2.64	0.00	Na	Na	INT
Belgium	29.27	96.85	25.03	32.58	37.28	6.11	0.00	0.14	INT
Canada	21.43	29.28	1.76	40.72	55.56	6.52	64.09	14.54	INT
China	0.00	0.00	0.00	0.00	0.21	1.56	0.76	39.75	INT
Denmark	0.00	0.00	12.63	6.14	51.14	0.00	0.00	0.00	INT
Finland	na	0.00	0.00	3.01	52.68	na	92.66	0.00	INT
France	27.90	0.00	0.00	86.00	6.97	1.15	0.00	5.88	INT
Germany	6.26	18.01	4.12	6.27	0.41	0.18	0.11	1.17	INT
Ghana	1.44	0.80	0.00	0.02	0.00	0.00	6.37	1.44	INT
Hong Kong	1.33	0.00	0.00	0.00	0.24	79.54	0.00	2.42	INT
India	0.08	0.00	0.00	0.00	18.40	0.00	0.05	0.12	INT

Iran	0.00	0.00	0.00	43.19	6.85	0.00	na	0.00	INT
Italy	36.00	3.96	0.00	0.00	0.00	0.00	0.02	57.28	INT
Lesotho	3.57	59.21	0.00	0.00	0.00	6.68	88.98	81.67	INT
Malawi	5.96	12.61	31.59	95.75	0.00	13.18	4.38	1.92	INT
Mauritius	98.50	0.00	0.00	1.65	0.15	80.10	0.72	10.55	INT
Namibia	8.29	2.13	0.00	92.46	82.46	55.99	77.30	73.17	**IIT**
Netherlands	48.02	0.00	0.00	39.56	28.44	7.39	35.87	0.15	INT
New Zealand	16.54	0.00	74.56	0.00	0.00	0.00	83.15	75.78	INT
Norway	0.00	Na	1.80	0.00	0.00	na	0.00	0.00	INT
Portugal	0.00	0.00	0.00	96.01	0.00	0.00	25.95	0.00	INT
South Africa	41.81	50.37	46.86	51.29	55.51	67.91	76.40	77.10	**IIT**
Spain	0.79	0.00	0.00	12.71	6.29	0.53	0.00	0.00	INT
Swaziland	98.86	0.00	Na	0.00	0.00	6.88	48.48	0.15	INT
Sweden	0.00	0.00	0.53	0.00	0.37	0.00	na	Na	INT
Switzerland	0.00	0.00	0.00	88.93	66.80	84.19	0.30	9.02	INT
Uganda	0.00	0.00	Na	0.00	0.00	na	na	Na	INT
United Arab Emirates	na	na	Na	0.00	0.00	27.75	7.29	9.66	INT
United Kingdom	11.25	35.29	22.96	40.86	28.31	14.12	2.57	1.01	INT
United Republic of Tanzania	0.00	9.10	4.72	2.88	0.00	0.00	2.69	0.31	INT
United States	8.32	11.43	23.78	5.90	1.03	0.24	0.55	1.01	INT
Zambia	2.58	0.01	0.07	44.15	0.00	23.39	0.00	146.75	INT
Zimbabwe	25.13	29.01	83.22	93.31	99.33	37.58	32.49	84.21	INT

Source: author calculations

Overall, the tabulated IIT/INT results for the textile sector imply that this sector's trade is specialized driven emanating from Botswana's relative textile abundance. At the same time, it is also important to note that the country exports unprocessed textile to South Africa where, because of the latter country's advanced technology, textile which originates from Botswana is manufactured into value-added products such as shirts, blankets, jeans, etc. Botswana in turn imports these textiles from South Africa, but in a different form.

5.5 Conclusions

This study employed the IIT adjusted Grubel and Lloyd's (1975) indices to investigate exports from Botswana's three sectors, namely, diamond, textile, and meat and meat products for the period 1999 to 2006. Simulated results for meat and meat products, and textiles show that export trade for these two sectors between Botswana and its major trading partners was INT driven for the period under study. This emanates from the relative abundance of meat and textile resources in Botswana compared to its trading partners.

On the other hand, Botswana's diamond trade with its major trading partners is found to be IIT driven, as evidenced by the simultaneous exports and imports of diamonds by Botswana to and from its trading partners. A further decomposition of IIT into either HIIT or VIIT is also done. The simulated results show that VIIT, as opposed to HIIT, dominated Botswana's IIT for the period reviewed.

5.6 Policy recommendations

As pointed out in Section 4.5, Botswana's engagements in trade liberalization will result in changes in trade. This could be in the form of an increase and/or decrease in exports, and an increase and/or decrease imports. These changes in exports and imports will involve shifts in resources between sectors. Given that two of the three sectors analyzed, i.e., textile and meat and meat products are INT driven, any increase in imports of competing or similar goods, especially from the developed countries, will hurt these sectors, and may result in closure of some companies in these sectors. This possible sectoral negative impact stems from the fact that imports from developed countries will be of high quality, due to these countries having advanced and better production technologies, as well as being relatively cheaper, given that producers from developed countries have economies of scale, do mass production and for agricultural production, they are given both production and export subsides by their governments. The increase in imports will thus result in loss of employment, due to structural changes brought about by increased competition emanating from trade liberalization, and re-allocation of capital to other surviving sectors. For labour, it

may mean that those formally employed in the closing sectors will have to find jobs in other industries where their experience may not match the job requirements and this may involve re-training, normally at a cost. At the same time, relocated capital, especially specialized machinery and equipment may end up being redundant.

Since some of these trade liberalization arrangements in which Botswana has (is) engaged itself are still to be implemented (e.g., the EPA with EU and WTO liberalization arrangements), the country needs to formulate and implement policies to deal with the possible negative impacts of trade liberalization of the meat and meat products, and textile sectors. Possible defensive strategies would be product differentiation within the same sectors with more emphasis on value-addition production. For instance, rather than concentrating on production and exportation of raw meat, the country can improve and value-add meat production in the form of caned meat. The same applies to textiles, where value addition can entail shift into production of shirts, t-shirts, jeans, as opposed to production and exportation of rolls of cloth or un-knitted garments.

Lack of proper structure and implementation of diversification and value-addition strategies may mean that, once imports increase due to trade liberalization, the INT driven sectors, i.e., the meat and meat products, and textiles sectors, will experience structural unemployment and possible capital redundancy.

CHAPTER SIX: SECTORAL GRAVITY MODELS

6.1 Introduction

This chapter presents the results from the estimated sectoral gravity trade models. Given that the results of the F-test reported in Chapter 3 showed the Fixed Effects Model (FEM) as the most appropriate estimation procedure, this section will analyze and interpret the estimated results from the FEM. Besides the F-test confirmation, the FEM is also a logical model to use given that the country's trading partners have different and distinct features which renders then totally different. For instance, there is no doubt that trading partners such as USA and Zambia, or Canada and Mozambique are totally different. Nevertheless, the pooled model equation which assumes that Botswana's trading partners for each of the three sectors are the same will also be presented, and interpreted only for dummy variables which cannot be estimated by the FEM. In estimating gravity models for both pooled and FEM models, Equations (12) and (13) will be employed, with the difference between the two being that the latter has one extra explanatory variable to cater for IIT in the diamond model, and INT in textiles, and meat and meat products models. As will be shown, since estimations from Equation (13) in each of the three gravity models have more variables that are significant and also have higher adjusted-R^2 and F-values, this section will mainly analyze results estimated by Equation (13), although results estimates from Equation (12) will also be shown.

As alluded to before, Ghosh and Yamarik (2004) point out that a total of 48 explanatory variables have been used in the gravity equation in literature. This presents a potential challenge in terms of which variables to choose for each of the three gravity trade model equations. Whilst a number of these explanatory variables have been experimented with in the estimations, the fact of the matter remains the same that no one has ever designed an experiment that is free of bias, and no one can (Leamer, 1981). As such, robustness analysis whereby the coefficients of the final variables selected for each of the gravity models have been checked for consistency by way of adding or deleting the explanatory variables have been done. The results of this robustness investigation indicate that the coefficients of the explanatory variables

presented in this section do not change significantly as variables are added or deleted from the respective gravity trade model equations. Table A3 to Table A5 in Section 3 of the Appendices presents the results of the robustness estimations. The experimentation with a number of these potential explanatory variables also acts as a reliability check especially given that results from these gravity models estimations will be used further to investigate export destinations with untapped potential exports in Chapter 7.

In terms of interpretation of explanatory variables, Jayasinghe and Sarker (2007) argue that because of the double-logarithmic representation of the gravity Equations (12) and (13) to be estimated, the parameter estimates on non-dummy variables such as Y_{ik}, k_{ik}/l_{ik}, Y_j, D_{ij}, P_i, Π_j and $exr_{i,usa}$ variables can be interpreted as elasticities. For instance, in both Equations (12) and (13), α_1 shows the percentage change in X_{ijk} induced by a 1% change in Y_{ik} while holding all other variables constant.

6.2 Diamond sector

The results from the gravity trade model estimations of Equations (12) and (13) presented in Table 8 show that both Botswana's sectoral GDP and the importers' GDP are important factors which encourage exportation of diamond. A 1% increase in GDP in the mining sector in Botswana and a 1% rise in the GDPs of importing countries will increase diamond export by 1.9% and 1.3%, respectively. This positive relationship is, as explained earlier, according to theoretical expectations. These results compare well with the findings of most studies on gravity equations estimated on trade, including a study by Chan-Hyun (2001), Jayasinghe and Sarker (2007) and Rojid (2006). The Chan-Hyun study showed that Korea's mineral exportation was, among other factors, propagated by both the importers' and exporter's GDPs. In particular, the paper found that a 1% increase in the product of Korea's GDP and the GDP of any of its trading partners resulted in an increase in mineral exportation by 1.1%. In the case of the Jayasinghe and Sarker's (2007) study, a 1% increase in the GDPs of the exporter and importer trading partners increased the export trade of the exporting partner by 8.24% and 17.49%, respectively. Finally, Rojid's (2006) findings showed that a 1% increase in GDP of both the importing and exporting trading

partners increase export trade of the exporting partner by 0.9% and 0.8%, respectively.

Table 8: Diamond sector regression results (dependent variable: export)

Variable	Pooled Model		Fixed Effects Model	
	Equation (12)	**Equation (13)**	**Equation (12)**	**Equation (13)**
Botswana mining GDP	4.9 (1.33)	8.9 (1.8)**	1.2 (1.93)**	1.9 (3.2)***
Importer GDP	1.4 (3.2)***	1.5 (3.4)***	1.01 (1.1)	1.3 (1.8)*
Importer population	1.5 (3.2)***	1.6 (3.4)***	5.1 (1.7)*	3.2 (2.7)***
Botswana mining K/L ration	-3.04 (-1.25)	1.8 (2.6)**	-0.7 (-0.2)	-0.6 (-0.12)
Exchange rate	1.6 (1.4)	1.2 (1.9)*	1.7 (2.3)**	1.2 (3.8)***
Hafbauer index	-------	50.1 (2.4)**	-------	59 (1.84)*
Distance in Kilometers	1.5 (2.9)***	1.6 (3.4)***	-------	-------
De Beers Trading Co. dummy	6.1 (3.0)***	6.11 (3.19)***	-------	-------
Adjusted – R^2	0.57	0.65	0.65	0.69
F-Test	5.89	6.6	5.30	6.36
Total observations	48	48	48	48

Notes: [***], [**], [*] significant at 1%, 5%, 10% level
t-statistics in parenthesis

The coefficient of the product differentiation variable, the Hafbauer index, is positive and in accordance with theoretical expectations. Given that the diamond sector is intra-industry trade (IIT) driven as empirically tested in Chapter 5, an increase in the Hafbauer index will result in more diamond export, ceteris paribus. Thus, a 1% increase in the Hafbauer index will result in a 59% increase in the proportion of total diamond exports which follows the IIT and/or product differentiation trade model structure.

The results on dummy variables (pool Equation (13)) indicate that the diamond trade arrangement dummy, representing the De Beers Trading Company (DBTC) preferential trade arrangement through which a larger proportion of Botswana's

diamond sells are handled, positively affect the mineral's exportation. This sign is theoretically expected, since trade arrangements are mostly aimed to improve trade flows, exports and imports. These results are also supported by the findings of Rose (2005) whereby PTA in the form of regional trade arrangements (RTA) increased trade for both export and import gravity equations.

The positive sign on distance is wrong as theory predicts that it should be negative under the assumption that the longer distances between trading partners increase costs, hence negatively affecting trade flows. Three possible reasons for the wrong sign can be postulated. First, since diamond is a high valued product, and its exportation mostly uses air transport, as opposed to sea or road transport, distance may not be a major huddle. Second, purchase of diamond is associated with rich people. Thus, for the rich diamond buyers, what matters is the need to have diamond products to oestantiously or proudly show off their riches and hence, costs (including transport) do not matter. Third, as a means of avoiding the sector's activities falling into the trap of 'blood diamond', like other African countries, Botswana prefers trading with buyers in far nations, as opposed to customers in the domestic market or neighbouring countries. The assumption being that, with proximity buyers, there will be a temptation by many potential illegal diamond miners to come into the industry as they will be able to illegally sell the diamond quickly to nearby buyers located in the country or neighbouring countries. A positive sign for the distance coefficient, although rare, is however also present in literature. For instance, Jayasinghe and Sarker's (2007) gravity estimations on red meat found a positive coefficient on distance on two (i.e, 1985-1987 and 1988-1990) of the five time periods for which the estimations were done.

The importer countries' population, as shown in Table 8, is associated with an increase in diamond export and this implies that as the populations for the trading partner countries grow, the international market expands and there will be an increase in the export of diamond. This result is in line with Rose's (2005) study which also found a positive coefficient for the importer country's population.

A depreciation of the pula is associated with an increase in diamond exports and this is according to theoretical expectations. Table 8 indicates that a1% depreciation (or

increase in exchange rate) will increase Botswana export trade by 1.2%. These results compare well with the findings of most studies on gravity equations estimated on export trade, including a study by Rahman *et al*, (2006), Rahman (2003) and Molinari 2003. Rahman *et al,* (2006) found that a 1% depreciation (or increase in exchange rate) resulted in an increase in Bangladesh's exports by 0.077%, while Molinari (2003) found that a 1% increase in exchange rate (depreciation) increased exports by a range of 0.023% to 0.123% for the eight sectoral exports that were investigated.

Comparing the performance of the two equations, for both pooled and FEM, using the adjusted R^2 and F-test (Equation (13)), the modified gravity model performs better than the traditional gravity trade model of Equation (12).

6.3 Textile sector

The textile sector's exports increased as the GDP for the importing countries and the Botswana manufacturing sector's GDP increased. Specifically, textile exports increased by 1.1% and 1.5%, respectively, when both the GDP for Botswana's manufacturing sector and that of importing countries increased by 1%. These results are shown in Table 9. This result is closer to Rojid's (2006) findings where a 1% increase in the GDP of the importing country increased exports by 0.9% while a rise in the GDP of the exporting trading country increased exports by 0.8%.

The estimated coefficient for distance, from the pooled Equation (13), has the expected negative sign and is statistically significant. For instance, a 1% increase in distance will reduce textile exports by approximately 2.3%. This negative finding is in line with most studies, for instance, Marques (2008), Kandogan (2008), and Baier and Bergstrand (2005), to mention just three papers.

The dummy variable representing Botswana's textile export trade under AGOA is positive and significant. This is in agreement with trade theory which expects trade to increase in the presence of regional trade arrangements. A study by Eita and Jordaan (2007) found that the SADC regional trade arrangement was one of the factors which boosted South Africa's wood exports to other regional member countries.

The coefficient RCAI is positive, and according to theoretical expectations. Given that the textiles sector is INT driven, as empirically tested in Chapter 5, an increase in the RCAI index will result in more textile export, ceteris paribus. Thus, a 1% increase in the RCAI index will result in a 0.5% increase in the proportion of total textile exports which follows the INT model structure.

Table 9: Textiles regression results (dependent variable: export)

Variable	**Pooled Model**		**Fixed Effects Model**	
	Equation (12)	**Equation (13)**	**Equation (12)**	**Equation (13)**
Botswana manufacturing GDP	2.83 (3.89)***	2.56 (2.1)**	1. (2.1)**	1.1 (1.8)**
Importer GDP	0.92 (4.6)***	0.91 (4.58)***	1.6 (1.2)	1.5 (2.4)**
Importer population	0.57 (1.82)*	0.57 (1.83)*	2.1 (2.3)**	2.6 (3.7)***
RCAI for textiles	-------	0.74 (2.7)***	-------	0.50 (2.1)**
Importer Inflation	0.01 (1.83)*	0.01 (1.81)*	0.001 (2.2)**	0.01 (3.8)***
Botswana manuf. K/L ration	-1.57 (-1.65)*	-1.61 (-1.41)	-0.24 (-0.04)	-0.22 (-0.03)
Exchange rate	0.1 (2.2)**	0.2 (2.9)***	0.12 (1.8*)	0.22 (2.5)**
AGOA dummy	4.04 (2.69)***	2.4 (6.8)***	-------	-------
Distance	-2.4 (-3.83)***	-2.3 (-3.82)***	-------	-------
Adjusted – R^2	0.61	0.66	0.64	0.69
F-Test	15.30	15.61	9.26	9.80
Total observations	192	192	192	192

Notes: [***], [**], [*] significant at 1%, 5%, 10% level
t-statistics in parenthesis

The positive coefficient on exchange is according to theory. Tabulated results indicate that 1% depreciation increases textile exports by 0.22%. This result is closer to Rahman (2003) findings where a 1% depreciation (or increase in exchange rate) increased exports by 0.34%.

Comparing the performance of the two equations using the adjusted R^2 and F-test, the modified gravity trade model Equation (13) relatively performs better than the traditional or basic gravity trade model Equation (12).

6.4 Meat and meat products sector

Increases in both Botswana's agricultural GDP and importers' GDP, as shown in Table 10, result in a positive effect on the sectoral meat export. For instance, meat and meat products exports increased by 1.9% and 0.74%, respectively, when the GDP for Botswana's agriculture sector and that of importing countries increased. These positive signs, as explained above, are according to theoretical expectations and compare well with studies by such researchers as Eita and Jordaan (2007), and Rose (2005), who among others, also found positive impacts of both the importers' GDP and exporters' GDP on exports of a given partner.

The importer's inflation has a negative sign, implying that an increase in the inflation levels of the trading partners will cause them to reduce their expenditure, including imports of meat from Botswana. For example, a 1% rise in importers' inflation will reduce meat imports from Botswana by 0.21%.

The negative coefficient on distance is according to theoretical expectation, whereby an increase in distance will increase such things as transaction and transportation costs, among other expenses, thus resulting in a reduction in exports of meat and meat products. According to Table 10, a 1% increase in distance reduces Botswana's meat exports by 0.77%. Previous studies by Marques (2008) Kandogan (2008), Baier and Bergstrand (2005), among others also found a negative sign for the coefficient of distance in their respective gravity trade equations.

The coefficient RCAI is positive, and according to the theoretical expectations. Given that the meat and meat products sector is INT driven, as empirically tested in Chapter 5, an increase in the RCAI index will result in more textile export, ceteris paribus. Thus, a 1% increase in the RCAI index will result in a 0.43% increase in the proportion of total meat and meat exports which follow the INT model structure.

Although, the capital-labour ratio is correctly signed, it is however not statistically significant.

The dummy variable representing Botswana's meat and meat products export trade under Cotonou agreement positive and significant. This is in agreement with trade theory which expects trade to increase in the presence of regional trade arrangements. A study by Eita and Jordaan (2007) found that the SADC regional trade arrangement was one of the factors which boosted South Africa's wood exports to other regional member countries.

Table 10: Meat regression results (dependent variable: export)

Variable	**Pooled Model**		**Fixed Effects Model**	
	Equation (12)	**Equation (13)**	**Equation (12)**	**Equation (13)**
Botswana agriculture sector GDP	1.8 (3.5)***	2.1 (2.5)**	1.0 (2.5)***	1.9 (3.5)***
Importer GDP	0.61 (2.86)***	0.63 (2.9)***	0.74 (2.2)**	0.74 (1.8)*
Importer Inflation	-1.23 (-3.72)***	-1.2 (-3.28)***	-0.19 (-2)**	-0.21 (-3.7)***
RCAI for meat	-------	0.52 (2.67)**	-------	0.43 (2.1)**
Botswana agriculture K/L ration	2.91 (0.55)	1.11 (4.6)***	1.1 (0.9)	2.4 (1.4)
Exchange rate	1.3 (2.3)**	1.9 (1.8)*	0.9 (1.2)	1.4 (2.2)**
Cotonou dummy	0.9 (1.8)**	1.2 (2.3)**	-------	-------
Distance	-0.66 (-1.50)	-0.77 (-1.72)*	-------	-------
Adjusted – R^2	0.62	0.67	0.64	0.65
F-Test	6.12	6.5	5.16	7.3
Total observations	88	88	88	88

Notes: [***], [**], [*] significant at 1%, 5%, 10% level
t-statistics in parenthesis

A depreciation of the pula is associated with an increase in meat and meat products exports and this is according to theoretical expectations. Table 10 shows that a1% depreciation (or increase in exchange rate) will increase Botswana's meat export trade

by 1.4%. These results compare well with the findings of most studies on gravity equations estimated on export trade, including a study by Molinari (2003). The Molinari (2003) investigation found that a 1% increase in exchange rate (depreciation) increased exports by a range of 0.023% to 0.123% for the eight sectoral exports that were investigated.

Comparing the performance of the two equations in terms of the maximum number of significant coefficients in each equation, Table 10 indicates that the modified gravity model Equation (13) performs better than the traditional gravity model Equation (12).

6.5 Conclusions

This chapter investigated the determinants of sectoral exports from Botswana for the period 1999 to 2006 and these estimations were done for the country's exports of diamond, textile, and meat and meat products sectors. The following are the conclusions that emanated from the empirical evidence done on the three sectors.

i. In all the three sectoral results, the respective Botswana's sectoral GDPs and the GDPs for the importing countries were positive and statistically significant determinants of Botswana's sectoral exports. This implies that growth in the GDP or economic activities in mining, manufacturing and agriculture enhanced Botswana's diamond, textiles, and meat and meat products, respectively.

ii. With the exception of diamond exports, results from the sectoral gravity estimations indicate that distance retarded exports, and this is expected from theory. The negative correlation implies that, as distance increased from Botswana to any trade partner, the country's export trade from both textiles and meat and meat products sectors declined.

iii. Regional trade arrangements contributed positively to the country's exports in all the three sectors for the period under review. For instance, in the case of textiles, the AGOA trade preferences in the form of duty-free-quota-free

(DFQF) resulted in Botswana's textiles entering the USA market freely since 2000 than was the case before the arrangement was initiated. This has increased exports of textiles.

iv. The statistically significant positive signs on the IIT trade variable in the diamond gravity equation and INT variables in both textiles and meat and meat products indicate that product differential in the diamond sector; and factor endowments in the other two sectors promote sectoral exports.

v. The relationship between exchange rate on one hand, and exports from the sectors on the other hand was found to be positive and statistically significant. This implies that currency devaluation leads to increase in exports across these three sectors.

6.7 Policy recommendations

The findings from the gravity trade model estimations suggest the following policy recommendations for consideration by Botswana policy makers.

i. Given that higher GDPs for importing partners promote Botswana's export trade, the country needs to continue its engagement especially with those partners with higher GDPs. This can be easily achieved if the country remains committed in such trade arrangements as the envisioned Economic Partnership Agreement (EPA) with the EU, and the AGOA trade arrangements with the USA. Continued engagement with high income countries can also be enhanced if the country implements the various agreed trade liberalizations promulgated by the WTO so that it can get reciprocal treatment and trade preferences from some of the high income and developed WTO members

ii. The fact that distance retards exports especially in textiles, and meat and meat products means that the country should increase its trade as much as possible

with proximity countries. Botswana, besides being a full member of the already advanced and highly integrated Southern African Customs Union (SACU), should also move together with other member states of the Southern African Development Community (SADC) in their endeavour to move from the current Free Trade Area (FTA) to higher stages of regional integration such as Customs Union (CU), Common Market (CM), Monetary Union (MU) and Economic Union (EU). These higher stages of integration, especially with geographically close countries will also mean enlarged markets for Botswana's exports, among other benefits.

iii. To continue increasing its exports, the country needs to remain in its current trade arrangements, ranging from bilateral, regional (for instance with SACU and SADC), inter-regional (with EU) and multilateral (at WTO level). The country can also consider entering into new preferential trade arrangements not only with the current rich countries, but also with emerging and fast growing economics such as China, India and Brazil, among others, as they provide huge future potential in terms of markets for Botswana's exports.

CHAPTER SEVEN: SECTORAL EXPORT TRADE POTENTIALS

7.1 Introduction

Following estimations of Botswana's three sectoral gravity equations for bilateral export flows in Chapter 6, the study continues with the next step of estimating the trade potential for the same sectors. Thus, in this Chapter, the sectoral model estimates from the previous chapter are employed to predict Botswana's sectoral trade with all the relevant countries in the respective samples.

This section of the thesis is important especially at this juncture given that the country is still finalizing its national export strategy policy, which inter *alia*, seeks to promote exports from textiles, and meat and meat products sectors, among others, in its drive to diversify away from diamond exports. As such, the policy implications associated with the presence of unrealized trade potential with relevant trading countries in the above sectors would, according to Ram and Prasad (2007), "extend from the necessity of country-specific trade promotional campaigns and bilateral integration to the need to anticipate relevant distributional changes due to the effect of the expansion in bilateral flows in the near future". This section of the thesis is also helpful as it will assess the extent to which Botswana has some unrealized sectoral trade potential with its relevant major (sectoral) trading partners and with its diverse preferential trade partners with whom it has a number of operational trade arrangements. Lastly, the study will provide valuable indicators for current negotiations for the new Economic Partnership Agreement (EPA) with the European Union to be introduced at any time from 2010.

7.2 Objectives

Given the above introduction, the main objective of this chapter is to empirically investigate Botswana's trade potential for its three sectors under study. In pursuit of

this objective, the following are the three questions that this chapter will try to answer:

i. With which trading partners has Botswana reached its trade potential in these three sectors?

ii. With which trading countries has Botswana gone beyond its trading potential in these three sectors?

iii. With which partner countries does Botswana still have untapped (or unrealized) trade potential in these three sectors?

7.3 Export trade potential

In this section, coefficients from gravity trade models estimated in Equation (13) of Chapter 6, also presented below, will be used to analyse the unrealised export potential for the country's sectoral exports.

$$\ln X_{ijk} = \alpha_0 + \alpha_1 \ln Y_{ik} + \alpha_2 \ln\left(K_{ik}/L_{ik}\right) + \alpha_3 PTA_{ijk} + \alpha_4 \ln Y_j + \alpha_5 \ln D_{ij} + \alpha_6 \ln P_j + \alpha_7 \ln \Pi_j + \alpha_8 \ln exr_{i,usa} + \alpha_9 IIT(INT)_{ik} + \varepsilon_{ij} \quad (13)$$

The gravity trade model Equation (13) will be simulated to get within export potential for all the three sectors, diamond, textiles, and meat and meat products. This is mainly because results from this equation are more significant than those from Equation (12) for these three sectors' gravity estimations presented in the previous chapter. As indicated earlier in Chapter 6, the coefficients of these gravity models have been tested for sensitivity and robustness, and the conclusion made was that they are relatively stable. Thus, this section uses the coefficients of each of the three gravity equations estimated in the previous chapter assuming them to be reliable.

Analysis of untapped trade potential with some regional groupings have been chosen keeping in mind the current and approaching preferential trading arrangements that are already operational (e.g., SACU and SADC FTA) as well as those that are in offering in the near future (EU, SADC CU, EPA). The regional blocs that will be analyzed for sectoral trade potential with Botswana are the group of countries under the SADC and SACU. Furthermore, this chapter will investigate Botswana's export trade potential with the European Union (EU) under the Economic Partnership Agreement (EPA) regime which is expected to enter into force any time from January 2010[24].

Having estimated the respective sectoral gravity models for bilateral export trade flows between Botswana and its respective trading partners, the study proceeds to estimate the export trade potential for the country. This section relies on the sectoral model estimations from the previous chapter. The ratio of sectoral export trade potential (P) as simulated/predicted by the model and actual sectoral export trade (A), i.e., (P/A), will be used to analyze the future direction of export trade for the country's three sectors. In terms of interpretation, in a case where the value of the ratio (P/A) exceeds 1, that will indicate existence and evidence of export trade potential between Botswana and the country in question. Following Batra (2004) and the International Trade Centre (ITC) (2005, 2003), evidence of unrealized export trade in turn implies the potential for Botswana to expand its exports to that country. On the other hand, if the value of (P/A) is less than 1, it indicates that Botswana has exceeded its trade potential with that country. In short, values of (P/A) can either be greater than or less than 1, with the former indicating countries with which Botswana has potential for expansion of export trade in the foreseeable future, while the latter shows trading partners with which Botswana has already exceeded its trade potential.

Conversely, the absolute difference between the potential and actual level of export trade, that is, the value of (P-A) can also be used to indicate whether a country has unrealized export trade potential with Botswana or not. In this case, a positive value will indicate unrealized export trade potential, thus the possibility of future export

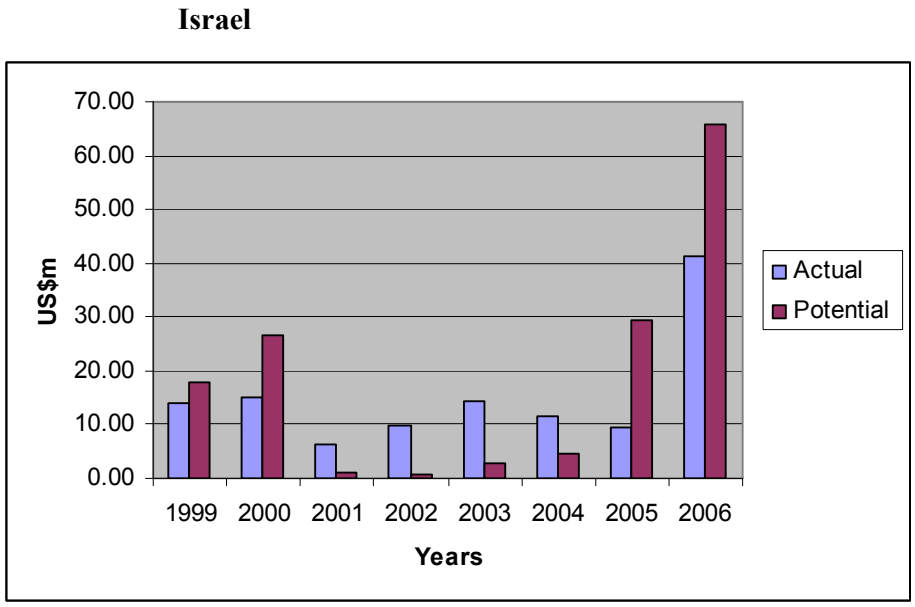
[24] EPAs were supposed to have come into effect from January 1st 2008. However, due to delays in completion of the negotiations, they have been postponed to at least enter into force anytime in 2010.

trade expansion into that country while a negative value will indicate that the country's exports have already exceed their trade potential.

7.3.1 Export trade potential in diamond sector

An analysis of Botswana's diamond export trade potential indicates that there is, on average, untapped potential in three destination countries, Israel, South Africa and Switzerland, as shown in Table A6 of the Appendices. Figure 4 graphically depicts the trade potential for Israel. Note that South Africa and Switzerland could not be depicted graphically due to the fact that the range between some figures across the years is so big resulting in drawing scale problems. Existence of unrealized export potential implies that Botswana should export diamond products to these partner countries so as to exhaust the unrealized trade potential. On the other hand, the country has exceeded its export trade potential in diamonds with Belgium, United Kingdom (UK) and United States of America (USA).

Figure 4: Diamond export potential



7.3.1.1 Botswana's diamond trade potential with regional groupings

This part of the study will analyze the country's export trade potential with regional trade groups to which Botswana is a member. The analysis is done on both already existing regional trade blocs as well as those to be operationalized in the near future, using estimates from the gravity model. In particular, this section will investigate the group of trading partners constituting SADC, SACU, and the EU (both under the Cotonou agreement and under the envisioned Economic Partnership Agreement (EPA)).

Among the trading partners who are members of the EU, there is only one country, Switzerland, where there is unrealized trading potential for Botswana's diamond exports according to Table A8 of the Appendices. This suggests that Botswana and Switzerland are trading much less than what the gravity model predicts and this implies that Botswana has untapped export trade potential in diamond with this EU trading bloc nation. This scenario suggests that it will be an advantageous move for Botswana to make all efforts to implement its free trade area (FTA) commitments under the envisioned EPA with the EU.

Table A9 of the Appendices shows the trading partners in America and EU regional groups where Botswana has exceeded its export trade potential in the export of diamond. This implies that Botswana and these respective countries in these regional groupings are trading more than the gravity model predicts and this is an indication of a successful partnership, using the trade dimension only, among trading countries (International Trade Centre (ITC) (2005, 2003).

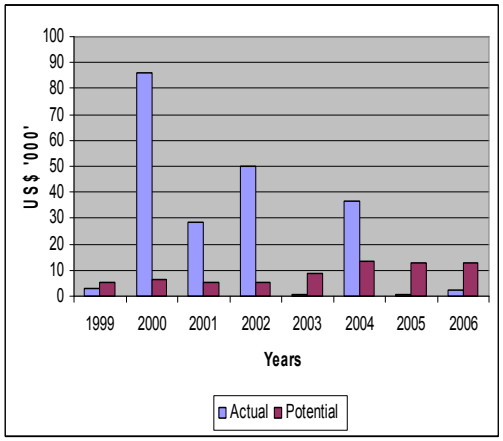
7.3.2 Export trade potential in textile sector

When Botswana's textile export potential is compared among different trading partners, maximum potential is indicated for Ghana and Mozambique. Figure 5 also shows that Canada, Denmark, Finland, Saudi Arabia, Spain, and Switzerland are the other export destinations in which textiles exports from Botswana have unexploited trade potential. This suggests that Botswana should export textile products to these

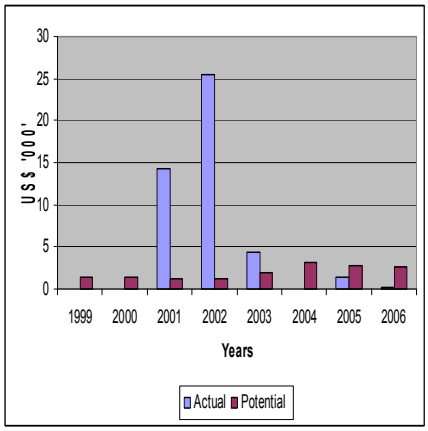
countries so as to exhaust the unrealized trade potential. See also Table A10 in the Appendices.

Figure 5: Textile export potential

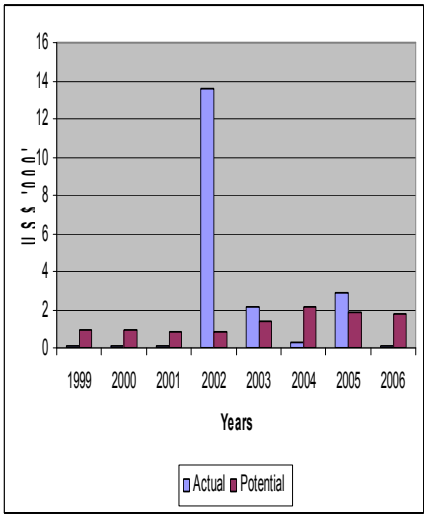
Canada



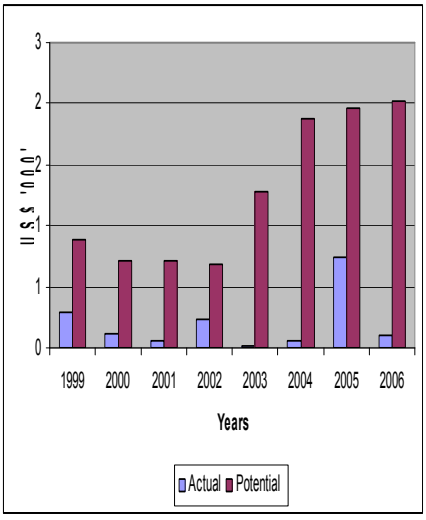
Denmark



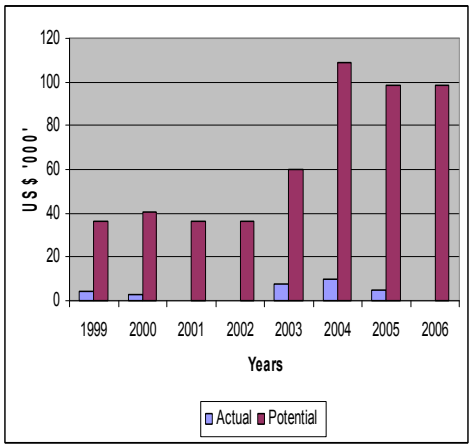
Finland



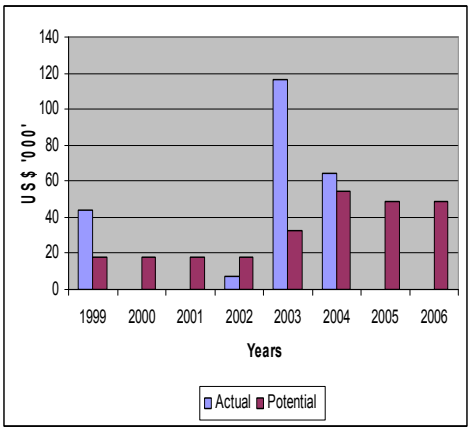
Ghana



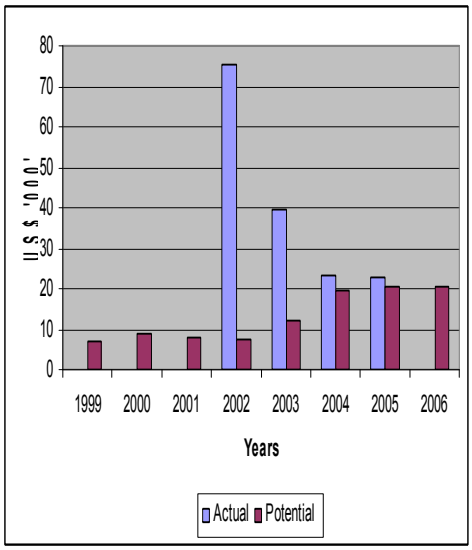
Mozambique



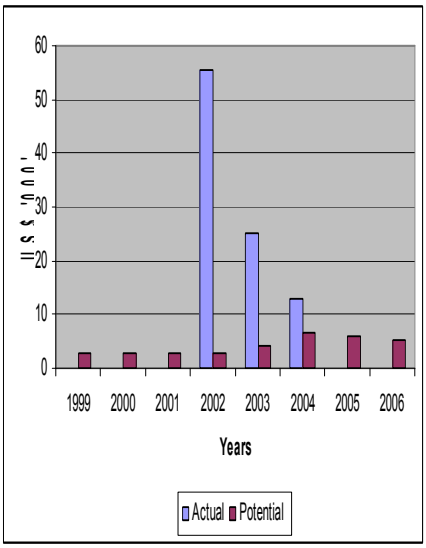
Spain



Saudi Arabia



Switzerland



7.3.2.1 Botswana's textile trade potential with regional groupings

In this section the study analyzes Botswana's export trade potential with sets of countries defined by some preferential trading arrangements which are already in existence as well as those to be operationalized in the near future, using estimates from the gravity model. In particular, the thesis investigates the group of trading partners constituting the SADC, SACU, USA's AGOA and EU (both under Cotonou agreement and the envisioned EPA).

Among the trading partners who are members of EU, the highest unrealized trading potential in textile for Botswana, according to the calculation in Table A12 of the Appendices, is shown in Spain, followed by Switzerland and Finland, among other countries. On the other hand, highest export textile trade potential according to the magnitude of the trade potential calculation is indicated for Mozambique, followed by Tanzania and lastly by Swaziland, for countries in the SADC regional configuration. Thus, tabulated information shows that Botswana and its respective trading partners in the EU and SADC are trading much less than what the gravity model predicts and this implies that Botswana has untapped export trade potential in textiles with countries in both the EU and SADC. This scenario suggests that it will be a noble move for Botswana to continue making all efforts to implement its free trade area (FTA) commitments under the SADC and also for the country to enter into an EPA with the EU, i.e. expected to be implemented any time from 2010.

Table A13 shows the trading partners in America, EU and SADC (SACU) regional groups where Botswana has exceeded its export trade potential in textile products. This implies that Botswana and these respective countries in these regional groupings are trading more than the gravity model predicts. This is an indication of a successful partnership among trading countries (International Trade Centre (ITC) (2005, 2003).

7.3.3 Export trade potential in meat and meat products sector

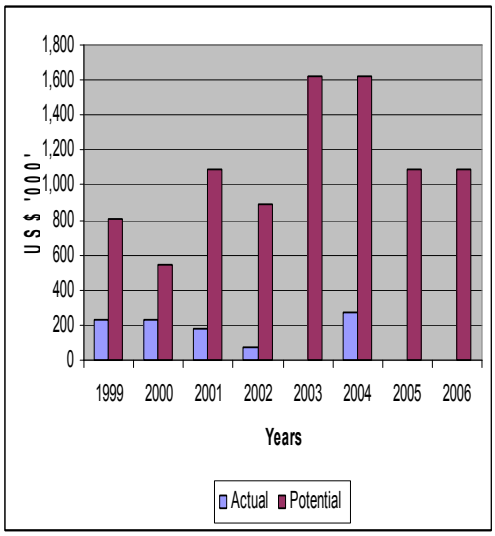
Export trade potential among Botswana's meat and meat products destination is maximum for Italy, followed by Namibia, Norway and Mauritius, as shown in Figure 6. This suggests that Botswana should export meat and meat products to these countries so as to exhaust the untapped trade potential. See also Table A14 of the Appendices.

Generally, for the meat and meat products sector, the country has more trading partners with which it has exceeded its export trade potential when compared to trading partners with which it has untapped potential. Table A15 (of the Appendices)

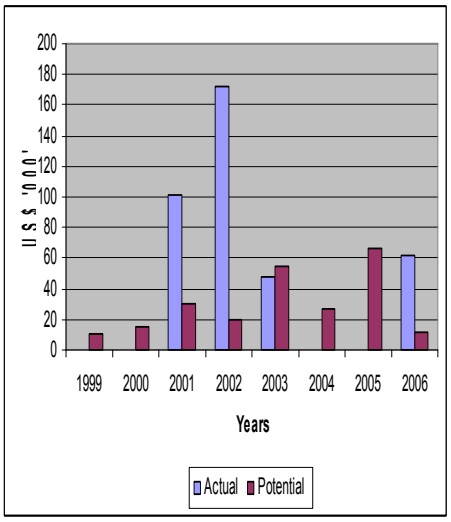
presents the countries that Botswana has exceeded its export potential during the period 1999 to 2006.

Figure 6: Meat and meat products export potential

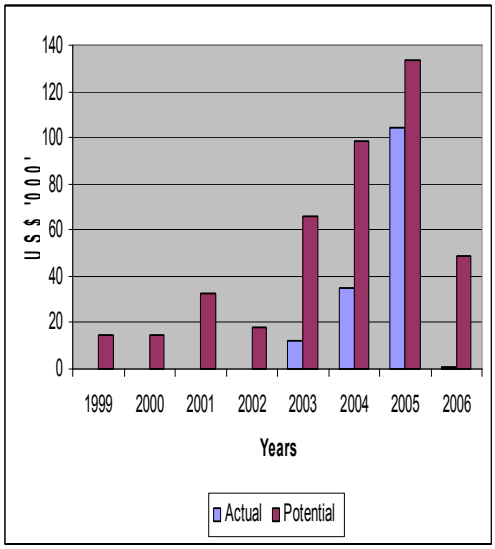
Italy



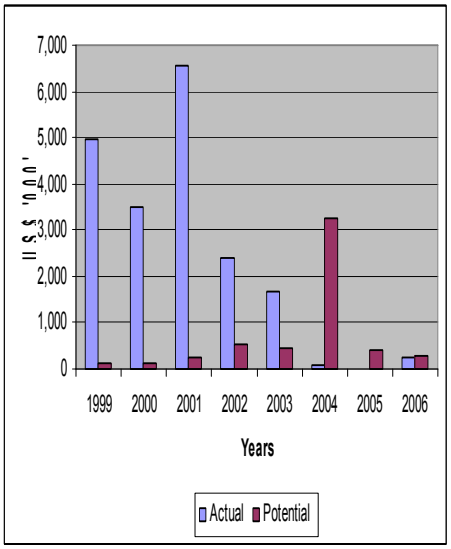
Mauritius



Namibia



Norway



7.3.3.1 Meat and meat products trade potential with regional groupings

At regional level, Table A16 of the Appendices indicates that the EU (Italy) and SADC (Mauritius and Namibia) are the trading blocs with which Botswana has unrealized export trade potential. On the other hand, Germany, the Netherlands and United Kingdom from the EU, and South Africa and Zimbabwe from SADC, are the countries with which Botswana has successful bilateral partnerships given that trade potential with these countries in meat and meat products has been exceeded. See Table A17 of the Appendices.

7.4 Comparison with other studies

The unrealized export potential results are not unique to the findings of this thesis, but compares well with other previous studies which also found untapped potential in various trading partners for a given country's exports. For instance, Ram and Prasad's (2007) found that Fiji had untapped trade potential for its aggregate exports with its trading partners such as Australia, New Zealand, Thailand and the United States. A study by Eita and Jordaan (2007) found that South Africa's leather products for the period 1997 to 2004 had unrealized export trade potential to such trading partners as South Korea, UK, USA, and Zimbabwe. Batra's (2004) study on India's global trade indicates that the country, for the year 2000, had highest unexploited export trade potential with trading partners from the Asia-Pacific region followed by Western Europe and North America. At country level, India had the highest unrealized export potential with countries like China, UK, Italy and France

7.5 Causes of unrealized export trade

The existence of unrealized trade potential with a number of trade partners signifies that there might be some trade barriers still inhibiting export trade to some of these trade partners. The following are some of the possible trade barriers that Botswana's sectoral exports face in a number of countries.

i. Stringent rules of origin (RoO)

Although tariffs applied by most of Botswana's export partners have generally declined over the years, stringent rules of origin (RoO)[25] continue to present challenges to the country's exports. For instance, in the case of textiles, whilst the USA's AGOA allows even for global cummulation[26] under the "Special Rule" (Allen *et al.,* 2007); while trade with EU (under Cotonou and the envisioned EPA) only allows regional (SADC) and diagonal cummulation[27], thereby limiting the ability of Botswana manufacturers to source textiles inputs from potentially cheaper countries. Thus, these RoO have limited Botswana's exports to the EU, especially those from the textiles sector, resulting in the actual exports being less than the predicted or simulated exports.

ii. Non-tariff barriers (NTBs)

Most countries, especially from the developed world have over the years developed sophisticated NBTs which are arbitrary, difficult and costly to meet, especially for the developing exporting countries. In the case of the EU, application of Sanitary and Phyto-sanitary Standards (SPS) measures whose

[25] RoO can be simply defined to mean the country of origin from which a given exported product came or was manufactured.

[26] Cummulation when applied within RoO concepts implies that if Botswana textile manufacturers use cotton or yarn imported say from Zimbabwe (an Africa/SADC country) to manufacture their textiles for exports, the exported textiles will be considered as wholly originating from Botswana. Thus Africa-wide cummulation implies that Botswana can import cotton or yarn from any African country for manufacturing its textiles for exports and those exports will be considered as originating from Botswana. SADC cummulation means the manufactured exported textiles will only be considered as originating from Botswana if the yarn, cotton, etc., used to manufacturer them were imported from SADC countries. Thus, SADC cummulation when compared to Africa-wide cummulation limits the sources from which Botswana's textiles manufacturers imports their production inputs.

[27] Diagonal cummulation means that any material, e.g. cotton, yarn, zips, etc., used to manufacture textiles in Botswana should be imported only from EU member countries so that the exported textiles can be considered as wholly originating from Botswana. If the manufacturers import cotton or yarn say from India or USA, the exported textiles will not be considered as originating from Botswana when entering EU markets, and thus will not be given any preferential treatment within the ACP-EU trade preferential arrangement, and will be levied import duty like any other textiles from other non-preferential trade partners.

main objectives are to safeguard damages to health, animal and plant life have become disguised trade barriers. SPS standards have affected agricultural exports including meat products not only of Botswana but also for most ACP countries. EU SPS measures require that for any exporter to export to the EU member states, he or she must be certified and for one to be certified he or she must meet some 'standards' set by EU bodies. In the case of meat products, SPS requires that the abattoirs must be certified; the animals to be slaughtered, e.g. cattle, should be traced to their origin, i.e. from which farm, area or region within any country they originated. Meeting these requirements is costly and cumbersome and this has resulted in less meat products being exported to some developed trade partners, especially in the EU.

iii. Animal diseases

FAO (2005) reports that Botswana's meat and meat export products have been limited due to a plethora of diseases, chief among them being the foot and mouth[28]. With the outbreak of foot and mouth disease, all meat exports are abruptly brought to a halt until health officials are fully satisfied that the disease has come under control or been eradicated. Owing to the lengthy procedure involved in arriving at the conclusion that the diseases has been brought under control, the country ended up exporting less that its potential meat products in the years where such disease has occurred.

iv. Unrecorded informal trade

Another possible cause of unrealized export trade potential is the fact that informal trade exports figures were not recorded. A case in point, as an illustration, is the fact that more than 80% of Zimbabweans[29] have been

[28] Other listed diseases are (i) African swine fever, (ii) Avian Influenza, (iii) Bluetongue, (iv) Bovine spongiform encephalopathy (BSE), (v) Contagious bovine pleuropneumonia (CBPP), (iv) lumpy skin disease (vii) Newcastle diseases, (viii) Rinderpest, (ix) sheep and goat pox and (x) Rift valley fever

[29] Zimbabwe is just an illustration given that Botswana's textiles, and meat and meat products to this partner country have exceed their export potential.

importing their groceries from their neighbouring countries including Botswana (South Africa, Zambia and Mozambique) for nearly a decade. Given that these imports were mostly done in small amounts or informally, e.g. groceries of around US$150 per month per individual, both Botswana customs and Zimbabwean customs were not officially recording these 'small figures'. However, if these small figures are aggregated, they run into millions of US dollars. Thus, the existence of untapped trade potential may be as a result of the fact that informal trade figures were not recorded, resulting in the actual recorded trade figures being less than the predicted potential figures.

v. Inadequate international marketing

Effective trade, especially with international consumers is underpinned by rigorous marketing of the products on offer. Botswana's National Export Strategy (NES) (Republic of Botswana, 2008) alludes to the fact that the country's exports have not been vigorous marketed at international fora. Whilst it may be difficult to single out the effect of marketing on a country's exports, the fact remains that marketing contributes positively towards exports, especially given the continued growth in competition from other countries in most products offered on the international market by Botswana.

vi. Relative low quality

Salm *et al.* (2004) alludes to the fact that relatively low quality, especially in the textiles sector, has contributed towards reduced exports of Botswana's exports from this sector. In particular, the study noted that although the RoO for yarn under the AGOA have been enhanced, the sector has not adequately taken advantage of that gesture by ensuring that it procures the better quality fabric required by regional garment manufacturers producing for the USA market. As a result, relatively low quality fabric has been in manufacturing resulting in relatively low quality garments which faced fierce competition on the international market on quality terms.

7.6 Conclusions

This chapter presented the countries in which Botswana has unrealized trade potential in the diamond, textile, and meat and meat products export sectors. The reported results indicate that Israel, South Africa and Switzerland are export destinations for which there is still untapped export potential for Botswana's diamond, and as such, the country should increase its diamond export to these countries. Countries such as Canada, Denmark, Ghana and Mozambique, among others have unrealized export markets for textile products from Botswana while Italy, Mauritius, Namibia and Norway are the export destination in which Botswana should increase its export of meat and meat products as these countries have untapped market potential for meat and meat products.

7.7 Policy recommendations for utilizing unrealized trade potential

The ultimate objective of investigating whether a country has unrealized export potential with its trading partners is to help the country to initiate relevant trade and promotional policies, among others, so as to try and export more to those destination countries with untapped markets. This section therefore presents some of the policy options that Botswana can consider so as to try and expand its sectoral exports to relevant export destination partners which have unexhausted markets for the country's sectoral exports. In the presence of existing export potential, the following are some of the policy recommendations:

1. *Analyze export barriers*

   Botswana policy analysts need to do an investigation of the factors that hinder the country's sectoral export to countries with untapped export potential. Such an investigation will help to identify hindrances to export of sectoral products to these countries. With that information policy markers will be in a better position to design relevant policies to capitalize on those unrealized export markets and export more.

2. *Increase export promotion activities*

Effective trade, especially with international consumers is underpinned by rigorous marketing of products on offer. Botswana's National Export Strategy (NES) (Republic of Botswana, 2008) alludes to the fact that the country's exports have not been vigorous marketed at international fora. The country should therefore increase trade promotional activities of its foreign services and consulates, especially in countries where there is untapped export potential. These consulate offices abroad can provide more information on how one can import from Botswana as well as what products can be imported. If possible, the country can put new consulate offices in a trade partner country where there were no such services before. Presence of new consulate services which also provides trade information, among other services, may encourage imports from Botswana. According to Rose (2005), ceteris paribus, "each additional consulate placed abroad is associated with a rise of bilateral exports of between 6% and 10%".

3. *Negotiate for better trade preferences*

Given that Botswana is still in the process of negotiating a number of free trade arrangements, for instance with EU countries and also with WTO member countries, the country can try to ensure that it gets the most in terms of liberal trade preferences and better market access for its sectoral exports, especially with countries from these two groups with which it has untapped sectoral trade potential.

4. *Seek technical assistance to meet NTBs*

The country needs to work closely and in collaboration with its developed trade partners, especially the EU, with the aim of getting technical assistance in meeting some of the SPS and RoO requirements. Meeting and satisfaction of these measures will positively enhance the country's sectoral exports to the

EU trade partners, hence exhausting any currently existing untapped potential within these markets.

5. *Enhance diseases monitoring mechanisms*

The success of Botswana's meat and meat products, among other agricultural products, is underpinned by the country's ability to eradicate perennial diseases such as the foot and mouth. Whilst the country is highly endowed with a larger head of cattle, failure to control diseases means the country will not be able to maximize its exports from this sector. Thus, the country should consider enhancing disease monitoring mechanisms to ensure that should there be an outbreak of any animal disease; the country will be able to swiftly put it under control or totally eradicate it.

6. *Improve product quality*

It is important to note that importers (and hence consumers) do not simply consider price when importing any product, but also consider other issues, among them being the quality of the product. Most importers, especially from the developed world, are particular about the quality of the products they purchase and they generally prefer products of high quality. Thus, Botswana manufacturers can enhance the possibility of increasing its sectoral exports, especially those from the textiles sector if they use high quality yarn and fabric in their manufacturing processes.

CHAPTER EIGHT: CONCLUSIONS AND POLICY RECOMMENDATIONS

8.1 Introduction

The main objective of this thesis chapter is to provide overall study conclusions as well as policy recommendations based on the findings discussed in the preceding chapters. In particular, Section 8.2 will summarize the main conclusions from the major study findings, with Section 8.3 providing some policy recommendations. Section 8.4 will present the limitations of this thesis study while Section 8.5 will offer suggestions for further research in the same or related fields.

8.2 Overall conclusions

The main objectives of this thesis study were to analyze Botswana's exports from the diamond, textile, and meat and meat products sectors for the period 1999 to 2006. The objectives were three-fold. Firstly, the study examined the extent to which either intra–industry trade (IIT) or inter–industry trade (INT) dominate Botswana's sectoral exports. Secondly, the research investigated the determinants of the country's sectoral exports, with the third objective being the identification of destination markets with unrealized potential for the country's three sectoral exports. Two statistical methodologies were employed, the Grubel-Lloyd (G-L) index and panel data econometrics. The former technique was used to investigate the extent to which the sectoral exports were either IIT or INT driven (Chapter 5), while the latter methodology was employed to analyze the determinants of sectoral exports and also for identifying destination markets with untapped export potential (Chapters 6 and 7, respectively).

8.2.1 Conclusions from the IIT and INT analysis

The study employed the IIT-adjusted Grubel and Lloyd's (1975) index to investigate exports from Botswana's three sectors, namely, diamond, textile, and meat and meat

products for the period 1999 to 2006. Simulated results for the meat and meat products, and textile sectors show that export trade for these two sectors between Botswana and its major trading partners were INT driven for the period under study. This emanates from the relative abundance of meat and textile resources in Botswana compared to its trading partners.

On the other hand, Botswana's diamond trade with its major trading partners is found to be IIT driven, as evidenced by the simultaneous exports and imports of diamonds by Botswana to and from its trading partners. A further decomposition of IIT into either horizontal IIT (HIIT) or vertical IIT (VIIT) is also done. The simulated results show that HIIT, as opposed to VIIT, dominated Botswana's IIT for the period reviewed.

The study of both INT and IIT is important in that it provides a better platform for formulating policies which deal with trade adjustments caused by increased trade liberalization, especially given envisioned increase in trade between Botswana and a number of its trading partners following the country's participation in the SADC FTA, EPA FTA with the EU and at the multilateral WTO level. Overall, IIT is viewed as good given that simultaneous increases in exports and imports is likely to result in marginal, if any, shift of resources between sectors, while INT is considered as undesirable since it results in massive costs to the country and the sectors affected. That is, in the case of textile, and meat and meat products sectors, which are INT driven, increased imports of competing or similar goods will hurt these sectors, and may result in the closure of some companies in these sectors. This will result in the loss of employment and re-allocation of capital to other surviving sectors.

8.2.2 Conclusions from the analysis of determinants of exports

The chapter investigated the determinants of sectoral exports from Botswana for the period 1999 to 2006 and these estimations were done for the country's diamond, textile, and meat and meat products sectors. The following are the conclusions that emanated from the empirical evidence obtained on these three sectors.

i. In all the three sectoral results, the respective sectoral GDPs for Botswana and the importing countries were positive and statistically significant determinants of Botswana's sectoral exports. This implies that growth in the GDP or economic activities in mining, manufacturing and agriculture enhanced Botswana's diamond, textiles, and meat and meat products, respectively.

ii. With the exception of diamond exports, results from the sectoral gravity estimations indicate that distance retarded exports and this is expected from theory. The negative correlation implies that, as distance increase from Botswana to any trade partner, the country's export trade from both textiles and meat and meat products sectors declined.

iii. Regional trade arrangements contributed positively to the country's exports in all the three sectors for the period under review. For instance, in the case of textiles, AGOA trade preferences in the form of duty-free-quota-free (DFQF) resulted in Botswana's textiles entering the USA market free since 2000 than was the case before the arrangement was initiated. This has increased exports of textiles.

iv. The statistically significant positive signs on the IIT trade variable in the diamond gravity equation and INT variables in both textiles, and meat and meat products indicate that the product differential in the diamond sector; and factor endowments in the other two sectors promote sectoral exports.

v. The relationship between exchange rate on one hand, and exports from the sectors on the other hand was found to be positive and statistically significant. This implies that currency devaluation leads to increase in exports across these three sectors.

8.2.3 Conclusions from unrealized export potential

This chapter presented the countries in which Botswana has unrealized trade potential in diamond, textile, and meat and meat products export sectors. The reported results

indicate that Israel and Switzerland are export destinations for which there is still untapped export potential for Botswana's diamond, and as such, the country should increase its diamond export to these countries. Countries such as Canada, Denmark, Ghana, Mozambique among others have unrealized export markets for textile products from Botswana, while Italy, Mauritius, Namibia and Norway are the export destination in which Botswana should increase its export of meat and meat products as these countries have untapped market potential for meat and meat products.

8.2.3.1 Possible causes of unrealized export trade potential

The existence of unrealized trade potential with a number of trade partners signifies that there might be some trade barriers still inhibiting export trade to some of these trade partners. The following are some of the possible trade barriers that Botswana's sectoral exports face in a number of countries.

i. Stringent rules of origin (RoO)

Although tariffs applied by most of Botswana's export partners have generally declined over the years, stringent rules of origin (RoO) continue to present challenges to the country's exports. For instance, in the case of textiles, whilst the USA's AGOA allows even for global cummulation under the "Special Rule" (Allen *et al.,* 2007); the EU only allows regional (SADC) and diagonal cummulation, thereby limiting the ability of Botswana's manufacturers to source textile inputs from potentially cheaper countries. Thus, these RoO have limited Botswana's exports to the EU, especially those from the textiles sector, resulting in the actual exports being less than the predicted or simulated exports.

ii. Non-tariff barriers (NTBs)

Most countries, especially from the developed world have over the years developed sophisticated NBTs which are arbitrary, difficult and costly to meet

especially for developing exporting countries. In the case of the EU, application of Sanitary and Phyto-sanitary Standards (SPS) measures whose main objectives are to safeguard damages to health, animal and plant life has become disguised trade barriers. SPS standards have affected agricultural exports including meat products not only of Botswana but also for most ACP countries. EU SPS measures requires that for any exporter to export to EU member states, he or she must be certified and for one to be certified he or she must meet some 'standards' set by EU bodies. In the case of meat products, SPS requires that the abattoirs must be certified; the animals to be slaughtered, e.g. cattle, should be traced to their origin, i.e. from which farm, area or region within any country they originated from. Meeting these requirements is costly and cumbersome and this has resulted in less meat products being exported to some developed trade partners, especially the EU.

iii. Animal diseases

FAO (2005) reports that Botswana's meat and meat export products have been limited due to a plethora of diseases, chief among them being the foot and mouth[30]. With outbreak of the foot and mouth, all meat exports are abruptly brought to a halt until the health officials are fully satisfied that the disease has come under control or been eradicated. Owing to the lengthy procedure involved in arriving at the conclusion that the diseases has been brought under control, the country ended up exporting less that its potential meat products in the years where such disease has occurred.

iv. Unrecorded informal trade

Another possible cause of unrealized export trade potential is the fact that informal trade exports figures were not recorded. A case in point, as an

[30] Other listed diseases are (i) African swine fever, (ii) Avian Influenza, (iii) Bluetongue, (iv) Bovine spongiform encephalopathy (BSE), (v) Contagious bovine pleuropneumonia (CBPP), (iv) lumpy skin disease (vii) Newcastle diseases, (viii) Rinderpest, (ix) sheep and goat pox and (x) Rift valley fever

illustration, is the fact that more than 80% of Zimbabweans have been importing their groceries from their neighbouring countries including Botswana (South Africa, Zambia and Mozambique) for nearly a decade. Given that these imports were mostly done in small amounts or informally, i.e. groceries of around US$150 per month per individual, both Botswana customs and Zimbabwean customs were not officially recording these 'small figures'. However, if these small figures are aggregated, they run into millions of US dollars. Thus, the existence of untapped trade potential may be as a result of the fact that informal trade figures were not recorded, resulting in the actual recorded trade figures being less than the predicted potential figures.

v. Inadequate international marketing

Effective trade, especially with international consumers is underpinned by rigorous marketing of the products on offer. Botswana's National Export Strategy (NES) (Republic of Botswana, 2008) alludes to the fact that the country's exports have not been vigorously marketed at international fora. Whilst it may be difficult to single out the effect of marketing on a country's exports, the fact remains that marketing contributes positively towards exports, especially given the continued growth in competition from other countries in most products offered on the international market by Botswana.

vi. Relatively low quality

Salm *et al.* (2004) points out the fact that relatively low quality, especially in the textiles sector has contributed towards reduced exports of Botswana's products from this sector. In particular, the study noted that although the rules of origin (RoO) for yarn under the AGOA have been enhanced, the sector has not adequately taken advantage of that gesture by ensuring that it procures the better quality fabric required by regional garment manufacturers producing for the USA market. As a result, relatively low quality fabric has been used in

manufacturing resulting in relative low quality garments which faced fierce competition on the international market on quality terms.

8.3 Policy recommendations

The findings of this research suggest that Botswana policy makers should consider the following respective policies.

8.3.1 Policy recommendations from IIT and INT analysis

As pointed out in Section 4.5, Botswana's engagements in trade liberalization will result in changes in trade, i.e. increase and/or decrease in exports, and increase and/or decrease imports. These changes in exports and imports will involve shifts in resources between sectors. Given that two of the three sectors analyzed, i.e. textile, and meat and meat products, are INT driven, any increase in imports of competing or similar goods especially from the developed countries will hurt these sectors, and may result in closure of some companies in these sectors. This possible sectoral negative impact stems from the fact that imports from developed countries will be of high quality, due to these countries having advanced and better production technologies, as well as being relatively cheaper, given that producers from developed countries have economies of scale, do mass production and for agricultural production, they are given both production and export subsides by their governments. The increase in imports will thus result in loss of employment, due to structural changes brought about by increased competition emanating from trade liberalization, and re-allocation of capital to other surviving sectors. For labour, it may mean that those formally employed in the closing sectors will have to find jobs in other industries where their experiences may not match the job requirements and this may involve re-training, normally at a cost. At the same time, relocated capital, especially specialized machinery and equipment may end up being redundant.

Since some of these trade liberalization arrangements in which Botswana has (is) engaged itself are still to be implemented, e.g., the EPA with EU and WTO

liberalization arrangements, the country needs to formulate and implement policies to deal with these possible negative impacts of trade liberalization on the meat and meat products, and textile sectors. Possible defensive strategies would be product differentiation within the same sectors with more emphasis on value addition production. For instance, rather than concentrating on production and exportation of raw meat, the country can improve and value-add meat production in the form of caned meat. The same applies to the textiles, value addition can entail shift into production of shirts, t-shirts, jeans, as opposed to production and exportation of rolls of cloth or un-knitted garments.

Lack of proper structure and implementation of diversification and value-addition strategies may mean that, once imports increase due to trade liberalization, the INT driven sectors, i.e., the meat and meat products and textiles sectors, will experience structural unemployment and possible capital redundancy.

8.3.2 Policy recommendations from gravity trade models

The findings from gravity trade model estimations suggest the following policy recommendations for consideration by Botswana policy makers.

i. Given that higher GDPs for importing partners promote Botswana's export trade, the country needs to continue its engagement especially with those partners with higher GDPs. This can be easily achieved if the country remains committed in such trade arrangements as the envisioned Economic Partnership Agreement (EPA) with the EU, and the AGOA trade arrangements with the USA. Continued engagement with high income countries can also be enhanced if the country implements the various agreed trade liberalizations promulgated by the WTO so that it can get reciprocal treatment and trade preferences from some of the high income and developed WTO members

ii. The fact that distance retards exports especially in textiles, and meat and meat products means that the country should increase its trade as much as possible

with proximity countries. Botswana, besides being a full member of an already advanced and highly integrated Southern African Customs Union (SACU), should also move together with other member states of the Southern African Development Community (SADC) in their endeavour to move from the current Free Trade Area (FTA) to higher stages of regional integration such as Customs Union (CU), Common Market (CM), Monetary Union (MU) and Economic Union (EU). These higher stages of integration, especially with geographically close countries will also mean enlarged markets for Botswana's exports, among other benefits.

iii. To continue increasing its exports, the country needs to remain in its current trade arrangements, ranging from bilateral, regional (for instance with SACU and SADC), inter-regional (with EU) and multilateral (at WTO level). The country can also consider entering into new preferential trade arrangements not only with the current rich countries, but also with emerging and fast growing economics such as China, India and Brazil, among others, as they provide huge future potential in terms of markets for Botswana's exports.

8.3.3 Policy recommendations to utilize unrealized trade potentials

The ultimate objective of investigating whether a country has unrealized export potential with its trading partners is to help the country to initiate relevant trade and promotional policies, among others, so as to try and export more to those destination countries with untapped markets. This section therefore presents some of the policy options that Botswana can consider so as to try and expand its sectoral exports to relevant export destination partners which have unexhausted markets for the country's sectoral exports. In the presence of existing export potential, the following are some of the policy recommendations:

1. *Analyze export barriers*

   Botswana policy analysts need to do an investigation of the factors that hinder the country's sectoral export to countries with untapped export potential. Such

an investigation will help to identify hindrances to the export of sectoral products to these countries. With that information policy markers will be in a better position to design relevant policies to capitalize on those unrealized export markets and export more.

2. *Increase export promotion activities*

Effective trade, especially with international consumers is underpinned by rigorous marketing of the products on offer. Botswana's National Export Strategy (NES) (Republic of Botswana, 2008) alludes to the fact that the country's exports have not been vigorously marketed at international fora. The country should therefore increase trade promotional activities of its foreign services and consulates, especially in countries where there is untapped export potential. These consulate offices abroad can provide more information on how one can import from Botswana as well as what products can be imported. If possible, the country can put new consulate offices in a trade partner country where there were no such services before. Setting up of new consulate services which also provides trade information, among other services, may encourage imports from Botswana. According to Rose (2005), ceteris paribus, "each additional consulate placed abroad is associated with a rise of bilateral exports of between 6% and 10%".

3. *Negotiate for better trade preferences*

Given that the Botswana is still in the process of negotiating a number of free trade arrangements, for instance with EU countries and also with WTO member countries, the country can try to ensure that it gets the most in terms of liberal trade preferences and better market access for its sectoral exports especially with countries from these two groups with which it has untapped sectoral trade potential.

4. *Seek technical assistance to meet NTBs*

The country needs to work closely and in collaboration with its developed trade partners, especially in the EU, with the aim of getting technical assistance in meeting some of the SPS and RoO requirements. Meeting and satisfaction of these measures will positively enhance the country's sectoral exports to its EU trade partners, hence exhausting any currently existing untapped potential within these markets.

5. *Enhance diseases monitoring mechanisms*

The success of Botswana's meat and meat products, among other agricultural products, is underpinned by the country's ability to eradicate perennial diseases such as the foot and mouth. Whilst the country is highly endowed with a larger head of cattle, failure to control diseases means the country will not be able to maximize its exports from this sector. Thus, the country should consider enhancing disease monitoring mechanisms to ensure that should there be an outbreak of any animal disease; the country will be able to swiftly put it under control or totally eradicate it.

6. *Improve product quality*

It is important to note that importers, and hence consumers, do not simply consider price when importing any product, but also consider other issues, among them being the quality of the product. Most importers, especially from the developed world are particular on the quality of the products they purchase and they generally prefer products of high quality. Thus, Botswana's manufacturers can enhance the possibility of increasing its sectoral exports, especially those from the textiles sector if they use high quality yarn and fabric in their manufacturing processes.

8.4 Limitations of the study

Although the main objectives of the research thesis were achieved, the following limitation can however be noted. The use of the gravity model in predicting and analyzing potential export destinations is premised on the assumption that there will be no structural break in the future. It follows that should a structural break occur, for instance in the form of new innovations which results in other countries becoming cheaper competitors to the country's exports, discoveries of say large diamond reserves in another country, an import ban on products from Botswana, by importing countries, and establishment of import substitution industries in particular export destination countries will render the use of gravity model's ability to predict export destination potential off the trajectory. In such cases, simulated export potential destinations from the gravity model will be misleading.

8.5 Suggestions for future research

Future research on this topic could focus on the following outstanding issues.

- Options to reduce the negative costs associated with resource shifts emanating from increased trade especially in the INT driven sectors of textile, and meat and meat products should be considered. This dimension is important given the possibility of unemployment and redundancy of capital.

- Detailed destination-specific export promotion and strategies to increase sectoral exports to various countries. Rather than having a "one-size-fit-all" export promotion and strategy, there is need to have these promotions and strategies tailor-made to respective destination country markets.

- A critical analysis of the possible factors at destination-country level which might be hindering sectoral exports from Botswana. Instead of assuming import tariffs levied on sectoral products from Botswana into various major export markets as the main export trade barrier, there is need to explore the

exact hindrances existing in each major export destination country for these three sectoral exports.

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APPENDICES

1 PAIRWISE GRANGER CAUSALITY TEST

There is generally no consensus about the direction of causality between exports and GDP. Therefore, the question of whether exports (*Exp*) cause GDP growth (*Y*) or vice versa in Botswana is investigated empirically using the pairwise Granger causality test. Through Granger causality tests, one can proceed to test for the direction of causality between the two series. The standard Granger (1986) causality test examines the role of past changes in export growth (*Exp*), in explaining the current variations in GDP (*Y*). On the other hand, a reversed causality direction is determined by experimenting with variables Exp and *Y* interchanged, using the following equations to determine whether or not *Exp* the Granger causes Y_t and vice versa, respectively.

$$Exp_t = \sum_{i-1} \beta_i Exp_{t-1} + \sum_{i-1} \alpha_i Y_{t-1} + \mu_t \quad \text{(A1)}$$

$$Y_t = \sum_{i-1} \alpha_i Y_{t-1} + \mu_t + \sum_{i-1} \beta_i Exp_{t-1} + V_t \quad \text{(A2)}$$

In terms of interpretation, Y_t is said to be Granger-caused by Exp_t if exports help in the prediction of Y_t, or equivalently if the coefficient on the lagged values of exports are statistically significant. In our case, there are four possible causal relationships between exports (Exp) and GDP (Y):

i. *Unidirectional causality from Exp to Y* is indicated in the case were the estimated coefficients on lagged *Exp* in equation (A2) are statistically different from zero as a group (i.e., $\sum \beta_i \neq 0$) and the set of estimated coefficients on the lag of Y in equation (A1) is not statistically different from zero (i.e., $\sum \alpha_i = 0$)

ii. Conversely, *unidirectional causality from Y to Exp* exists if the set of lagged Y coefficients in equation (A2) is not statistically different from zero (i.e., $\sum \beta_i = 0$) and the set of lagged Y coefficients in equation (A1) is statistically different from zero (i.e., $\sum \alpha_i \neq 0$).

iii. *Bidirectional, or feedback causality,* is suggested when *Exp* causes *Y* and vice versa. That is, when the sets of *Exp* and *Y* coefficients are statistically significantly different from zero in both regressions.

iv. Finally, *independence* is suggested when there is no causal relationship between *Exp* and *Y*. That is, when the sets of Exp and Y coefficients are not statistically significant in both regressions.

The null hypothesis postulated in each case is that the variable under consideration does not "Granger-cause" the other variable.

The results of the Granger causality test are presented in Table A1. The results suggest bidirectional (or feedback) causality between exports (Exp) at aggregate level and GDP (Y) for the period 1980 to 2008.

Table A1: Pairwise Granger Causality test (Sample 1980 – 2008)

Null Hypothesis	Obs	F-Statistic	Probability
LogEXP does not Granger Cause LogGDP	27	2.78774	0.04672
LogGDP does not Granger Cause LogEXP		2.34139	0.09170

2 ROBUSTNESS CHECK FOR HIIT AND VIIT

This part of the Appendices provides robust check by using different values of **α** in equation (4) and equation (5).

2.1 Horizontal IIT and Vertical IIT with different values of α

Table 4 presents the results for HIIT and VIIT in which the calculation was done with both small and large dispersion values of α and compared to a value α = 0.15 whose results are presented in the main text. Panel *A* of Table A2 in this section shows the results when a smaller value of α, 0.10, is used. The results are exactly the same with those in which a value α =0.15 has been used. Tabulated results in both panels *B* and *C*, where values of α, 0.20 and 0.25 have been used, are nearly the same. When α is either 0.20 or 0.25, the results shows that it is only trade with Belgium where the share of HIIT and VIIT have equally dominated trade between Botswana and the former country for the period under review. The results did not change at all for trade with Israel, while HIIT dominated trade with South Africa in 2001 when α=0.20, and both in 2000 and 2001 when α=0.25. In the case when α=0.30 is used in the calculations, the results are the same with the situation when α=0.25 is employed. Overall, one can conclude that in the case of Botswana, the HIIT/VIIT results are almost the same for diamond sector when one uses either a smaller dispersion, α=0.10, or a larger dispersion, α=0.30.

Table A2: HIIT and VIIT in the Diamond sector with different dispersion

Panel A: (α=0.10)

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	HIIT	VIIT	VIIT	VIIT	VIIT	VIIT	na	VIIT
Israel	HIIT	VIIT	VIIT	VIIT	Na	Na	na	VIIT
South Africa	VIIT	VIIT	VIIT	VIIT	VIIT	VIIT	VIIT	VIIT

Panel B: (α=0.20)

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	HIIT	VIIT	VIIT	VIIT	HIIT	VIIT	na	VIIT
Israel	HIIT	VIIT	VIIT	VIIT	na	Na	na	VIIT
South Africa	VIIT	VIIT	HIIT	VIIT	VIIT	VIIT	VIIT	VIIT

Panel C: (α=0.25)

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	HIIT	HIIT	VIIT	VIIT	HIIT	VIIT	na	VIIT
Israel	HIIT	VIIT	VIIT	VIIT	na	Na	na	VIIT
South Africa	VIIT	HIIT	HIIT	VIIT	VIIT	VIIT	VIIT	VIIT

Panel D: (α=0.30)

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	HIIT	HIIT	VIIT	VIIT	HIIT	VIIT	na	VIIT
Israel	HIIT	VIIT	VIIT	VIIT	na	Na	na	VIIT
South Africa	VIIT	HIIT	HIIT	VIIT	VIIT	VIIT	VIIT	VIIT

3 ROBUSTNESS CHECK ON COEFFICIENTS OF EXPLANATORY VARIABLES

The coefficient values for the explanatory variables for each of the gravity trade models presented in Table A3 to Table A5 shows that they do not significantly change, in the case where they change. For instance, the range of the coefficient values (from the FEM equation (13)) of Botswana's mining GDP in the diamond gravity trade model is between 1.7 and 1.9 (with the actually coefficient value reported in the main text being within this range, with a value of 1.76) whether more potential explanatory variables are added or deleted. This lower range shows that the

model is robust and can be relied upon for any interpretation or any further inferences. The same trend is also recorded for the coefficient of the other explanatory variables in the diamond gravity model, and also for the explanatory variables in both textiles, and meat and meat products gravity equations.

In summary, the results reported from robustness estimations indicates that the coefficients of the explanatory variables for each of the three gravity trade models are relatively stable and can therefore be relied upon both for inference and further application, in this case, in the analysis of untapped export potentials.

Table A3: Robustness check on Diamond gravity model

Variable/Model	Pooled Model – Equation (13)			Fixed Effects Model – Equation (13)		
Botswana mining GDP	5.2 (2.1)**	4.9 (1.4)	5.3 (1.9)*	1.8 (1.96)**	1.9 (2.7)**	1.7 (3)***
Importer GDP	1.4 (2.9)***	1.7 (3.1)***	2.3 (2.8)***	0.92 (2.01)**	1.2 (1.9)**	2.1 (2.0)**
Importer population	----------	7.4 (1.8)*	6.5 (3.8)***	----------	5.2 (4.7)***	4.8 (1.7)*
Exchange rate		1.3 (2.1)**	2.3 (1.6)	0.9 (2.1)**	2.1 (1.2)	1.7 (1.9)*
Hafbauer index	----------	----------	49.2 (1.9)*	----------	----------	52 (2.4)**
Adjusted – R^2	0.61	0.62	0.66	0.66	0.67	0.60
F-Test	5.7	5.3	5.9	4.8	4.67	3.87
Total obs	48	48	48	48	48	48

Notes: [***], [**], [*] significant at 1%, 5%, 10% level
t-statistics in parenthesis

Table A4: Robustness check on Textiles gravity model

Variable/Model	Pooled Model – Eqn (13)			Fixed Effects Model – Eqn (13)		
Botswana manf sector GDP	2.6 (2.0)**	1.97 (5.3)***	2.97 (5.3)***	1.03 (2.7)**	1.28 (4.1)***	1.08 (2.04)*
Importer GDP	0.8 (0.58)	0.97 (2.6)**	0.95 (3.6)***	1.6 (1.37)	1.5 (2.8)**	1.5 (2.5)**
Importer	1.07 (3.1)***	0.49 (4.7)***				

population			0.42 (2.18)**	2.17 (1.9)*	2.6 (1.5)	2.7 (3.9)**
RCAI for textiles	----------	0.57 (1.9)*	0.49 (2.9)**	----------	0.47 (2.1)*	0.49 (2.17)*
Importer Inflation	----------	----------	0.01 (3.2)***	----------	----------	0.08 (1.93)*
Exchange rate	0.09 (1.2)	0.5 (2.3)**	0.18 (0.5)	0.1 (2.1)**	0.4 (0.3)	0.3 (1.9)*
Adjusted – R^2	0.59	0.66	0.65	0.60	0.62	0.65
F-Test	18.1	12.6	16.44	5.6	9.7	9.26
Total obs	192	192	192	192	192	192

Notes: [***], [**], [*] significant at 1%, 5%, 10% level

t-statistics in parenthesis

Table A5: Robustness check on Meat and meat products gravity model

Variable/Model	**Pooled Model – Eqn (13)**			**Fixed Effects Model – Eqn (13)**	
Botswana agric sector GDP	2.2 (8.51)***	1.9 (4.5)***	2 (4.0)***	1.8 (3.4)***	1.3 (5.1)***
Importer GDP	0.49 (2.46)**	0.49 (2.5)**	0.49 (2.4)**	0.6 (5.2)***	0.57 (4.7)***
Importer Inflation	-0.96 (-2.8)**	-0.97 (-3)***	-0.98 (-2.8)***	-0.16 (-2)**	-0.15 (-0.2)
Exchange rate	1.0 (2.1)**	0.87 (1.4)	0.2 (19)*	0.23 (2.3)**	0.2 (1.4)
RCAI for meat	----------	0.59 (0.92)	0.70 (1.0)	----------	0.29 (2.2)**
Cotonou dummy	1.2 (2.1)**	1.9 (1.2)	0.8 (2.5)**	----------	--------
Botswana agric K/L ration	----------	---------	2.6 (0.4)	----------	--------
Adjusted – R^2	0.61	0.62	0.61	0.65	0.66
F-Test	13.2	9.1	6.76	9.3	8.6
Total obs	88	88	88	88	88

Notes: [***], [**], [*] significant at 1%, 5%, 10% level

t-statistics in parenthesis

4 BOTSWANA'S SECTORAL TRADE POTENTIAL

This part of the Appendices presents countries and regions with which Botswana has both unrealized and exhausted export potential for each of the three sectoral exports (diamond, textiles; and meat and meat products).

Note:
For all Tables in this Appendices section:
UP – means unrealized trade potential
EP – implies exceeded trade potential

4.1 Diamond Sector

Table A6: Countries with unrealized potential for expansion of diamond export trade

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Israel	1.3	1.8	0.2	0.1	0.2	0.4	3.1	1.6	**UP**
South Africa^{+}	2.1	22.9	1.6	1285	11.9	0.0	0.0	0.3	**UP**
Switzerland	0.0	0.0	1336	48	58	52	7.6	1345	**UP**

Table A7: Countries where Botswana's diamond has exceeded its export trade potential

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Belgium	3.8	29.0	5.0	0.0	0.1	0.0	0.0	0.0	**EP**
United Kingdom	2.0	9.2	0.3	0.0	0.0	0.0	202225	0.2	**EP**
U.S.A	4.9	7.3	0.4	0.1	2.8	8987	0.0	0.1	**EP**

Table A8: Regional distribution of countries with untapped diamond export potential

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
European Union (EU)									
Switzerland	0.0	0.0	1336	47.8	57.7	52.2	7.6	1345	**UP**
SADC									
South Africa^{+}	2.1	22.9	1.6	1285.3	11.9	0.0	0.0	0.3	**UP**

Note: "+" Both a SADC and SACU member country

Table A9: Regional distribution of countries with exceeded diamond export potential

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
European Union (EU)									
Belgium	3.8	29.0	5.0	0.0	0.1	0.0	0.0	0.0	**EP**
United Kingdom	2.0	9.2	0.3	0.0	0.0	0.0	202 225	0.2	**EP**
America									
U.S.A	4.9	7.3	0.4	0.1	2.8	8 987	0.0	0.1	**EP**

4.2 Textile Sector

Table A10: Countries with unrealized potential for expansion of textile export trade

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Belgium	0.6	0.7	0.8	0.8	1.0	0.6	1.9	1.8	**UP**
Canada	1.1	0.8	0.8	0.8	1.4	0.9	1.5	1.2	**UP**
Denmark	2.0	2.7	0.7	0.7	0.9	2.3	1.1	1.7	**UP**
Finland	1.6	1.5	1.7	0.7	0.9	1.4	0.9	1.7	**UP**
Ghana	1.2	1.4	1.6	1.2	2.5	1.9	1.1	1.7	**UP**
Mozambique	1.2	1.3	2.4	2.5	1.2	1.3	1.4	3.3	**UP**
Saudi Arabia	3.0	2.2	1.9	0.8	0.9	1.0	1.0	2.8	**UP**
Spain	0.9	3.1	2.2	1.1	0.9	1.0	2.1	3.7	**UP**
Swaziland	1.9	1.2	2.0	1.8	2.8	1.5	0.9	0.8	**UP**
Switzerland	1.9	2.0	1.6	0.7	0.8	0.9	2.3	1.7	**UP**
Tanzania	1.9	0.6	0.6	1.3	2.8	2.3	0.7	3.6	**UP**

Table A11: Countries where Botswana's textile has exceeded its export trade potential

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
France	1.0	2.3	3.1	0.8	0.9	0.8	2.9	0.8	**EP**
Germany	0.9	0.8	0.7	0.8	0.8	0.8	0.7	0.8	**EP**
Lesotho	0.8	0.8	1.8	1.7	1.0	1.1	0.9	0.8	**EP**

Malawi	0.7	0.8	1.3	0.8	1.1	1.1	0.9	0.8	**EP**
Mauritius	0.4	1.8	1.1	0.6	1.1	0.4	0.4	0.4	**EP**
Namibia	0.6	0.6	2.1	0.9	0.8	0.8	0.8	0.7	**EP**
Netherlands	0.9	3.3	2.1	0.8	0.9	0.8	1.2	0.6	**EP**
Norway	1.4	2.8	0.8	0.7	0.7	2.2	0.7	1.8	**EP**
South Africa	0.97	0.98	0.99	0.96	0.99	0.99	0.98	0.98	**EP**
United Kingdom	0.7	0.7	0.7	0.7	0.9	0.7	0.7	0.6	**EP**
USA	1.00	1.02	1.11	1.00	1.04	0.97	0.92	0.97	**FP**
Zambia	0.9	0.6	0.6	0.9	1.0	1.0	0.9	0.9	**EP**
Zimbabwe	0.6	0.7	0.7	1.0	1.0	0.9	0.8	1.1	**EP**

Table A12: Regional distribution of countries with potential for textile trade expansion

Country/Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Overall**
European Union (EU)									
Belgium	0.6	0.7	0.8	0.8	1.0	0.6	1.9	1.8	**UP**
Denmark	2.0	2.7	0.7	0.7	0.9	2.3	1.1	1.7	**UP**
Finland	1.6	1.5	1.7	0.7	0.9	1.4	0.9	1.7	**UP**
Spain	0.9	3.1	2.2	1.1	0.9	1.0	2.1	3.7	**UP**
Switzerland	1.9	2.0	1.6	0.7	0.8	0.9	2.3	1.7	**UP**
SADC									
Mozambique	1.2	1.3	2.4	2.5	1.2	1.3	1.4	3.3	**UP**
Swaziland^{+}	1.9	1.2	2.0	1.8	2.8	1.5	0.9	0.8	**UP**
Tanzania	1.9	0.6	0.6	1.3	2.8	2.3	0.7	3.6	**UP**

Note: "+" Both a SADC and SACU member country

Table A13: Regional distribution of countries with exceeded textile trade potential

Country/Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Overall**
European Union (EU)									
France	1.0	2.3	3.1	0.8	0.9	0.8	2.9	0.8	**EP**
Germany	0.9	0.8	0.7	0.8	0.8	0.8	0.7	0.8	**EP**
United Kingdom	0.7	0.7	0.7	0.7	0.9	0.7	0.7	0.6	**EP**

Netherlands	0.9	3.3	2.1	0.8	0.9	0.8	1.2	0.6	**EP**
SADC									
Lesotho[+]	0.8	0.8	1.8	1.7	1.0	1.1	0.9	0.8	**EP**
Malawi	0.7	0.8	1.3	0.8	1.1	1.1	0.9	0.8	**EP**
Mauritius	0.4	1.8	1.1	0.6	1.1	0.4	0.4	0.4	**EP**
Namibia[+]	0.6	0.6	2.1	0.9	0.8	0.8	0.8	0.7	**EP**
South Africa[+]	0.97	0.98	0.99	0.96	0.99	0.99	0.98	0.98	**FP**
Zambia	0.9	0.6	0.6	0.9	1.0	1.0	0.9	0.9	**EP**
Zimbabwe	0.6	0.7	0.7	1.0	1.0	0.9	0.8	1.1	**EP**
America									
U.S.A	1.00	1.02	1.11	1.00	1.04	0.97	0.92	0.97	**EP**

Note: "+" Both a SADC and SACU member country

4.3 Meat and meat products sector

Table A14: Countries with unrealized potential for meat and meat export trade

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Italy	3.57	2.36	6.20	12.55	3584	5.94	10992	7254	**UP**
Mauritius	144	59.1	0.30	0.12	1.15	128	501.30	0.19	**UP**
Namibia	250.3	132	335	902	5.28	2.83	1.28	59.9	**UP**
Norway	0.03	0.03	0.04	0.22	0.26	35.73	1879.40	1.03	**UP**

Table A15: Countries with exceeded meat and meat products export trade

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
Germany	41968	0.07	0.70	0.53	0.70	0.19	0.09	0.16	**EP**
Greece	0.06	0.04	0.09	0.04	0.08	0.10	0.03	0.03	**EP**
Netherlands	0.31	0.31	5455	1.25	2126	0.28	0.17	1.26	**EP**
Reunion	0.01	0.01	0.05	0.05	0.23	0.02	0.01	0.02	**EP**
South Africa	0.18	0.24	0.18	0.71	0.26	1.05	0.08	0.04	**EP**
United Kingdom	0.06	0.08	0.08	0.08	0.11	0.12	0.06	0.05	**EP**
Zimbabwe	0.01	39.35	0.06	41.60	1.60	0.03	3.40	0.02	**EP**

Table A16: Regional distribution of countries with potential meat and meat products trade expansion

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
European Union (EU)									
Italy	3.57	2.36	6.20	12.55	3583.55	5.94	10991.53	7254.41	**UP**
SADC									
Mauritius	143.92	59.06	0.30	0.12	1.15	127.50	501.30	0.19	**UP**
Namibia^{+}	250.25	131.83	335.30	901.69	5.28	2.83	1.28	59.85	**UP**

Note: "+" Both a SADC and SACU member country

Table A17: Regional distribution of countries with exceeded meat and meat products trade

Country/Year	1999	2000	2001	2002	2003	2004	2005	2006	Overall
European Union (EU)									
Germany	41967.55	0.07	0.70	0.53	0.70	0.19	0.09	0.16	**EP**
Netherlands	0.31	0.31	5454.57	1.25	2125.84	0.28	0.17	1.26	**EP**
United Kingdom	0.06	0.08	0.08	0.08	0.11	0.12	0.06	0.05	**EP**
SADC									
South Africa^{+}	0.18	0.24	0.18	0.71	0.26	1.05	0.08	0.04	**EP**
Zimbabwe	0.01	39.35	0.06	41.60	1.60	0.03	3.40	0.02	**EP**

Note: "+" Both a SADC and SACU member country

Table A18: List of sample countries for each sector

Diamond	Textile	Meat and Meat products
Belgium	Belgium	Germany
Israel	Canada	Greece
South Africa	Denmark	Italy
Switzerland	Finland	Mauritius
United Kingdom (UK)	France	Namibia
United States of America (USA)	Germany	Netherlands

Belgium	Ghana	Norway
Israel	Lesotho	Reunion
	Malawi	South Africa
	Mauritius	United Kingdom
	Mozambique	Zimbabwe
	Namibia	
	Netherlands	
	Norway	
	South Africa	
	Saudi Arabia	
	Spain	
	Swaziland	
	Switzerland	
	Tanzania	
	United Kingdom	
	USA	
	Zambia	
	Zimbabwe	

5 F-TEST FOR TESTING THE JOINT VALIDITY OF FIXED EFFECTS

This section of the Appendices presents both the steps that are used in calculating the F-test used to test the joint validity of fixed effects as well as the empirical results of the F-test for the three sectoral equations.

a) F-test steps

The null hypothesis of no individual effects can be tested with an applied Chow or F-test by combining the Residual Sum of Squares (RSS) for the regression both with constraints (under the null) and without (under the alterative). In this test, the following steps are done.

i. Null and alternative hypotheses

The null and alternative hypotheses to be tested should be stated. According to Baltagi (2005), the null and alternative hypotheses are expressed as follows:

H_0: H_0: $\mu_1 = \mu_2 = \ldots = \mu_{N-1} = 0$ (no individual effects; same intercept for all cross sections)

H_A: Not all μ_i are equal to zero

ii. F-test specification

$$F = \frac{(RRSS - URSS)/(N-1)}{URSS/(NT - N - K)} = F\left(N-1\right),\left(NT - N - K\right)$$

where: RRSS = restricted residual sum of squares

URSS = unrestricted residual sum of squares

N = number of cross section panel units (countries in this thesis)

K = parameters in each gravity equation to be estimated

T = the length of the panel (e.g., months, years etc)

iii. Decision rule

Reject null hypothesis of no individual fixed effects in favour of fixed effects, i.e. heterogeneity of cross-sections if and only if the calculated F value (from the above F-test formula) is greater that the critical value of F (usually provided at the back of most econometric textbooks)[31].

[31] In this section, all the critical values of F are taken from Gujarati (2005)

iv. **Implementation of the F-test**

Instead of doing the manual calculations of the F value using the formula in (ii) above, an Eviews program can be utilized to get the same value of F. This Eviews run program is the one utilized in this section of the analysis (though the printouts of the program outputs are not presented here).

b) F-Test results

i. Diamond equation

The calculated value of F is contained in the Eviews run program, $\boldsymbol{F_{calculated}} = 6.6$. The critical value of $F_{critical}$, given from the textbook figures is $\boldsymbol{F_{5,36}} = 2.45$.

Inference

Since the calculated F value (=6.6) is greater that the critical value of F (=2.45), the null of no individual fixed effects is rejected in favour of fixed effects. That is, for the diamond gravity model, trade partner countries are heterogeneous and thus fixed effects must be allowed.

ii. Textile equation

The calculated value of F is contained in the Eviews run program, $\boldsymbol{F_{calculated}} = 8.23$. The critical value of $F_{critical}$, given from the textbook figures is $\boldsymbol{F_{23,168}} = 1.57$.

Inference

Since the calculated F value (=8.23) is greater that the critical value of F (=1.57), the null of no individual fixed effects is rejected in favour of fixed effects. That is, for the

textile gravity model, trade partner countries are heterogeneous and thus fixed effects must be allowed.

iii. Meat and meat products equation

The calculated value of F is contained in the Eviews run program, $\boldsymbol{F_{calculated}} = 7.1$. The critical value of $F_{critical}$, given from the textbook figures is $\boldsymbol{F_{21,154}} = 1.62$.

Inference

Since the calculated F value (=7.1) is greater that the critical value of F (=1.62), the null of no individual fixed effects is rejected in favour of fixed effects. That is, for the meat and meat products gravity model, trade partner countries are heterogeneous and thus fixed effects must be allowed.

6 HAUSMAN TEST FOR EXOGENEITY AND MISSPECIFICATION

This section of the Appendices presents the Hausman test

a) Purpose and underlying principles of Hausman test

The purpose and underlying principles of the Hausman test is to test for exogeneity of independent (X_{it}) variables (and misspecification). Hausman test is necessitated by the assumption normally made in one-way error component models that $E(u_{it}/X_{it})$[32]$=0$ (where $u_{it} = u_i$ t v_{it}). Nevertheless, in empirical investigations, the one-way error component, u_{it}, normally contains individual invariant effects (the u_i) which are unobserved and maybe correlated with the X_{it}. Thus the Hausman will test this relationship between u_i and X_{it}.

[32] In Equations (13) and (14), μ_{it} is represented by ε_{ij}

i. Null and alternative hypotheses are

$H_0 : E(u_{it}|X_{it}) = 0$; No misspecification (or no correlation between u_{it}) and X_{it} are exogenous

$H_A : E(u_{it}|X_{it}) \neq 0$; u_{it} and X_{it} are correlated, i.e., X_{it} is endogenous

ii. Procedure to calculate the test statistic

There are four (4) equivalent test statistics suggested by Hausman & Taylor (1981) which can be employed to calculate the test statistic.

a) $\hat{q}_1 = \hat{\beta}_{GLS} - \tilde{\beta}_w$

b) $\hat{q}_2 = \hat{\beta}_{GLS} - \hat{\beta}_B$

c) $\hat{q}_3 = \tilde{\beta}_w - \hat{\beta}_B$

d) $\hat{q}_4 = \hat{\beta}_{GLS} - \hat{\beta}_{OLS}$

iii. Distribution of the test statistic

The test statistic has a Chi-Square distribution, with *k* degrees of freedom, i.e., χ^2_k under the null, and this distribution is represented as follows:

$$m_3 = \hat{q}_3' V_3^{-1} \hat{q}_3 \sim \chi^2(6)$$

where

$\hat{q}_3 = \tilde{\beta}_{WITHIN} - \hat{\beta}_{BETWEEN}$

$V_3 = \text{var}(\hat{q}_3)$

iv. Deriving statistical inference

The calculated value of m_3 (from the above formula) will compared with the critical $\chi^2(k^{33})$. If the value of m_3 is greater than the value of $\chi^2(k)$, the null of no misspecification will be rejected, and the conclusion will be that the model specification suffers from misspecicification and the regressors are not exogenous. On the other hand, if the value of m_3 is less than the value of $\chi^2(k)$, the null of no misspecification will not be rejected, and the conclusion will be that the model specification does not suffers from misspecicification, and that the regressors are exogenous.

v. Implementation of the Hausman Test

Instead of doing the manual calculations of the Hausman test's m_3 using the formula presented above, an Eviews program can be utilized to get the m_3 values. This Eviews program is the one utilized in this section of the analysis, although the printouts of the program outputs are not presented here.

b) Hausman test results

i. Diamond gravity equation

The critical value of χ^2 from the textbook tables is $\chi^2(5)=11.1$. The calculated value of Hausman test m_3 from the Eviews run program, $m_3 = 0.14$.

Inference

Since the Hausman test m_3 (=0.14) is less than the critical value $\chi^2(5)$ (=11.1), the null hypothesis is NOT rejected. The conclusion therefore is that the X-regressor is exogenous and that there is no misspecification problem.

[33] 'k' is the number of non-dummy explanatory variables

ii. Textile gravity equation

The critical value of χ^2 from the textbook tables is $\chi^2(5)=11.1$. The calculated value of the Hausman test m_3 from the Eviews run program, $m_3 = 2.17$

Inference

Since the Hausman test m_3 (=2.17) is less than the critical value $\chi^2(5)$ (=11.1), the null hypothesis is NOT rejected. The conclusion therefore is that the X-regressor is exogenous and that there is no misspecification problem.

iii. Meat and meat products equation

The critical value of χ^2 from the textbook tables is $\chi^2(5)=11.1$. The calculated value of the Hausman test m_3 from the Eviews run program, $m_3 = 0.6$

Inference

Since the Hausman test m_3 (=0.6) is less than the critical value $\chi^2(5)$ (=11.1), the null hypothesis is NOT rejected. The conclusion therefore is that the X-regressor is exogenous and that there is no misspecification problem.

7 THEORETICAL DEVELOPMENT OF SECTORAL GRAVITY MODEL

Although the basic gravity trade model used in most empirical studies has been developed from Equation (11) presented in Chapter 3 of the main thesis, theoretical developments for sectoral gravity models are still scarce. One notable study which developed a sectoral gravity model which is adopted in this thesis is by Marques (2004).

Following Marques (2004), Botswana and its trading partners are considered to be composed of a finite number (h) of export sectors, which export to a number of destinations. When analyzing Botswana, it is paramount to note that exports of these

sectors are compounded among other things by both non-spatial and spatial components of trade costs. Non-spatial costs includes import duties and non-tariff barriers (NTBs) and these costs can be reduced (or eliminated) by means of entering into a regional trade agreement with relevant trading partners. The second component of trade costs is purely spatial and depends on country pair-specific distance. Although these costs can be reduced by improvements in trade-related infrastructure, they can not be totally eliminated. Spatial trade costs are denoted by $\tau_{ij}d_{ij}$, with d being the distance between countries i and j, and $\tau_{ij}>0$ denoting a parameter which measures the quality of infrastructures in that country-pair. Thus the total cost of trade between two countries i and j is:

$$T_{ij} = t + \tau_{ij} d_i \qquad \text{(A3)}$$

Each country is assumed to have a finite number (h) of industrial export sectors which uses two factors of production in its production activities. These factors are unskilled labour (L^U) and industry-specific skilled labour (L^S), and an agricultural sector that only employs unskilled labour. The agriculture sector is assumed to be perfectively competitive and employing unskilled labour and arable land under constant returns to scale to produce a homogeneous product which will be traded at a cost of zero and this product will be also used as a numeraire. In the model, the price of the homogeneous good (pY) and the wage of unskilled labour (w^U) are both assumed to be equal to unit across all the countries. On the other hand, imperfect competition underpins production and trade in the h increasing returns to scale industrial sectors (X_h) where both unskilled and skilled labour in different proportions are employed to produce both final and intermediate differentiated goods. Product variety is categorized according to quality and rational consumers prefer quality since it increases their utility. Incorporating a utility weight function $\theta(k)=k^{\eta}$, where $\eta<1$ is the elasticity of the consumer's valuation of quality with respect to the quality index k, the utility function for a consumer in country i can be written as:[34] [35]

[34] Though there are many countries in the model, we will use a generic country subscript i as we assume that all countries share a preference structure with a CES functional form.

[35] The assumption of a share of manufacturers in consumption not higher than 1/3 ensures that, even if all industry is concentrated in a single country, the other country also has some agriculture, and thus equilibrium industrial wages equal equilibrium agricultural wages in each country. In this model the

$$U_t = \left[\prod_h (X_{ih})^{\gamma_h}\right]^{\rho} \left(Y_i^{1-\rho}\right), \quad 0 < \gamma_h < 1, \quad \sum_h \gamma_h = 1, \quad 0 < \rho \leq 1/3 \tag{A4}$$

with each of the increasing returns to scale composite good formed as follows:

$$X_{ih} = \left[\int_0^{N_h} \left(k^{\eta} x_{ihk}\right)^{\frac{\sigma-1}{\sigma}} dk\right]^{\frac{\sigma-1}{\sigma}}, \text{ h} = 1, 2, \ \sigma > 1 \tag{A5}$$

where x_{ihk} is the quantity consumed of each variety k produced in sector h in country i, N_h is the number of varieties effectively produced in sector h, σ is the elasticity of substitution among varieties of the same good, γ is the share of expenditure on each differentiated good, and ρ is the share of expenditure on all the differentiated goods. Further, assume n_{ih} to be the total number of varieties of differentiated goods of sector h effectively produced in country i, pi the free-on-board (FOB) prices in the producer's location i, and i_i the individual income in country i. The budget constraint faced by a consumer in country i can then be written as:

$$p_i Y_i + \sum_{j=ROW} \sum_h \int_0^{n_{jh}} T_{ij} p_{jhk} x_{ihk} dk = i_i \tag{A6}$$

*w*here ROW = Rest of the world

Consumers maximize utility Equation (A4) subject to the budget constraint represented by equation (A6)[36]. Assume that the price index P_i of each industry's

equality applies to unskilled labour only since skilled labour is specific to industry. Thus wage determination can be treated as if there was one single factor of production in the model.

[36] Each consumer allocates to good Y a share 1-ρ of individual income. In addition, solving for the first order conditions returns the demand functions in market i for a variety k of each sector X_h. These are represented by the first term in the total demand equation (A9).

aggregate good in country *i* is the same for inputs as for final products and is expressed as:[37]

$$P_{ih} = \left[\sum_{j=ROW} \int_0^{n_{jh}} \left(\frac{T_{ij} p_{jhk}}{k^{\eta}} \right)^{1-\sigma} dk \right]^{\frac{1}{1-\sigma}} \tag{A7}$$

Venables (1999) argues that inter-industry linkages are sufficiently weaker than intra-industry linkages to be ignored. On the other hand, Forslid (1999) point out that labour is categorized according to fixed costs (skilled labour engaged in research) and marginal costs (unskilled labour employed in production) such that skill-intensive industries have a higher degree of scale economies. Additionally, fixed costs become a function of quality, their natural limit being provided by the total supply of skilled labour available. As a consequence countries with more skilled labour are able to achieve higher quality levels. Using a fixed cost function $\varphi(k) = k^{\delta}$, where $\delta > 1$ is the elasticity of the firm's fixed cost of quality with respect to the quality index *k*, the minimum cost function for producing a variety *k* in country *i* will then be:

$$TC_{ihk} = (P_{ih})^{\mu} \left[(w_i^s)^{\alpha} k^{\delta} + (w^U)^{1-\alpha-\mu} \right] c x_{ihk} \tag{A8}$$

with w^S and w^U the wage rates for skilled and unskilled labour, respectively, α the share of skilled labour in total cost, μ the share of intermediates in total cost, *c* the marginal cost, and *x* the equilibrium output. The total demand from consumers and firms of both sectors faced in market *i* by a firm producing variety *k* in country *j* is represented by:

$$X_{ijhk} = \left[P_{jhk} \right]^{-\sigma} \left[\frac{T_{ij}}{k^{\eta} P_{ih}} \right]^{1-\sigma} E_{ih} \tag{A9}$$

with E_{ih} the expenditure function given by:

[37] The procedure for the derivation of the CES demand functions and the corresponding price index is fully described in Fujita et al. (2000).

$$E_{ih} = \gamma_h \rho I_i + \mu \int_0^{n_{i1}} TC_{i1k}\, dk \tag{A10}$$

where I_i is the total income in country i. The profit maximizing price is a mark-up over marginal cost:

$$p_{ihk} = \left(\frac{\sigma}{\sigma - 1}\right)\left(w^U\right)^{1-\alpha-\mu}\left(P_{ih}\right)^{\mu} c \tag{A11}$$

The zero profit condition can be solved for the firm's equilibrium output:

$$x_{ihk} = (\sigma - 1)\frac{k^{\delta}\left(w_i^s\right)^{\alpha}}{c\left(w^U\right)^{1-\alpha-\mu}} \tag{A12}$$

The firm's demand for labour is:

$$w_i^s \lambda_{ih}^S = \sigma\alpha\left(w_i^S\right)^{\alpha}\left(P_{ih}\right)^{\mu} + \int_0^{n_{ih}} k^{\delta}\, dk \tag{A13}$$

with λ^S_{ih} being the share of country i's skilled labour endowment working in manufacturing sector h. According to this condition, the equilibrium wage bill of skilled workers is equal to their share of the equilibrium revenue.[38] In addition, with quality differences firms are no longer symmetric and it is the mass of firms that determines total production[39]. Finally, due to the assumption of non-substitutability of labour skills, wages are determined independently: the skilled wage is determined in the differentiated goods sector by (A13) and the unskilled wage is determined in the

[38] In equilibrium the zero profit condition applies and thus the equilibrium total revenue must equal the equilibrium total cost. Hence it is indifferent to think in terms of share in revenue or in costs.

[39] The mass of firms is described by the "quality integral". Since firms differ in the quality of their products according to some distribution function, it is the total mass of firms that is relevant and not just their number. Obviously if firms are symmetric the distribution is uniform and we obtain the special case that is currently treated in the literature in which the mass of firms depends directly on the number of firms.

homogeneous goods sector. Unskilled wages are always constant and equal to unity, skilled wages will be denoted by *w*.

The demand equation (A9) represents the total quantity demanded from a firm producing variety *k* in country *j* by consumers and firms of both sectors in market *i*. According to this equation, the quantity of variety *k* flowing from country *j* to country *i* depends on, among other variables, the total expenditure of country *i* in the sector to which that variety belongs. Expenditure as defined in equation (A10) depends on total cost as given by equation (A8). The latter in turn depends on the equilibrium output of the firm producing variety *k* as defined in equation (A10). After substituting (A12) into (A8) and the resulting expression into (A10), equation (A9) becomes:

$$x_{ijhk} = \left[P_{jhk}\right]^{-\sigma}\left[\frac{T_{ij}}{k^{\eta}P_{ih}}\right]^{1-\sigma} E_{ih} \qquad \text{(A14)}$$

as E_{ih} the expenditure function is now given by:

$$E_{ih} = \left[\gamma_h \rho I_i + \frac{\sigma\mu}{\delta+1}\left(w_i^S\right)\left(P_{ih}\right)^{\mu}\left(n_{ih}\right)^{\delta+1}\right] \qquad \text{(A15)}$$

Hence exports of variety *k* of sector *h* from country *j* to country *i* (x_{ijhk}) are a function of the relative price of the variety (p_{jhk}) with respect to country *i*'s price index in sector *h* (P_{ih}), the barriers to trade between countries *i* and *j* (T_{ij}), the consumer's quality index k^{η}, the number of firms in market *i* ($n_{i1}+n_{i2}$), and the income of market *i* (I_i) that depends on the skilled wage and the skilled labour force[40]. This relationship resembles a sectoral gravity equation that is presented and described in section 3.3.3 of the main thesis.

[40] Note that, in the model's set-up, the total income of country i is a function of both the skilled and unskilled labour force, and of wages. However, as it is assumed that the number and reward of unskilled workers is the same in all markets, a market's income is really determined by the number and reward of skilled workers.

8 HUFBAUER 1970 INDEX

The Hufbauer's (1970) index of product differentiation is one of the possible variables used to represent intra-industry trade (IIT) emanating from the product differentiation or increasing returns to scale theories in a gravity model equation. The index is constructed in the form of the coefficient of variation in unit export values as follows:

$$PD = \frac{U_n}{V_n} \tag{A16}$$

where PD denotes product differentiation, U_n is the standard deviation export unit values for shipments of Botswana's diamond product to different trading partner countries; and V_n, denotes the unweighted mean of these unit values.

9 REVEALED COMPARATIVE ADVANTAGE

Revealed comparative advantage (RCA) was pioneered by Bella Balassa (1965). The approach emanated from difficulties in measuring an industry's actual comparative advantage in production and trade. Given the difficulties in (i) accounting for all the factors which influence an industry's comparative advantage, and (ii) actually measuring and comparing these factors between countries and industries, Balassa argued that the revealed performance of an industry's trade pattern would serve as a reasonably adequate indicator of that industry's comparative advantage (Hamilton and Svensson, 1984).

RCA states that if a country can produce a good at a lower cost relative to other countries, then with international trade, that country should devote more of its scare resources to the production of that good. Through trade, that country can obtain other goods at a lower price (opportunity cost), in exchange for the good in which it has a comparative advantage. Thus according to the predictions of RCA, if a country has a comparative advantage in the production of a good, it should be found to export a higher proportion of that good relative to other countries.

Following Balassa's (1965), revealed comparative advantage index (RCAI) formulation is expressed as follows:

$$RCAI_{ij} = \left(X_{ij} / X_i \right) / \left(X_{wj} / X_w \right) = \left(X_{ij} / X_{wj} \right) / \left(X_i / X_w \right) \quad \text{(A17)}$$

where: $RCAI_{ij}$ = country i's revealed comparative advantage for good j

X_{ij} = i^{th} country's exports of commodity (or industry) j

X_i = i^{th} country's total exports

X_{wj} = world exports of commodity (or industry) j

X_w = total world exports

$RCAI_{ij}$ measures a country's exports of a sector (or commodity or industry) relative to its total exports and to the corresponding world exports. A comparative advantage is "revealed", if $RCAI_{ij} > 1$. On the other hand, if $RCAI_{ij}$ is less than unity, the country is said to have a comparative disadvantage in the commodity/industry.

10 DIFFERENT TYPES OF PANEL UNIT ROOT TEST STATISTICS

This section of the Appendices presents the six panel unit root tests that are normally employed in testing the stationarity of a panel data set.

Table A19: Different types of panel unit root tests statistics

Test	**H_0**	**H_A**	**Assumption of the unit root process (Common/ individual)**	**Test statistic**	**When to reject H_0 and associated inference in this case**
Levin, Lin, Chu (LLC) (2002)	Each individual time series contains a unit root	Each time series is stationary	Common	Adjusted (standardised) ***t*-statistic** t_ρ^* on pooled regression:	$p<0.05$; panel is stationary

				$\tilde{e}_{it} = \rho\tilde{v}_{i,t-1} + \tilde{\varepsilon}_{it}$	
Breitung (2000)	Each individual time series contains a unit root	Each time series is stationary	Common	Adjusted (standardised) ***t*-statistic** on pooled regression: $e^*_{it} = \rho v^*_{i,t-1} + \varepsilon^*_{it}$	p<0.05; panel is stationary
Im, Pesaran, Shin (2003)	Each individual time series contains a (series specific) unit root, $\rho_i = 0 \ \forall_i$	Some (but not all) of the individual series have unit roots, i.e., $p_i<0$ for at least one i.	Individual	Weighted, standardised ***t*-statistic** based on t-stats of individual ρ_i coefficients (individual ADF statistics)	p<0.05; panel is stationary
ADF-Fisher (Madala & Wu 1999; Choi 2001)	Each individual time series contains a (series specific) unit root, $\rho_i = 0 \ \forall_i$	Some (but not all) of the individual series have unit roots, i.e., $p_i<0$ for at least one i.	Individual	**Combined information on *p*-values** of individual unit root tests: $P = -2\sum_{i=1}^{N} \ln p_i$	p<0.05; panel is stationary
PP-Fisher Madala & Wu 1999; Choi 2001)	Each individual time series contains a (series specific) unit root, $\rho_i = 0 \ \forall_i$	Some (but not all) of the individual series have unit roots, i.e., $p_i<0$ for at least one i.	Individual	**Combined information on *p*-values** of individual unit root tests: $P = -2\sum_{i=1}^{N} \ln p_i$	p<0.05; panel is stationary
Hadri (2000)	No unit roots in any of the series in the panel	All series contain unit roots	Common	Two standardised ***Z*-statistics** (based on two *LM* statistics, where one allows for heteroskedastisity accros *i*)	p<0.05; panel is non-stationary

Source: author compilation

11 DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

This part of the Appendices presents the descriptive statistics and correlation metrics for all the data used in the empirical analysis done in this thesis.

11.1 Descriptive statistics

Table A20: Descriptive statistics for data used in Diamond gravity equation

	EXPO	MGDP	GDP	POP	KLR	HF
Mean	14.05474	7.930801	6.345557	3.292091	11.22658	0.437681
Median	15.04852	7.963398	5.681327	3.07074	11.25675	0.412326
Maximum	21.91819	8.232632	9.491341	5.702832	11.45475	0.511659
Minimum	2.302585	7.566206	4.684767	1.783559	10.87953	0.410188
Std. Dev.	5.754608	0.215639	1.600522	1.383991	0.160668	0.041068
Skewness	-0.66497	-0.19428	0.870327	0.51756	-0.89052	1.105667
Kurtosis	2.605734	1.937462	2.346994	1.916484	3.413526	2.311427
Jarque-Bera	3.848413	2.559934	6.912586	4.490962	6.686191	10.72827
Probability	0.145992	0.278046	0.031546	0.105877	0.035327	0.004682
Sum	674.6277	380.6785	304.5868	158.0204	538.876	21.00868
Sum Sq. Dev.	1556.429	2.185518	120.3985	90.0253	1.213264	0.07927
Observations	48	48	48	48	48	48
Cross sections	6	6	6	6	6	6

Key:

EXPO =Botswana's sectoral exports (e.g., diamond); MFGDP = Botswana's Mining sector GDP; GDP = GDP for importing partners; POP = Importer population; KLR = Botswana's sectoral capital labour ratio; HF = Haufbauer index

Table A21: Descriptive statistics for data used in the Textiles gravity equation

	EXPO	MFGDP	GDP	POP	INFL	KLR	RCAIT
Mean	9.643426	5.620694	4.251186	2.652099	17.48281	-4.98542	0.4
Median	10.04765	5.610141	5.150801	2.665883	3.2	-4.98115	0.3
Maximum	18.38125	5.848947	9.491341	5.702832	1016.7	-4.71538	0.7
Minimum	2.484907	5.40178	-0.35811	0.002996	-1.3	-5.2064	0.2
Std. Dev.	4.499969	0.169522	2.748404	1.317023	83.50559	0.189688	0.166265
Skewness	0.081166	0.049875	-0.07258	0.065477	9.81236	0.066433	0.657843
Kurtosis	1.831717	1.285236	1.700168	2.633269	111.0763	1.25018	1.950413
Jarque-Bera	11.1299	23.60292	13.68506	1.213121	96524.94	24.6362	22.66129
Probability	0.00383	0.000007	0.001067	0.545223	0	0.000004	0.000012
Sum	1851.538	1079.173	816.2278	509.2031	3356.7	-957.2	76.8
Sum Sq. Dev.	3867.696	5.488932	1442.761	331.2988	1331878	6.872464	5.28
Observations	192	192	192	192	192	192	192
Cross sections	24	24	24	24	24	24	24

Key:

MFGDP = Botswana's Manufacturing sector GDP; INFL = importer inflation; RCAIT = revealed comparative index for textiles exports; and Other variables as defined before

Table A22: Descriptive statistics for data used in the Meat gravity equation

	EXPO	AGDP	GDP	INFL	KLR	RCAIM
Mean	12.16171	5.028592	4.663977	1.387487	0.067614	2.6375
Median	13.74886	5.031871	5.2	1.047165	0.042414	2.55
Maximum	17.47221	5.267081	7.97	6.924317	0.275323	3.9
Minimum	2.995732	4.828882	1.14	-0.91629	0.024971	1.9
Std. Dev.	4.434024	0.159274	2.427602	1.37706	0.079629	0.599101
Skewness	-0.75575	0.082359	-0.23071	2.145219	2.191995	0.848736
Kurtosis	2.133224	1.40014	1.490931	7.819477	5.952492	2.957224
Jarque-Bera	11.1318	9.484504	9.130736	152.6624	102.4341	10.57187
Probability	0.003826	0.008719	0.010406	0	0	0.005062
Sum	1070.231	442.5161	410.43	122.0989	5.95005	232.1
Sum Sq. Dev.	1710.47	2.207029	512.7129	164.9776	0.551641	31.22625

Observations	88	88	88	88	88	88
Cross sections	11	11	11	11	11	11

Key: AGDP = Botswana's Agriculture sector GDP; RCAIM = revealed comparative index for meat and meat products exports; and Other variables as defined before.

11.2 Correlation matrix

Table A23: Correlation matrix for data used in the diamond gravity equation

	EXPO	MGDP	GDP	POP	KLR	HF2
EXPO	**1.000000**	0.180545	-0.146745	-0.085143	0.352907	-0.042973
MGDP	0.180545	**1.000000**	-0.449021	-0.905168	0.030495	-0.330805
GDP	-0.146745	-0.449021	**1.000000**	0.270814	-0.651643	0.225288
POP	-0.085143	-0.905168	0.270814	**1.000000**	-0.651710	0.202821
KLR	0.352907	0.030495	-0.651643	-0.651710	**1.000000**	-0.713597
HF2	-0.042973	-0.330805	0.225288	0.202821	-0.713597	**1.000000**

Table A24: Correlation matrix for data used in the textiles gravity equation

	EXPO	MFGDP	GDP	POP	INFL	KLR	RCAIT
EXPO	**1.000000**	0.415545	-0.271713	-0.254188	0.064899	-0.040412	-0.167879
MFGDP	0.415545	**1.000000**	0.364825	0.399216	0.206567	-0.640943	0.625790
GDP	-0.271713	0.364825	**1.000000**	0.767978	0.112810	-0.431685	0.544788
POP	-0.254188	0.399216	0.767978	**1.000000**	0.400535	-0.642989	0.470745
INFL	0.064899	0.206567	0.112810	0.400535	**1.000000**	-0.539600	0.340592
KLR	-0.040412	-0.640943	-0.431685	-0.642989	-0.539600	**1.000000**	-0.943110
RCAIT	-0.167879	0.625790	0.544788	0.470745	0.340592	-0.943110	**1.000000**

Table A25: Correlation matrix for data used in the meat gravity equation

	EXPO	AGDP	GDP	INFL	KLRLEV	RCAIM
EXPO	**1.000000**	0.006901	-0.174699	0.232189	0.256941	-0.070196
AGDP	0.006901	**1.000000**	-0.842904	-0.580477	-0.781264	-0.356644
GDP	-0.174699	-0.842904	**1.000000**	0.393880	0.425880	0.394706
INFL	0.232189	-0.580477	0.393880	**1.000000**	0.247504	-0.173933
KLR	0.256941	-0.781264	0.425880	0.247504	**1.000000**	0.411824
RCAIM	-0.070196	-0.356644	0.394706	-0.173933	0.411824	**1.000000**

12 USE OF GRAVITY LAWS IN SOCIAL SCIENCE AND ECONOMICS

According to Paas (2000), there are various considerations regarding the application of a gravity approach to social phenomena and modeling of international trade flows. These considerations are generalized in the main stages of the development of theoretical background of the gravity approach in social science and economics. Thus according to this author the theoretical foundations underpinning the use of gravity models in social sciences in general, and economics in particular, can be traced to disciplines such as regional science, economic geography, microeconomics and general equilibrium, among others. Table A26 therefore presents some of the theoretical background and main concepts of the use of gravity laws in social sciences and economics.

Table A26: Theoretical foundations and main concepts of the use of gravity laws

Theoretical background	The main aspects	Authors
Regional science, economic geography	Measurement of intra-regional relationships and their influence on the behaviour of individual units. Regions are conceived as a mass. The location of the firm is guided by two fundamental forces: 1) economies of scale at the factory level, and 2) trade	Carey (1858), Reilly (1929), Steawart (1948), Isard and Freutel (1954), Hammer and Ikle (1957), Isard (1960), Harvey (1969), Nijkamp and Reggiani (1992), Krugman (1991, 1998), Davis and Weinstein (1996), Fujita et al

	costs.	(1999).
Microeconomics, utility maximization, general equilibrium	An optimal allocation of the given budget can be obtained by postulating a utility function for the decision-marker that reflects relative preferences. Assuming the budget constraint is linear; the volume of transactions between two points can be stated as a utility maximizing problem. A model using gravity theory could be derived from a utility maximizing function.	Linnemann (1996), Niedercorn and Bechdolt (1969), Golob and Beckman (1971), Nijkamp (1975), Bergstrand (1985), Nijkamp and Reggiani (1992)
Trade theories, which differ in the way product specialization is obtained in equilibrium: 1) technology differences across countries in the Ricardian model, 2) variations in terms of countries' differencing factor endownments in the Heckscher-Ohlin (H-O) model, 3) increasing returns at the firm level in the increasing returns to scale (IRS) models.	A gravity model for trade, considers three main functions: 1) the total potential supply (or exports) of a country to the world market; 2) the total potential demand (or imports) of a country to the world market; and 3) those factors that create a resistance to trade and thus affect the degree of trade intensity.	Tinbergen (1962), Poyhonem (1963), Linnemann (1966), Anderson (1979), Bergstrand (1985), Helpman and Krugman (1985), Deadorff (1995), Evenett and Keller (1998), Eichengreen and Irwin (1998), and Evenett and Killer (2002).

Source: Paas (2000, p 17-19)