Dynamics of Firm-Level Export Diversification in Botswana

By

Pinkie Gertrude Kebakile

Thesis Presented for the Degree of

Doctor of Philosophy

In the School of Economics

University of Cape Town

August 2018

Supervisor: Professor Lawrence Edwards

Abstract

This thesis investigates the firm-level dynamics of export diversification in Botswana. Botswana is a country characterised by a high level of export concentration, with diamonds dominating its export bundle. With the stock of diamonds expected to be depleted in the near future, Botswana faces the urgent challenge of diversifying its export bundle. While much analysis has focused on the product composition of exports, little focus has been placed on the role that firms play in driving the composition of exports in Botswana over time. This thesis fills this gap in the literature.

The analysis draws on various unique and unexplored databases. Firstly, it uses a panel of transaction level data for the period 2003 to 2012 obtained from Statistics Botswana. Second, the transaction data are merged with a panel of manufacturing firm data for the period 2003 to 2012 obtained from Department of Industrial Affairs. Finally, tariff data at the product level (HS8) for the period 2003 to 2012 are obtained from the World Integrated Trade Solution (WITS). Drawing on these databases allows for a detailed firm level analysis of export diversification not previously possible for Botswana.

The thesis is comprised of three main chapters in addition to the general introduction and concluding chapters.

The first main chapter (chapter 2) uses the transaction data to document the stylized facts associated with Botswana's firm-level export diversification. Their consistency is assessed with empirical evidence in other countries. The background analysis reveals that a majority of exporting firms (over 70%) export to a single export destination and a small fraction of firms (less than 25%) export to multiple export destinations. However, as found in the international literature, export values are highly concentrated amongst the multi-destination exporters. The analysis also reveals that diamonds dominate Botswana's export bundle, which are exported to one major destination, being the United Kingdom.

An additional focus of the chapter is the relationship between firm size and changes in export diversification, defined in terms of product and destination margins. To study the dynamics between firm export size and diversification, a Multinomial logit regression approach is adopted. This technique is used to estimate the predicted probabilities of moving between different product-destination categories as a firm grows in export value. The results reveal non-linearities in the evolution of a firm's diversification path. At low values of exports, firms concentrate on selling a single product to a single destination. As firms grow in export value,

they expand the number of products to the destination rather than the number of destinations of that product. This is a striking contrast to results found in other countries whose diversification path has been found to be driven mainly by the expansion of the number of destinations per product (Stirbat et al., 2011; Cadot et al., 2013). Only at higher export values do the multi-product firms transition into exporting to multiple destinations. The contrasting diversification path for Botswana suggests that diversification into new export markets is a key constraint to growth and diversification of Botswana's export bundle. Therefore, the remaining chapters of the thesis explore firm level factors determining export destination diversification.

Chapter 3 looks at the role of firm productivity in driving the diversification of firm exports across destinations. An important component of this analysis is the productivity relationship associated with manufacturing firm's exporting out of the Southern African Customs Union (SACU). To assess the relationship, the transaction data are merged with the manufacturing database. Given the high number of zero trade flows for many firms, the Zero-inflated Poisson regression model is used to estimate the link between firm productivity and export destination diversification. The results strongly support the prediction that more productive firms enter the export markets. The results also show that upon entering the export market, only the relatively productive firms become multi-destination exporters. The results also confirm the presence of a productivity premium for firms exporting out of the SACU region.

Chapter 4 tests the complementary input hypothesis where access to imported intermediate inputs enhance productivity thus enabling firms to access more export destinations. It further assesses whether the impact varies across differentiated inputs or homogenous inputs. Three measures are used to proxy input complementarity, namely: number of product-source country pairs, number of source countries and total import value. Using a poisson model with fixed effects, the results provide strong evidence of a positive association between variety of imported inputs used by a firm and the range of destinations it exports to. The results are robust across all the measures of input complementarity.

Given concerns regarding endogeneity of imported input use, the reductions in tariffs under the South Africa – European Union Trade, Development and Cooperation Agreement (TDCA) is used to instrument firm use of imported intermediate inputs. Using the Two-stage Residual Inclusion approach, the results confirm the productivity-enhancing effects of the input complementarity hypothesis on firm export destination diversification. These results, hence,

suggest that firms stand to benefit from the productivity-enhancing effects of imported intermediate inputs which can boost their export destination diversification efforts.

Declaration

I, *Pinkie Gertrude Kebakile*, declare that this thesis is my original work and other sources have been acknowledged through referencing. I also declare that the thesis has not been submitted for the award of a PhD degree at any other university.

Signed: Signed by candidate

Acknowledgements

All Glory belongs to the Almighty Lord!

To my PhD supervisor, Professor Lawrence Edwards, I can never thank you enough for the invaluable advice and guidance that you tirelessly provided throughout this PhD journey. Your patience and timely feedback will be forever appreciated, as it made this difficult journey more bearable. I am indebted to you for my sharpened writing and analytical skills. The skills I learned during your mentorship not only assisted me in completing this project, but has also prepared me to be a better researcher at my workplace.

My heartfelt gratitude also goes to the African Economic Research Consortium (AERC) for providing funding for my PhD studies, coupled with opportunities to present my work-in- progress at the AERC conferences in Arusha and Addis Ababa in 2015. Special thanks to the Resource Persons of the Trade Group at the AERC Thematic Research Workshops in 2015, for their invaluable comments on my PhD proposal and post field report. I also greatly appreciate the invaluable comments and suggestions I received from the School of Economics lecturers during my proposal defense. Special thanks also go to the members of the UCT Trade Reading Group and Brown Bag seminars for their comments and suggestions when I presented my draft papers. My sincere thanks also go to the Economic Society of South Africa (ESSA) for giving me the opportunity to present one of my PhD papers at their 2017 conference, at which my paper on "Export Destinations and Firm Heterogeneity: Evidence from Botswana's Manufacturing Firms" was awarded the "Best Student Paper" in International Economics award.

It would be remiss of me not to express my gratitude to my employer, Botswana Institute for Development Policy Analysis (BIDPA) for granting me study leave, facilitating access to the data used for this thesis and for funding the remaining period of my studies. My special thanks also goes to Statistics Botswana for availing the data.

Finally, to my husband, Stephen, thank you so much for all your ever-present support and patience. What you had to endure during my absence at home, taking care of our kids single-handedly will forever be imprinted in my heart. To my children, Seetsele, Seikatso, Lelentle and Sesupo, one day you will fully understand why mommy was away in Cape Town for some time. It is my sincere hope that my perseverance, will teach you to appreciate the lifelong virtue of "Determination".

Dedication

To my husband, Stephen, and children, Seetsele, Seikatso, Lelentle and Sesupo!

Table of Contents

Abstract ... ii
Declaration ... v
Acknowledgements ... vi
Dedication ... vii
Table of Contents ... viii
List of Tables ... xi
List of Figures ... xii
List of Acronyms ... xiii
Chapter 1 ... 1
1. General Introduction ... 1
1.1. Introduction and motivation ... 1
1.2. Objectives of the thesis ... 4
Chapter 2 ... 10
2. Export Diversification Characteristics of Botswana's Formal Cross-Border Traders ... 10
2.1. Introduction and Background ... 10
2.2. Overview of Botswana's Economy ... 12
2.3. Literature Review ... 17
2.3.1. Theoretical Background ... 17
2.3.2. Related Empirical Literature ... 20
2.4. Methodological Framework ... 23
2.4.1. Modelling Firm-Based Export Diversification Dynamics ... 23
2.4.2. Econometric Model ... 25
2.4.3. Description of Data and Sample Coverage ... 26
2.4.3.1. Export data ... 26
2.5. Results and Discussion: Firm Specific Measures of Export Diversification ... 28
2.5.1. Emerging Stylized Facts from Customs Data ... 28
2.5.1.1. Firm-Product-Destination Trends ... 28
2.5.1.2. Product-Firm Entry and Exit Dynamics ... 31
2.5.1.3. Multi-Product Multi-Destination Exporters ... 33
2.5.2. Empirical Results ... 37
2.5.2.1. Exporter Value and Firm Export Destination Status ... 37
2.5.2.2. Post-Estimation Results ... 40
2.5.2.3. Fixed Effects Multinomial logit regression ... 42
2.5.2.4. Robustness Checks ... 43
2.6. Conclusions and Policy Implications ... 44

Chapter 3 47
3. Export Destinations and Firm Heterogeneity: Evidence from Botswana's Manufacturing Firms 47
3.1. Introduction and Background 47
3.2. Literature Review 49
3.2.1. Theoretical Background 49
3.2.2. Related Empirical Literature 51
3.3. Methodological Framework 54
3.3.1. Modelling Firm-Based Geographic Export Diversification 54
3.3.2. Econometric Model 56
3.3.3. Data and Data Overview 59
3.3.3.1. Data Description 59
3.4. Results and Discussion 62
3.4.1. Profile of Botswana's Manufacturing Sector 62
3.4.1.1. Exporter Heterogeneity 64
3.4.2. Empirical Results: Zero-inflated adjusted Destination Choice Model 70
3.4.2.1. Descriptive Analysis 70
3.4.2.2. Empirical Analysis 75
3.5. Conclusion 83
Chapter 4 85
4. Imported Intermediate Inputs, Product Complexity and Export Destination Diversification: Firm-level Evidence from Botswana 85
4.1. Introduction 85
4.2. Literature Review on Firm Importing and Export Destination Diversification 89
4.2.1. Theoretical Background 89
4.2.2. Related Empirical Literature 94
4.3. Data and Data Overview 97
4.3.1 Data Description 97
4.3.2. Merger of Export and Import Transactions 98
4.4. Methodological Framework 99
4.4.1. Modelling Simultaneous Firm Exporting and Importing 99
4.4.2. Econometric Model and Identification Strategy 103
4.5. Results and Discussion 106
4.5.1. Stylized Facts about Botswana's Importers and Exporters 106
4.5.1.1. Trends in Firms' Export Destination Diversification and Importing Decisions 106
4.5.1.2. Firm Heterogeneity Across different trading status 110

4.5.2. Empirical Results 111
4.5.2.1. Descriptive analysis 111
4.5.2.2. Empirical analysis 113
4.5.2.2.1. Baseline Results 113
4.5.2.2.2. Robustness Checks using Instrumental Variables Estimation 116
4.6. Conclusion 121
Chapter 5 123
5. General Conclusion and Policy Implications 123
5.1. Summary of findings 123
5.2. Implications of findings for policy 128
5.3. Suggestions for future research 129
References 130
Appendix ch2 141
Appendix ch3 143
Appendix ch4 149

List of Tables

Table 1: Top HS-8 Exported Products in 2003 and 2012 15
Table 2: Top 10 Destinations for Botswana's exports in 2003 and 2012 17
Table 3: Export Transactions, Firms, Products and Destinations (2003-2012) 28
Table 4: Descriptive statistics from Botswana's customs data 29
Table 5: Comparison of Botswana with other countries (2006) 31
Table 6: The Evolution of the Number of Exporting Firms 32
Table 7: The Evolution of the Number of Exported Products 33
Table 8: Distribution of Exporters and Export Value by Number of Products and Export Destinations, 2003 35
Table 9: Distribution of Exporters and Export Value by Number of Products and Export Destinations, 2012 36
Table 10: Exporter Status-Exports Value Gap for Botswana's Formal Cross-Border Traders 39
Table 11: Test of independent variables 41
Table 12: Test for combining dependent categories 41
Table 13: Independence of Irrelevant Alternatives (IIA) tests 42
Table 14: Exporter Status-Exports Value Gap for whole sample versus Non-mining sample 43
Table 15: Transition matrix for the category of exports to which a firm belongs 44
Table 16: The Number of Exporting Manufacturing Firms per year 61
Table 17: Distribution of Firms by Firm Size and Ownership Categories (2003-2012) 63
Table 18: Distribution of Firms by Firm Ownership and Trading Status (2003-2012) 63
Table 19: Distribution of Firms by Firm Size and Trading Status (2003-2012) 64
Table 20: Distribution of export market diversification of firms with different regions (2003-2012) 68
Table 21: Distribution of export market diversification of firms with different ownership categories (2003- 2012) 69
Table 22: Distribution of export market diversification of firms with different sizes (2003- 2012) . 70
Table 23: Multi-Destination Exporter Premia (2007- 2012) 72
Table 24: Year to Year Transitions in number of export destinations 75
Table 25: Empirical Results of the Determinants of Geographic Export Diversification- All destinations (2007-2012) 78
Table 26: Firm Productivity and Export Destination Diversification - Out of SACU destinations (2007-2012) 80
Table 27: Firm Productivity and Export Destination Diversification – Non- Primary Products Exports (2007-2012) 82
Table 28: Descriptive statistics from Botswana's exports data 106
Table 29: Descriptive statistics from Botswana's imports data 109
Table 30: Trading Characteristics of Firms (2003-2012) 111
Table 31: Importer Premia (2003-2012) 113
Table 32: Pooled Poisson and Fixed Effects Regression: The Relationship between Import Variables and Number of destinations per firm (2003-2012) 115
Table 33: First-stage Regression: The Relationship between the Import Variables and the Tariff Preference Margin (2003-2012) 116
Table 34: Second-stage Regression Estimates of the Relationship between the Import Variables and Export Destination Diversification (2003-2012) 117
Table 35: Two-stage Residual Inclusion Regression Estimates for Differentiated Inputs versus Homogenous Inputs (2003-2012) 120

List of Figures

Figure 1: Trends in Customs and Published Aggregate Exports Data 13
Figure 2: Export value as a percentage of GDP 14
Figure 3: Distribution Dynamics of Number of Products per Exporter 29
Figure 4: Distribution Dynamics of Number of Destinations per Exporter 30
Figure 5: Number of Export Destinations and Exported Products (2012) 37
Figure 6: Analysis of the Predicted Probabilities of Entry Mode Choice 40
Figure 7: Average Number of Export destinations per firm over time (2003-2012) 65
Figure 8: Distributions of log number of export destinations per firm (2004-2012) 66
Figure 9: Destination Count Frequencies 73
Figure 10: Trends of Different Categories of Firms 99
Figure 11: Distribution of log of Average Number of Destinations per Firm (2004-2012) 107
Figure 12: Average Input Tariffs per Firm (2003-2012) 110

List of Acronyms

BEC	Broad Economic Classification
BURS	Botswana Unified Revenue Services
CES	Constant Elasticity of Substitution
EU-SA TDCA	Agreement on Trade, Development and Cooperation between the European Union and the Republic of South Africa
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HS	Harmonized System
IIA	Independence of Irrelevant Alternatives
IMF	International Monetary Fund
IV	Instrumental Variable
ISIC	International Standard Industrial Classification
LR	Likelihood Ratio
MNCs	Multinational Corporations
MPMD	Multi Product Multi Destination
MPSD	Multi Product Single Destination
NDPs	National Development Plans
OLS	Ordinary Least Squares
R&D	Research and Development
SACU	Southern African Customs Union
SADC	Southern Africa Development Community
SPMD	Single Product Multi Destination
SPSD	Single Product Single Destination
SSA	Sub-Saharan Africa
SBR	Statistical Business Register
TFP	Total Factor Productivity
UK	United Kingdom
US	United States
WITS	World Integrated Trade Solution
WTO	World Trade Organization

Chapter 1

1. General Introduction

1.1. Introduction and motivation

One of the key themes in macroeconomics is understanding aggregate fluctuations through the lens of microeconomic sources by studying firm behaviour. Evidence attributes larger aggregate fluctuations to a country specializing in highly volatile sectors (Di Giovanni et al., 2014; Koren and Tenreyro, 2007). In this light, diversification of sales across destinations and sectors is viewed as a potential channel to mitigate aggregate fluctuations. Export diversification is thus seen as one of the potential avenues that can be used by developing countries to stimulate economic growth in their countries. Diversification can occur across products, sectors, or trading partners, and often involves the shift to a more varied production structure through the introduction of new products or expansion and upgrading of existing products (Mclntyre et al., 2018)[1].

Export diversification thus originates from structural change that involves changes in products, size and location of firms, legal and social innovations, etc, which are all prerequisites of economic growth[2]. The theoretical underpinnings of structural transformation lie in several strands of literature including new growth models, "economic dualism" literature and the "new economic geography" models (Parteka and Tamberi, 2013).

Likewise, the empirical link between export diversification and long run economic growth is well documented. According to a vast body of empirical literature, export diversification has a strong, positive impact on economic growth, through various channels. Firstly, export diversification increases productivity through knowledge spillovers (Feenstra and Kee, 2004). Such knowledge spillovers reduce the cost of innovation and this allows for higher long-run per capita growth (Hausmann and Klinger, 2006; Hwang, 2006; Hausmann et al., 2007; Imbs and Wacziarg, 2003). Secondly, a more diversified export structure stimulates new firms and expands existing ones elsewhere in the economy by adding new production opportunities for

[1] Hence, there are different forms of diversification and upgrading of existing products is one of them. A firm's ability to upgrade the quality of its products is an important measure of its international competitiveness. Such quality improvements can occur through direct upgrading (within the same product type) or indirectly (through adding new goods to the export basket) (Can and Gozgor, 2018)

[2] Literature on structural transformation has cited the export structure as one potential predictor of economic growth and therefore one of the potential explanations of cross-country differences (Hausmann et al., 2007).

industries. This channel occurs mainly as a result of export diversification taking place through addition of new exports to the existing export basket (Lopez-Calix et al., 2010). Thirdly, export diversification has a direct link with global value chains in that it can lead to stronger global production networks and thus the development of new products as cost reductions are passed on to downstream industries. Finally, export diversification reduces the volatility of export revenue by reducing the dependence on a limited number of products and destinations that are subject to major price and volume fluctuations (Acemoglu and Zilibotti, 1997).

There is also evidence indicating that developed countries are more diversified as compared to developing countries. To this end, resource-rich countries are in pursuit of diversifying their economies within and away from their dominant sectors, making integration into global production networks more urgent than ever before.

Of particular importance to developing countries, literature has pointed out the relevance of export destination diversification for developing countries (Shepherd, 2010). In relation to this, recent advances in international trade have helped uncover the determinants of export destination diversification. On one end, are what is termed "single" attribute models in the likes of Melitz (2003) and Chaney (2008) models that assumes a one-to-one mapping of a firm's productivity into its sales and number of destinations served. These models assume that the more productive a firm is, the larger its sales and number of destinations reached. This one-to-one mapping of firm productivity into number of destinations reached is also assumed in the spirit of multi-product firms' models (Bernard et al., 2011). These models also predict a positive relationship between firm productivity, its sales and its scope (Bernard et al., 2011).

The "single attribute" assumption of the above models has recently been challenged by models that argue that the relationship between firm productivity and access to export markets is not perfect (Eaton et al., 2015; Armenter and Koren, 2015; and Arkolakis et al., 2014). This is premised on the evidence that there exist small firms that export as well as large firms that sell solely on the domestic market (Eaton et al., 2011). In relation to this argument, contrary to models such as the Chaney (2008) that predict a hierarchy in the destinations served by a firm based on productivity thresholds, models such as the one by Eaton et al., 2011 challenge this, pointing to evidence that there exist some firms that export to destinations that are difficult to reach but do not export to easily accessible export destinations. To accommodate these models, literature has proposed additional layers of heterogeneity across firms that include taking into

account the firm-destination specific shocks that are introduced into the fixed cost of exporting (Eaton et al., 2015; Armenter and Koren, 2015; and Arkolakis et al., 2014).

Still related to the productivity-export destination nexus, theoretical models such as Melitz (2003) argue that firm productivity is exogenously chosen such that firm productivity is constant over time. One of the potential channels that has been pointed out in the theoretical literature to influence variation in firm productivity is through the firm's use of imported intermediate inputs in its final production (Kasahara and Lapham, 2013; Turco and Maggioni, 2013). These productivity-enhancing effects of imported intermediate inputs can boost firm's exporting behaviour, in particular, firm export destination diversification. Worthy to mention also is that trade in goods that incorporate imported intermediate inputs has grown rapidly since the 1960s (Bridgman, 2012). Theoretically, we expect this improved integration into global production networks to translate into firms' productivity gains and hence lead to export diversification gains. This is predicted by Keller (2004) who suggests that foreign sources of technology account for at least 90 percent of domestic growth in developing countries.

However, a puzzling fact that needs to be unpacked further is that countries that rely heavily on trade preferences remain plagued with low productivity gains as well as limited export diversification. For example, Africa's export performance is still lagging behind that of advanced countries as a result of various vulnerabilities such as concentration and low survival that all underpin the continent's fragile export sustainability (Cadot et al., 2013; Brenton et al., 2012). This fragile export sustainability (trade deepening and export survival) has adverse implications on the realization of export diversification in the continent.

This thesis therefore makes a contribution to the debate on importing-productivity-export destination diversification nexus by considering the firm level dynamics of export diversification in Botswana. It presents evidence of the microeconomics of firm export diversification behaviour, paying particular attention to the role of firm productivity and access to imported intermediate inputs in boosting firm level export destination diversification behaviour. The thesis additionally identifies channels through which firm productivity and firm's use of imported intermediate inputs could enhance its export diversification gains. These are potentially largely through exporting out of the trade preferences and firm's usage of differentiated intermediate inputs. Roberts and Tybout (1977) have confirmed that firms in differentiated product industries face significant fixed costs of exporting.

We have chosen Botswana as a case study for the following reasons: Firstly, Botswana, which is a member of the oldest customs union in the world, the Southern African Customs Union (SACU), is also not an exception to the challenges of export concentration facing African countries. Despite the impressive economic growth record that the country has enjoyed over time, exports are not diversified, with continued dominance by diamond exports that make up more than 70% of its export value. The economy's vulnerability was exposed during the 2008/2009 financial crisis when diamond sales plummeted. In this light, export diversification remains one of the key developmental objectives of Botswana.

Secondly, by virtue of being a neighbour to South Africa[3], Botswana, which is a land-locked country thus presents an interesting case to explore. Evidence from literature suggests that exporting to a superior neighbouring country is a stepping stone to accessing more developed export markets and in turn, the realization of export diversification (Cebeci et al., 2012). Furthermore, almost all the prerequisites necessary for the realization of export diversification are in place as Botswana scores high in many dimensions of economic management and governance, yet attaining the national long-term priority of export diversification continues to be far-fetched (Kojo, 2010).

1.2. Objectives of the thesis

The main objective of this thesis is to analyse the dynamics and determinants of firm level export diversification in Botswana. Within this main objective, the sub-objectives are to better understand characteristics of exporters and how their diversification evolves over time, including how firm productivity and access to imported intermediate inputs affect their destination diversification. The thesis is structured around three main questions:

1. What are the export diversification characteristics of exporters in Botswana and how does this evolve as firms grow in export size?;
2. What is the role of firm productivity in boosting firm export destination diversification behaviour?; and
3. Does access to imported inputs enhance firm export destination diversification behaviour?

Each of these relationships is now discussed in more detail.

[3] South Africa is the second largest Sub-Saharan African (SSA) economy that accounts for over a third of SSA's GDP and about 40 percent of its exports. It thus has a strong trade and financial links to the global economy and other SSA economies (Canales-Kriljenko et al., 2013).

Objective 1

The first objective, which is addressed in chapter 2, serves to document the stylized facts that characterize firm export diversification behaviour in Botswana and to establish if these are consistent with international evidence. This is specifically informed by three sub-objectives, namely: (1) to use a unique and unexplored export transaction level dataset to present the behaviour and patterns of firm level export diversification dynamics in Botswana (2) to examine what is driving changes in firm export diversification patterns in Botswana (3) Finally, to investigate how the evolution of growth in value of firm exports is related to changes in firm export diversification characteristics.

Understanding the type of exporters that contribute more to the export value is an important research question for a country that is struggling with realizing aggregate export diversification. At country level, the literature on aggregate export diversification and the level of income per capita has pointed to the relationship as being u-shaped (Imbs and Wacziarg, 2003). The u-shaped relationship is suggestive of the existence of some non-linearities. In light of this prediction, we argue that even at the firm level, this u-shaped relationship will be found. Our study thus extends the Imbs and Wacziarg (2003) model by considering the dynamics of export diversification at the firm-level.

Theoretically, multi-product multi-destination exporters account for a disproportionate share of export value relative to single product single destination exporters (Chaney, 2008; Bernard et al., 2003; Bernard et al., 2011). This is because multi-product multi-destination exporters are theoretically viewed as the most productive firms which means that they are able to spread their fixed costs over larger export sales, hence earning sufficient export values to cover their cost of entry (Bernard et al., 2003). This underlying theoretical relationship has been tested empirically in developed countries (for example, in Belgium by Bernard et al, 2014; in US by Bernard et al, 2011; in Portugal by Amador and Opromolla, 2013). A number of developing country studies are emerging, as relevant firm-level data becomes available (see Chacha, 2017 for Kenya; Fernandes et al., 2016 for selected developing countries).

Furthermore, in empirical studies where this theoretical relationship has been tested, we are not aware of any studies that have considered the non-linearities associated with the relationship between a firm size and export diversification. This chapter is a contribution to this research gap. We address the objectives of this chapter, by employing firm level transactions data. The

first analysis, which is purely descriptive, identifies the stylized facts associated with Botswana's firm level export diversification characteristics.

The second analysis relies on firm size as measured by firm export value and product-destination characteristics of a firm to statistically infer whether there exist any non-linearities associated with firm size and firm product-destination characteristic. This hypothesis is tested for all firms forming the population of exporters in Botswana, using export transactions dataset from Statistics Botswana, using the Multinomial logit regression technique with firm fixed effects as well as without firm fixed effects. The export diversification status is defined according to product-destination characteristics, namely: single product single destination exporters (SPSD); single product multi-destination exporters (SPMD); multi-product single destination exporters (MPSD) and multi-product multi-destination exporters (MPMD). The non-linearities associated with firm size and firm product-destination characteristic are captured by way of predicted probabilities, which capture dynamic paths of moving between the different product-destination characteristics defined in terms of SPSD, SPMD, MPSD and MPMD.

Objective 2

Given the potential importance of multi-product multi-destination exporters in boosting the export value relative to the comparator exporters and their potential contribution to aggregate export growth and diversification in the country, it is imperative to investigate the characteristics of firms that fall in the category of multi-product multi-destination exporters. This evidence provides pathways through which a sustainable export diversification strategy can be achieved not only in Botswana, but also in countries with similar exporting structures. Objective two of the thesis, which is addressed in chapter 3, is to provide insights into firm characteristics that determine selection into export destinations, with a special focus on the link between firm productivity and export destination diversification.

The chapter follows two literatures. The first being firm heterogeneity and bilateral trade flows determination in seeking to answer the question of whether more productive firms export to multiple export destinations and if exporting into (out of) the SACU region matters for the firm's geographic export diversification. This study is motivated by theoretical predictions in the productivity-exporting nexus. The predictions link firm productivity, trade preferences and geographic export diversification. The conclusion points to the reduction of the productivity threshold for firms that export into trade preferences than for firms that export out of the trade

preferences. Hence, the less productive firms will enter the export markets of trade preferences, whilst high productive firms export out of the trade preferences (Bustos, 2011; Chaney, 2008; Egger and Kreickemeier, 2009). However, empirical studies that are largely confined to developed countries have greatly neglected the issue of trade preferences, with most studies investigating the relationship between firm productivity and geographic export diversification without taking into account the presence of trade preferences (Eaton et al., 2004; Lawless, 2009 and 2010; Damijan et al., 2007; Love et al., 2016; Andersson et al., 2008 and Xuefeng et al., 2016).

Objective two therefore contributes to the empirical literature by investigating the impact of firm productivity on geographic export diversification, taking into cognizance, the presence of trade preferences. The big challenge for Botswana remains reducing dependency on the SACU market, in particular South Africa. Over the period 2003 – 2012, of the total Botswana's manufactured exports, about 67 percent were destined to the SACU region, with South Africa accounting for a bigger share of 61 percent. Such a dependency calls for the need to factor in trade preferences when investigating the relationship between firm productivity and geographic export diversification for countries such as Botswana. No other study to the best of our knowledge has analysed the determinants of firm geographic export diversification, taking into consideration the presence of trade preferences, in the African context.

To investigate how firm productivity influences geographic export diversification, taking into account trade preferences, this chapter uses a unique dataset comprising of firm characteristics and export transactions obtained from Botswana Industrial Affairs Department and Statistics Botswana, respectively, for the period 2007 to 2012. The export transactions dataset used in this chapter is the one used in prior chapter. The analysis relies on the Zero-inflated Poisson regression model, which accounts for the fact that firm selection into the export markets may be correlated with unobserved heterogeneity. This also accounts for the high proportion of zero bilateral trade flows (zero export destinations) evidenced in the transactions dataset.

Objective 3

The analysis in chapter 3 establishes that firm productivity is a determinant of participation in exporting as well as the number of export destinations exported to. The objective of this component of the thesis is whether access to imported intermediate inputs, through their productivity enhancing effects, provides an additional mechanism to enable firms to diversify their export destinations. The theoretical models of Kasahara and Lapham (2013) and Turco

and Maggioni (2013) predict that a firm's access to imported intermediate inputs is one potential channel to boost firm productivity and through this firm export destination diversification. Objective 3, which is addressed in chapter 4, therefore, complements the second objective in that it investigates whether complementarity of a firm's use of imported intermediate inputs boosts its export destination diversification. Additionally, we ask if the input complementarity effect works stronger through differentiated or homogenous intermediate inputs.

The study is motivated by theoretical predictions in the exporting-productivity-importing nexus. The predictions point to the productivity-enhancing effects of imported intermediate inputs, which when the endogeneity of imports is accounted for, culminate in higher export performance (diversification). In an attempt to understand the productivity-enhancing effects of imported intermediate inputs, the literature has focussed on these key theoretical perspectives: international technology transfers, input complementarity, cross-firm synergy as well as the cost-saving hypothesis (Keller and Yeaple, 2009; Ethier, 1982; Cadot et al., 2013; Bas, 2012). The productivity-enhancing gains of imported intermediate inputs enable firms to overcome the productivity thresholds specific to each export destination (Andersson et al., 2008). Furthermore, theory suggests that the productivity externality effects of imported intermediate inputs is enhanced through the use of differentiated inputs. This therefore renders considering the joint productivity externality effects of input complementarity and product complexity an additional theoretical contribution of this study.

Several empirical studies have considered the impact of productivity-enhancing effects of imported intermediate inputs on firm's export performance (Bas and Strauss-Kahn, 2014; Turco and Maggioni, 2013). However, research is still limited on investigating the joint productivity-enhancing effects of firm's use of imported intermediate inputs and product complexity on firm export performance. While the input complementarity hypothesis has been confirmed in the existing empirical studies, we argue that the sign and significance of the joint productivity externality effects of input complementarity and product complexity is an empirical question. This argument is founded on the basis of the two opposing effects of homogenous and differentiated intermediate inputs on firm productivity. On one hand, with greater competition from abroad, technology diffusion is expected to be weaker through access to homogenous inputs than through differentiated inputs. This is premised on the fact that under these circumstances, firm innovation becomes standard as multi-product firms narrow down

their product scope[4] (Liu and Rosell, 2013). On the other hand, differentiated inputs, spur learning effects attributed to the advanced technology embedded in these inputs, leading to increased productivity gains (Yu et al., 2013; Yu and Li, 2014). Hence, the corresponding overall effect on firm productivity will depend on which effect dominates between the competition effect and the learning effects suggesting opposing signs. Chapter 4 attempts to fill this gap in the literature.

Finally, the analysis is complemented by using estimation strategies that explicitly address the potential endogeneity bias attributed by imported intermediate inputs. The study uses an unbalanced panel data of firm-level export and import transactions as well as product-level tariff and product complexity classification over the period 2003 – 2012. The export transactions dataset used is the one used in chapters 2 and 3 whilst the import transactions dataset is strictly on imports of intermediate inputs. The analysis relies on estimates of the fixed effects Poisson regression as well as two-stage residual inclusion estimator techniques as well as three measures that have been identified in the literature as proxying for input complementarity, namely, log of number of product-source country pairs, log number of source countries and log total import value.

[4] Theory links high firm productivity to multi-product firms.

Chapter 2

2. Export Diversification Characteristics of Botswana's Formal Cross-Border Traders

2.1. Introduction and Background

The relationship between firm export value and its export diversification status, defined in terms of number of products and destinations, is of great interest to academics and policymakers. The interest in this relationship is motivated by the theoretical and empirical evidence that export diversification has a strong, positive impact on economic growth (Hausmann and Klinger, 2006; Hwang, 2006; Hausmann et al., 2007; Imbs and Wacziarg, 2003). One of the potential channels through which export diversification boosts economic growth is through mitigating the negative fluctuations in export revenue attributable to unforeseen changes in prices of the major export products. This has prompted economists to advocate for a policy of export diversification (both product and destination diversification) to circumvent the negative effects associated with export concentration.

Premised on the literature on aggregate export diversification and economic growth, pointing to the relationship being U-shaped at country level, the study contributes to the debate on the link between export diversification and export value, by considering the non-linearities associated with the dynamics of export diversification at the firm level. Theoretically, multi-product multi-destination exporters contribute the highest share to the export value as compared to single product single destination exporters (Chaney, 2008; Bernard et al., 2003; Bernard et al., 2011). Empirically, this link has been tested in developed countries (Bernard et al., 2014 in Belgium; Bernard et al., 2011 in US; Amador and Opromolla, 2013 in Portugal. A number of developing country studies are emerging, as the relevant firm-level data becomes available (see Chacha, 2017; Fernandes et al., 2016 for selected developing countries).

However, these studies did not consider the non-linear relationship between a firm export diversification status and its export value. This study thus makes a novel contribution to the academic debate about firm export diversification and export value, by capturing the non-linearities associated with the relationship. To the best of our knowledge, this has not been hitherto investigated in developing countries. Thus, we hypothesize that, due to higher firm productivity, aggregate firm exports will increase while the number of destinations served and products exported increase.

To this end, we investigate this theoretical relationship using Botswana as a case study. Botswana is an interesting case study for a number of reasons. Firstly, it is currently projected that Botswana's low-cost diamond reserves will be depleted by the mid-2020s, which calls for alternative ways to diversify the economy (Kojo, 2010). Secondly, given that the country has succeeded in increasing its per capita GDP by an average of about 7 percent annually since 1960, there is need to maintain the current economic growth even after the depletion of diamonds, unless new diamond deposits are found (Kojo, 2010). Hence, to realize sustained economic growth, the country needs to diversify its exports as export diversification is linked to economic growth.

Given the preceding, the main objective of this study is to present the empirical evidence of the microeconomics of firm export behaviour (export diversification) in Botswana. The analysis is structured around the following specific questions:

- How diversified are Botswana's exports?
- What is driving changes in export diversification in Botswana?
- What is the relationship between firm export value and product-destination characteristics of firm?

To answer these research questions, annual firm export transactions for the period 2003 to 2012 are used. These data have not been used before in Botswana and were collected by Statistics Botswana. In this study, firm-based export diversification is defined in terms of number of products exported and number of destinations served by a firm, categorised into Single Product Single Destination (SPSD), Single Product Multi-Destination (SPMD), Multi-Product Single Destination (MPSD) and Multi-Product Multi-Destination (MPMD) firms.

The remainder of the chapter is structured as follows. The next section reviews the international trade landscape of Botswana in more detail. Then the theoretical models of heterogeneous firm behaviour and the relevant empirical literature follows. Section 2.4 discusses the methodological framework, which includes discussion on modelling firm-based export diversification dynamics, description of data and sample coverage as well as method of analysis. Section 2.5 presents the empirical results while Section 2.6 concludes.

2.2. Overview of Botswana's Economy

Botswana is a land-locked country in Southern Africa, sharing borders with South Africa, Namibia, Zambia and Zimbabwe. With a population of only 2.2 million as at the 2011 population census, the country gained its independence from Britain in 1966. During that time the country only had 12 kilometres of tarred road (Republic of Botswana, 2016). With the discovery of diamonds in the early 1980s, coupled with the country's prudent economic management, the economy managed to grow from humble beginnings to what it is currently. Botswana is unique in that it has had the highest rate of per-capita growth of any country in the last 35 years (Acemoglu et al., 2001). This led to the country being considered as a role model for success in Africa.

To this day, the country has been heavily investing on educating its citizens and on infrastructural development using revenues from diamonds. This investment, by extension, is expected to have translated into an increase in sophistication and value of exports. Hence, over time, we would expect the country to penetrate more middle-income destination markets. In addition, sharing a border with South Africa, a regional hub for trade in Southern Africa, is expected to enhance regional value chains between the two countries.

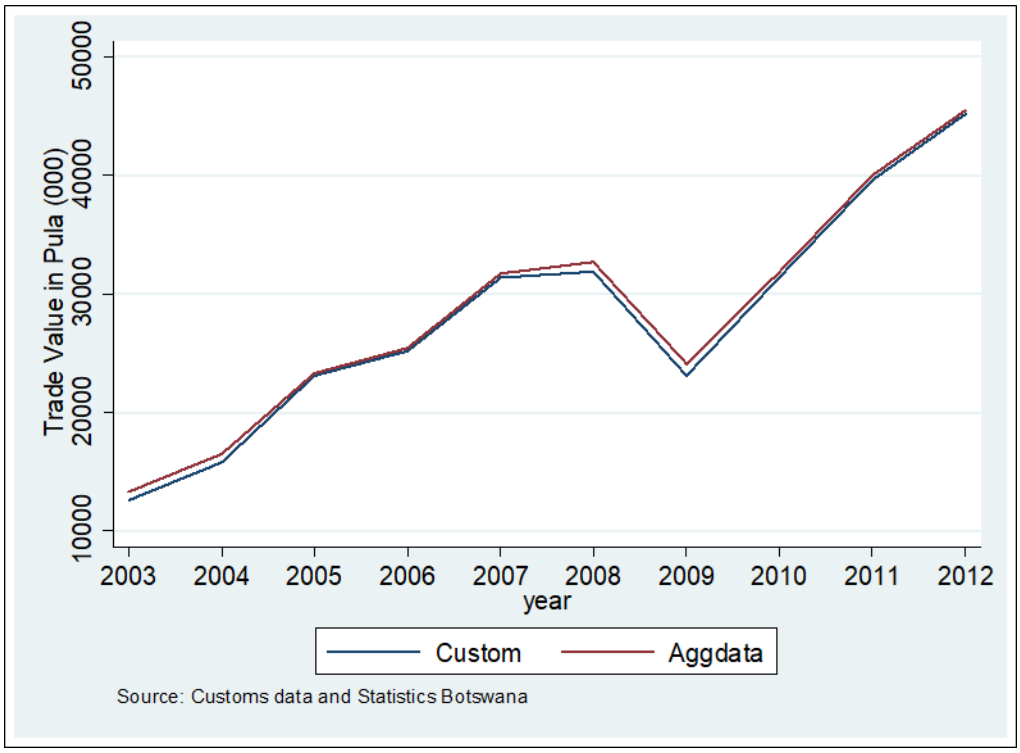
Amidst these positive attributes, diamonds are not forever. This has led the country to pursue export diversification as one of the developmental objectives. This is evidenced by how the country's trade policy is geared towards addressing issues such as export diversification covering product and market diversification, export competitiveness, supply-side constraints, employment creation and poverty reduction as well as diversification of the economy as a whole (Republic of Botswana, 2009).

In this study, we adopt the definition of exporting as defined in Young et al., 1989 to mean the transfer of goods or services across national boundaries using direct or indirect methods and export diversification to mean both intensive margin referring to established exporters exporting existing products to established markets as well as extensive margin referring to new exporters, products or markets (Matthee et al., 2015; Cadot et al., 2011). Before we delve into the exporting firm dynamics in Botswana, it is first important to discuss export developments at the aggregate level over time in more detail, to pave way for the subsequent discussion on

deeper stylized facts emerging from exporting firms. This is because firm-level information is important for understanding aggregate behaviour.

Figure 1 depicts trends in annual exports from the customs dataset as well as the published aggregate trade data from Statistics Botswana and Bank of Botswana. The Figure shows that exports have been increasing over time[5]. However, it is important to assess if this upward trend is accompanied by a rise in GDP share as well as export diversity in terms of firms, products and destinations.

Figure 1: Trends in Customs and Published Aggregate Exports Data



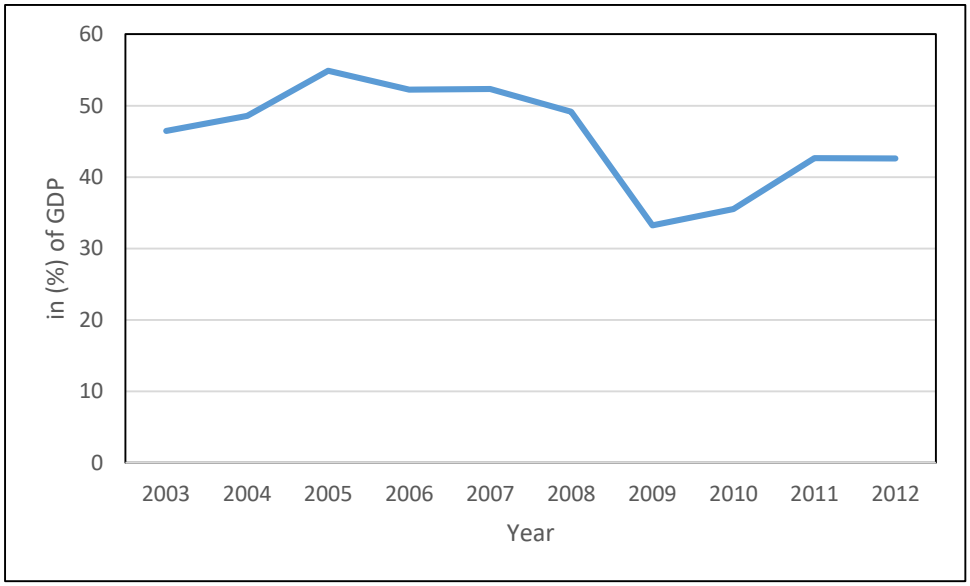
Note: The data are in constant 2006 prices.

We first explore the contribution of exports in GDP. Figure 2 shows that the ratio of exports to GDP increased from 46.4% in 2003 to 48.6% in 2004, then fell to 33.2% in 2009, before rebounding to 42.6% in 2012. Over the 10-year period (2003 – 2012), the average share of exports in GDP stood at 46%, suggesting that exports are a sizeable component of the domestic economy. However, generally the trend is flat or declining, suggesting that over time, exports have been declining as a component of GDP. However, exports are necessary for sustained growth as they provide the foreign exchange reserves that are needed to pay for imports that

[5] There are minimal discrepancies between the two datasets as depicted by a co-movement between the two datasets. A dip in 2009 points to the adverse effects of the 2008-2009 financial crisis.

increase during the growth spurts. Additionally, countries that export goods associated with higher productivity levels have been shown to grow more rapidly (Hausmann et al., 2007). For Botswana, in particular, this process is integrally linked to export diversification as the country's exports are highly concentrated in diamonds.

Figure 2: Export value as a percentage of GDP



Source: Bank of Botswana

We next explore the export diversification issue in terms of products and destinations, giving an overview of the overall export structure of the economy. A list of the top export products at HS8 digit level for Botswana in 2003 and 2012 is shown in Table 1[6]. The Table depicts the predominance in exports of products in the mining sector such as diamonds, nickel and gold, followed by meat and meat products and textiles and clothing. Over 70% of Botswana's exports are from the mining sector and over time there has not been any substantial changes in this export composition. However, present in the Table are also helicopters and aeroplanes, which is very surprising for Botswana. These are most likely indicative of items sent abroad for repair. While Figure 2 above suggests that exports' contribution has been relatively significant in fuelling economic growth, Table 1 suggests that this has not resulted in a dramatic change in the export basket of the country. However, over time some noteworthy products such as vaccines for veterinary medicine and toilet linen have emerged.

[6] The top HS8 products, averaged over 2003-2012 can be viewed in Table ch2A in appendix ch2.

Table 1: Top HS-8 Exported Products in 2003 and 2012

	2003		2012
	Share		Share
1	Non-industrial diamonds unworked or simply sawn,	68.11	Non-industrial diamonds unworked or simply sawn, c	67.51
2	Copper mattes	8.21	Non-industrial diamonds, not mounted or set, nes	11.92
3	Unsorted diamonds	7.86	Nickel mattes	5.65
4	Of a vehicle mass exceeding 1600kg	3.05	Copper ores and concentrates	1.62
5	Fresh or chilled boneless bovine meat	1.45	Unwrought gold (incl. gold plated with platinum), non-monetary	1.40
6	Frozen boneless bovine meat	0.87	Frozen boneless bovine meat	0.78
7	Ignition wiring sets and other wiring sets for vehicles, aircraft...	0.70	Ignition wiring sets and other wiring sets for vehicles, aircraft...	0.73
8	Disodium carbonate	0.59	Disodium carbonate	0.66
9	Jerseys, pullovers, slip-overs, cardigans, twinsets, bed jackets and jumpers	0.53	Industrial diamonds unworked or simply sawn, cleaved or bruted	0.44
10	Industrial diamonds unworked or simply sawn, cleaved or bruted	0.43	Waste and scrap of stainless steel	0.33
11	Salt and pure sodium chloride, whether or not cont.g anti-caking agents...; sea water	0.41	Salt and pure sodium chloride, whether or not cont.g anti-caking agents...; sea water	0.33
12	Chewing gum	0.33	Chewing gum	0.31
13	Other similar articles of man made fibres n.e.s[7]	0.30	Fresh or chilled boneless bovine meat	0.28
14	Other articles of iron or steel not elsewhere specified	0.22	Other vehicles of a cylinder capacity exceeding 1500cmcb but not exceeding 3000cmcb NES	0.27
15	T-shirts, singlets and other vests, of cotton, knitted or crocheted	0.21	Aeroplanes and other aircraft, nes, of an unladen weight =<2000kg	0.24
16	Unwrought gold (incl. gold plated with platinum), non-monetary	0.20	Illuminating kerosene, as defined in additional note 1(f), unmarked	0.21
17	Vaccines for veterinary medicine	0.20	Helicopters of an unladen weight >2000kg	0.21
18	New, right hand drive, fitted with interior parcel racks, footrests,....	0.19	Toilet linen	0.17
19	Industrial diamonds, not mounted or set, nes	0.19	Aeroplanes and other aircraft, nes, of an unladen weight 2000-15000kg	0.17
20	Hides and skins of bovine animals, fresh or wet-salted, nes	0.15	Vaccines for veterinary medicine	0.16

Source: Author's calculation based on customs data

[7] n.e.s means not elsewhere classified.

Understanding the characteristics of a country's trading partners is also key to realising the objective of export diversification. For example, trade links with growing and technologically sophisticated markets can spur domestic productivity growth (Aghion et al., 2004). Table 2 therefore presents Botswana's top export destinations for 2003 and 2012, with a view to assess whether the geographic structure has changed over time. The share of the top 10 trading partners was around 99 percent in 2003 and it reduced to 97% in 2012. Although the United Kingdom was the leading export destination for the country's exports between 2003 and 2012, its share has reduced over time, dropping from 77.78 percent in 2003 to 61.50 percent in 2012. The exceptionally high share of the UK is attributable to diamond exports.

Over time, other export destinations such as South Africa, India, China and Thailand have gained predominance. Exports going to South Africa have increased suggesting potential opportunities for regional value addition. It is also interesting to note that over time, Botswana has accessed new markets such as India and China.

Regionally, these results show that in 2012, out of the top 10 export destinations, 72.67 percent were destined to Europe, with other major export markets being SACU at 14.82 percent; rest of the world at 7.85 percent; and other Africa at 1.71 percent. The above is indicative of the importance and relevance of international trade agreements and arrangements for Botswana's international trade landscape. The country has trade agreements and arrangements with the World Trade Organization (WTO); the SADC-EC Interim Economic Partnership Agreement (SADC-EC-IEPA); the African Growth and Opportunity Act (AGOA); the Southern African Development Community (SADC); the Southern African Customs Union (SACU); and the free trade agreements with Malawi and Zimbabwe (Republic of Botswana, 2009).

Table 2: Top 10 Destinations for Botswana's exports in 2003 and 2012

2003		2012	
Trade Partners		Trade Partners	
United Kingdom	77.78%	United Kingdom	61.50%
South Africa	9.52%	South Africa	13.19%
Norway	5.79%	Israel	5.50%
Zimbabwe	3.02%	Norway	5.06%
Portugal	0.72%	Belgium	4.40%
US	0.65%	Zimbabwe	1.71%
Israel	0.52%	Switzerland	1.71%
Germany	0.49%	Namibia	1.63%
Belgium	0.23%	US	1.21%
Greece	0.17%	India	1.14%
Regional Groupings			
Europe	85.18%	Europe	72.67%
SACU	9.52%	SACU	14.82%
Other Africa	3.02%	Other Africa	1.71%
Rest of World	1.17%	Rest of World	7.85%

Source: Author's calculation based on customs data

The synopsis from the above macro overview is that despite diamonds being the main source of foreign exchange for the country, the key challenge remains the high concentration of diamonds in the country's export basket coupled with the narrow destination markets the country serves. With this in mind, it would be challenging to maintain sustained economic growth if export concentration is not addressed. To this end, the focus of this chapter is on investigating the relationship between export diversification and growth in firm export value. Firm level analysis gives a more holistic picture of Botswana's trading activity that is masked at the aggregate level.

2.3. Literature Review

2.3.1. Theoretical Background

This section provides a survey of literature on theories explaining why countries expand and diversify their exports. Export development and diversification models date back from the era of classical traditional trade theories, pioneered by Adam Smith (1776) and David Ricardo (1817) who posit that each country has a comparative advantage in producing and exporting certain products and that specialisation in those products will result in gains from trade. The guiding framework emanating from the comparative advantage theory is how good a country

is at producing one good relative to another. In the 1930s Heckscher and Ohlin pioneered the theory of comparative advantage focussing on relative resource or factor abundance to explain trade and exports composition.

Notwithstanding the above, the risks of specialization have long been recognized in the development literature for long-run economic growth and welfare. The Presbisch-Singer hypothesis of the 1950s argues that specialization into a narrow group of primary products exposes the country to a long-run deterioration in the terms of trade. The Presbisch-Singer hypothesis therefore argues that export diversification can mitigate the risks associated with specialization.

Over time traditional trade theories have fallen short of explaining all trade, resulting in the emergence of other theories of comparative advantage motivated by factors such as increasing returns, economies of scale and firm heterogeneity. Economies of scale trade models in the likes of Krugman (1980) model which has diverted from a country as a unit of analysis but to a representative firm to determine trade patterns. In this model, the gains from trade are as a result of increased product variety and lower prices.

The Melitz (2003) model introduces firm heterogeneity into Krugman's (1980) model and shows how trade liberalisation leads to reallocation of resources amongst firms. This results in the most productive firms entering the export markets while less productive firms continue to produce only for the domestic market. Due to firm heterogeneity, this model consequently provides new insights into firm selection into exporting as well as the variety of goods exported by a country[8].

The Imbs and Wacziarg (2003)'s model predicts that at country level, aggregate export diversification follows a U-shaped pattern with respect to the level of income per capita. This prediction suggests the existence of non-linearities between export diversification (measured in terms of concentration) and level of income per capita. This finding is in contrast with other existing trade models that predict a negative relationship between income and aggregate export diversification. Hence, there is some theoretical ambiguity relating to export diversification and development of the economy as measured by income per capita.

[8] This literature is followed by new literature on product and destination heterogeneity, which shows that exports are largely dominated by multi-product and multi-destination exporters (Bernard et al., 2011; Lawless, 2009).

Despite the proliferation of trade theories alluded to above, these do not provide a complete explanation of the causes of trade and specialization (diversification). Another key trade theory explaining exports is the multiple cone Heckscher-Ohlin model. The key insight of the multiple cone model is that countries will specialize in different products as determined by the cone in which their relative endowments lie. As endowments change, so the comparative advantage of the country changes leading to shifts in the product composition of exports and imports. Using US import data, Schott (2004) shows empirically how endowments have a role to play in driving changing export patterns, caused primarily by adjustment along the extensive margin.

Another key trade model that has been explicitly developed to explain changes in the composition of the export bundle is the Vernon's product life cycle model. In this model, Vernon (1966) identifies three stages of product development and uses these to explain the export and import dynamics of three types of nations, over time. The first stage involves the new product being produced by the advanced economy home nation and exported to other nations. As the product matures, the product starts to be produced by other advanced nations. In the third stage, the product becomes a standardized product such that it can be produced in less developed nations while continuing to be produced in other advanced nations. However, its production will decline in the home nation, resulting in the home nation ultimately importing the same product it once exported (Vernon, 1966). This model thus explains the dynamics behind changes in the composition of countries' export bundles.

Apart from trade theories, export diversification can also be explained by the modern theory of portfolio management which was developed by Professor Harry Markowitz (Love, 1979). In this theory, which is inspired by the argument "It is always risky to put all one's eggs in a single basket", diversification is viewed as a means of reducing a country's heavy reliance on a particular commodity or a narrow range of primary commodities that are generally exported without any form of processing (Love, 1979). Export diversification is thus viewed as a means to counteract market risks associated with specialization. Love (1979) and Bertinelli et al. (2009) used the portfolio theory model to quantify the diversification benefits. They find that the ability of diversification efforts' to counteract export fluctuations is dependent upon the country achieving an "optimal" export structure[9]. Otherwise diversification may lead to a

[9] This "optimality" may point to the existence of some non-linearities.

reduction in export earnings. Importantly, however, this result hinges upon the level of risk aversion of countries in question.

Parteka et al. (2013); Grossman et al. (1993); and Hausmann et al. (2003) argue that the theoretical background of export development and diversification can also be derived from new growth theories. In these models, structural transformation enters as an important input to the growth process. These theories argue that the economy grows because intermediate goods are always improved, increasing productivity in the production of the final output. This structural transformation is associated with the discovery of new export products by firms, contributing to export diversification (Hausmann and Rodrik, 2003).

2.3.2. Related Empirical Literature

There are three main strands of literature that explain the behaviour of international trading firms vis-à-vis export diversification. The first strand focusses on the link between export diversification and economic growth (Imbs et al, 2003; Parteka et al, 2013; and Cadot et al, 2011). The second strand focusses on firm heterogeneity arising from productivity differentials between firms leading to self-selection into exporting and importing (Bernard et al, 2012 and Melitz, 2003). Apart from the "self-selection" hypothesis, models of firm heterogeneity in international trade also argue that firms can become more efficient after they begin exporting through the learning effects, commonly known as the "learning-by-doing" hypothesis. Finally, the third strand focusses on global value chains and argues that trade in goods that incorporate imported inputs has grown rapidly since the 1960s (Bridgman, 2012). Integrating into the production networks has therefore contributed to the enhancement of firms' competitiveness, which may boost their export diversification prospects. This chapter will focus on the evolving firm trading behaviour in Botswana, with a focus on firm-based export diversification and linking it to the models of firm heterogeneity.

Empirical studies have been done on data from the developed countries such as US and Belgium (Bernard, Jensen and Lawrence, 1995; Bernard, Jensen and Schott, 2009; Bernard, Jensen, Redding and Schott, 2007; Bernard, Redding and Schott, 2011; and Muuls et al., 2009). Literature is rapidly growing in developing countries such as India, Malawi, Mali, Senegal, Tanzania, Kenya and Lesotho, due to availability of customs data (Goldberg et al., 2010; Foster-McGregor et al., 2014; Cadot et al., 2013; Chacha, 2017). Comparing the empirical

studies to theoretical models of firm exporting behaviour, the literature shows that the "self-selection Hypothesis" or "Learning by Doing Hypothesis" does not explain all the empirical features found in the studies. The following are the key findings from empirical studies on firm exporting behaviour and have direct link with firm export diversification[10].

The first stylized finding is that international trade is concentrated[11]. This high trade concentration is mainly due to the fact that larger exporters not only export more of a given product to a given destination than smaller exporters, but they also export more products to more destinations (Bernard et al, 2012; Bernard et al, 2011). Arguably, multi -product and multi- destinations firms have a direct positive link to firm-based export diversification and consequently to broad export diversification at national level. The empirical literature, however, shows that the extent of trade concentration varies considerably across countries (Bernard et al., 2007 in US; Castellani et al., 2010 in Italy; Andersson et al., 2008; Muuls et al., 2009 in Belgium), with Belgian trade more concentrated that the US trade during the period under consideration. Evidence is also emerging for developing countries (see Cadot et al., 2003; Fernandes et al., 2016).

The second empirical finding is about the relationship between number of exporting firms and number of countries (products) firms trade with. There is a negative relationship between the number of exporting firms and the number of countries firms trade with. The same negative relationship is observed between number of exported products and the number of exporting firms (for example, Eaton et al., 2004 for France; Andersson et al., 2008; Bernard et al., 2009; Muuls et al., 2009 for Belgium; and Castellani et al., 2010 for Italy). This stylized fact tends to suggest that amongst exporting firms, few firms export multiple products to multiple countries while the majority of the firms export few products to few countries. This finding is common across studies in developed countries, however, little empirical evidence is available from developing countries.

Empirical literature also seeks to decompose export growth into extensive and intensive margin of international trade. Some studies find that the extensive margin contributes more to export growth (Bernard et al., 2009) while others find the intensive margin to be more important

[10] The stylized facts discussed in this section include facts found in prominent studies in the literature.
[11] This trade concentration is characterised by few firms being able to export and foreign exchange making up low share of sales for median firms.

(Amiti and Freund, 2008). Furthermore, the exact measurement of the intensive and extensive margins used differ across the empirical studies and are also dependent on data availability and structure (Besedes et al., 2011). This is suggestive that empirical literature seeking to decompose export growth into extensive and intensive margin remains inconclusive.

The other empirical stylised finding from the literature is that of the complementarity between importing and exporting. The general conclusion is that two-way traders outperform "importers only" and "exporters only" in terms of trading and firm performance characteristics, although the extent varies even amongst developed countries (Muuls et al., 2009 in Belgium; Castellani et al., 2010 in Italy; Vogel et al., 2010; and Bernard et al., 2009 in the US). Furthermore, if firms undertake international trade, they are more likely to engage in both exports and imports instead of either one activity (Muuls et al., 2009). A number of studies in developing countries are emerging to confirm these results (Edwards et al., 2017; Chacha, 2017).

Finally, it is evident from the empirical literature that successful export growth and diversification requires not only entry into new export products and markets, but also the survival and growth of export flows. Low firm and product survival in the export market has also been cited in the empirical literature. The above contributes directly to the sustenance of extensive and intensive margins of trade. Empirical literature points to the fact that some new firms and products do not live up beyond their first year of entry into the export market. However, the extent varies between countries (Cadot et al., 2013; Besedes et al., 2006). For example, the extent of firm survival in Columbia differs from the one in Hungary (Halpern et al., 2011). While empirical evidence is available for developing countries on this one (Cadot et al., 2013 in Mali, Malawi, Senegal and Tanzania), it is still important to assess whether this finding applies to all developing countries.

The above literature can be synthesized in three key features. Firstly, it is noteworthy that research in both theoretical and empirical international trade is increasingly geared towards firms and products in addition to the traditional focus on countries and industries. To date, relatively little theoretical research examines how firms determine the range of products they will export, or the breadth of countries they will export to, or even how any of these margins are influenced by globalisation (Bernard et al., 2007; Bernard et al., 2011). The above gap or limitation makes research on the determinants of export diversification at the firm level an

empirical question, especially for countries such as Botswana where such research has not been undertaken.

Secondly, the above synopsis of the existing empirical literature shows stylized facts on firm exporting behaviour between countries. This justifies the necessity of conducting country-specific studies on firm-based export diversification using transactional-level data to establish if such stylized facts hold across countries. Hence, we contribute to the literature by considering a specific case of Botswana, where to the best of our knowledge, research of this nature has not been explored before in the context we are proposing. The study intends to identify the stylized facts associated with Botswana's firm-based export diversification characteristics and assesses whether these are consistent with those found in other countries. The empirical evidence is evaluated against theory to assess if it characterises models of heterogeneous firm exporting behaviour.

Thirdly, literature has a limited focussed methodology on firm-level export diversification capturing non-linearities associated with export diversification. Our study addresses this, in an innovative way, by employing the Multinomial logit model to estimate the firm export diversification status-exporter value gap as well as estimating probabilities of moving between the different states defined in terms of products and destinations. We do this by categorizing firms into the following exporter status categories: Single product single destination (SPSD); Single product multi-destination (SPMD); Multi-product single destination (MPSD); and Multi-product multi-destination (MPMD). To the best of our knowledge, there has been limited evidence on the usage of the concept of non-linearities to model the extent of firm-level export diversification in developing countries.

2.4. Methodological Framework

2.4.1. Modelling Firm-Based Export Diversification Dynamics

In estimating the firm-based export diversification dynamics in Botswana, this study is motivated by the Bernard et al. (2011)'s model of dynamic theory of multi-product exporters, which integrates joint destination and product attributes. This theoretical framework generalizes the standard Melitz (2003) single-product, heterogeneous-firm model of trade to allow firms to produce a set of horizontally differentiated products that are potentially exported to many countries (Bernard et al., 2011).

In this model, firms differ according to their underlying productivity and products vary in their profitability across both firms and destinations. This suggests that firms must pay a destination-specific fixed cost to export (irrespective of the number of products sent to the destination) coupled with a product-destination fixed cost for each product in each destination. The model therefore predicts that the more productive firms will be able to generate high variable profits that enable them to cover the product fixed cost[12]. The generated high variable profits will thus stimulate the firm to export more products to each market.

The existence of destination-specific fixed cost to export coupled with the product-destination fixed cost for each product in each destination implies that firms exporting multiple products will also serve many export destinations. Hence, they will export more of a given product to a given destination. This leads to the model's prediction that within-firm increases in productivity are associated with increases in total exports as well as increases in both the number of export destinations served and the number of products exported.

In order to understand how firms change their product-destination diversification over time, we next define a time-dependent (calvo-type) firm-specific product turnover rate, which governs the timing of firms' product scope changes (Bernard et al., 2010; Eckel and Neary, 2010). Firstly, firms are able to re-set their optimal product scopes only with a fixed probability, $1-\theta$. θ is the probability of not being able to change the product scope. Secondly, with the existence of cannibalization effects, an introduction of new products, beyond a certain level, can reduce the firm's profit. This is because extra products may erode the market shares of the existing products (Bernard et al., 2010; Eckel and Neary, 2010; Hottman et al., 2016). Thus, in response to the economy-wide and product-specific shocks, the flexibility in a firm's product scope adjustment can help the firms to diversify and absorb shocks (Eckel and Neary, 2010). This suggests that only the most productive firms will be able to update their product scopes with ease.

Hence, in line with the firm-product specific consumer tastes λ_i, there exists a zero-profit consumer taste threshold $\lambda_i^*(\varphi)$, such that a firm with productivity φ will produce product i only if it draws a consumer taste greater than or equal to $\lambda_i^*(\varphi)$. To this end, the zero-profit consumer taste cut-off is defined as follows:

[12] The least productive firms within each industry will be forced to exist (Bernard et al., 2011; Colantone et al., 2014).

$$\pi_i\left(\varphi, \lambda_i^*(\varphi)\right) = \frac{R_i\left(\rho P_{i\varphi\lambda_i^*(\varphi)}\right)^{\sigma-1}}{\sigma} - f_{pi} = 0 \quad (1)$$

where f_{pi}denotes fixed production cost of product *i*. Equation (1) suggests that the higher the firm's productivity φ, the lower is the zero-profit cut-off for consumer tastes $\lambda_i^*(\varphi)$ and so the greater the probability of having a value for consumer tastes to profitably produce product *i* (Bernard et al., 2010). Therefore, this model predicts that the number of products produced and exported by a firm is increasing in its productivity and consumer tastes.

2.4.2. Econometric Model

Based on the above discussion of the theoretical framework linking high firm productivity to multi-product multi-destination exporters and their predicted high export values, we motivate our empirical model by apportioning the firm's export diversification status into four product-destination categories[13]. These are Single Product Single Destination (SPSD); Single Product Multi-Destination (SPMD); Multi-Product Single Destination (MPSD) and Multi-Product Multi-Destination (MPMD). SPSD is an exporter that exports only one product to a single destination. SPMD is an exporter that exports only one product to at least one destination. MPSD is an exporter that exports at least one product to a single destination while MPMD is an exporter that exports at least one product to at least one destination.

Because these entry modes (choices) are not binary, we utilize discrete choice models. In particular, we employ the multinomial logit regression model to identify the direction of the relationship between firm export value and the probability of choosing a specific export diversification mode. The advantage of this empirical methodology is that unlike the empirical studies that have attempted to investigate the link between export value and firm export diversification status, it is able to capture the non-linearities associated with firm export diversification dynamics, by way of predicted probabilities.

Next, to answer the third research question of this study we specify our baseline empirical model as follows: A similar version of the model has also been used by Wulff (2015) to examine strategic choices with multiple outcomes. While the foreign market entry mode used in Wulff (2015) was defined in terms of foreign direct investment and exporting, the foreign

[13] In this study, firm-based export diversification is defined in terms of number of products and destinations.

market entry mode in this particular study is defined in terms of product-export destination categories.

$$P_{ij} = Pr(y_i = j|x_i) = \frac{exp(x_i'\beta_j)}{\sum_{j=1}^{4} exp(x_i'\beta_j)} \quad (2)$$

where P_{ij} is the probability that the i^{th} firm will choose entry mode j (j= 1, 2, 3,4), y is the dependent variable (that is, entry mode choices) and $x_i$captures regressors that explain entry mode choice such as firm export value as well as its exporting experience (in years).

In our case, the main variable of interest is firm export value. β_j represents the coefficient vector and it contains both the constant and the slope coefficient (Wulff, 2015). For the model to be identified, one entry mode choice, β_j , has to be set as a base category and the remaining entry mode choices should be independent, that is, dissimilar. Our base category is SPSD and the coefficients are thus interpreted with respect to SPSD. Hence, we estimate a set of coefficients, β_2, β_3 and $\beta_4$corresponding to each entry mode. In addition, our baseline empirical model in equation (2) will be extended by adding firm exporting experience (in years) and year fixed effects as our additional explanatory variables. The variable, firm exporting experience (in years), is calculated as the (difference between the last year a firm exports and the first year it exported) plus 1). The limitation of this variable is that it is determined by the number of years in the sample and it is also left censored. We also control for interdependence within firm over time by clustering at the firm level.

2.4.3. Description of Data and Sample Coverage

2.4.3.1. Export data

This study draws on a unique dataset consisting of highly disaggregated transactions data that categorize trade patterns in terms of exports. The data are obtained from Statistics Botswana/Botswana Unified Revenue Services (BURS). BURS records all export transactions that are undertaken by trading firms/traders in Botswana in any particular year. Each individual export record for a given commodity has information on the firm/trader identifier, the year the export transaction was undertaken, the 8-digit level of Harmonized System (HS-8) code of product traded, the destination country, the export value in Pula currency and the volume in kilograms and quantity. These data capture all export transactions made by Botswana's

international trading firms/traders between 2003 and 2012, adding up to total Botswana's exports as reported by Statistics Botswana. This classification of the data makes it possible to track the history of trading firms/traders as well as their products and destinations exported to over time.

However, it is noteworthy to indicate that the limitation of these data is that an entity can be a trading firm or a production unit. We cannot identify from the dataset if the entity exporting actually produces the good[14].

In this light, interesting facts can be identified from this data. The status of a firm/trader in terms of whether it is a new entrant, a continuing firm/trader or a firm/trader that has exited the export market can be determined from the data. It is also possible to distinguish between primary exports as well as new product lines. Furthermore, the analysis of the extent of firm and product churning in Botswana is made possible by the availability of this dataset. The data therefore has the novelty of enabling analysis of firm/trader trading behaviour vis-à-vis firm-based export diversification at the most disaggregated level.

Additionally, informal cross-border trade[15] is not an issue for this study as it is based on official statistics on export transactions as recorded by Statistics Botswana. Although its presence cannot be denied, the extent of informal trade conducted by traders in Botswana cannot be verified due to lack of official data on this form of trade. However, Ama et al. (2013) revealed the profitability of the informal cross-border trade in Botswana citing that the monthly profit generated by informal cross border traders is over ten times the minimum wage of workers in the country.

Table 3 presents a summary of the data. In 2012, for example, the sample includes 20 145 export transactions, made by 2181 exporters, exporting 3488 products to 95 destinations. There are some interesting trends. The number of export transactions, firms/traders and HS-8 products has increased over time. This suggests that to some extent Botswana has made some

[14] Hence, the data reflect not only producing firms but also traders such as individuals and Government organisations.

[15] According to Lesser et al. (2009), informal cross-border trade involves legitimately produced goods and services which escape the government regulatory framework, solely driven by the desires to avoid certain tax and regulatory burdens, resulting in the full or partial evasion of payment of duties and charges. It includes goods that pass through unofficial routes and avoid customs controls as well as those that pass through official border crossing points yet involve illegal practices.

success in diversifying exports into products and firms/traders. Thus, Table 3 provides some preliminary insights into the export diversification prospects.

Table 3: Export Transactions, Firms, Products and Destinations (2003-2012)

Year	No. of export transactions	No. of firms	No. of products	No. of destinations
2003	10524	1823	2897	95
2004	11340	1766	3001	92
2005	13929	1969	3226	87
2006	14903	2007	3229	99
2007	14903	1996	3047	92
2008	16275	2081	3283	100
2009	16454	2135	3261	97
2010	17205	2151	3226	98
2011	19929	2211	3440	95
2012	20145	2181	3488	95

Source: Author's calculation using customs data

Note: An export transaction refers to an export activity undertaken by a firm at a particular point in time.

2.5. Results and Discussion: Firm Specific Measures of Export Diversification

2.5.1. Emerging Stylized Facts from Customs Data

2.5.1.1. Firm-Product-Destination Trends

In this section, we present and discuss the stylized facts that characterize firm exporting behaviour in Botswana and relate these empirical findings to firm export diversification and to theories of firm heterogeneity in international trade. Table 4 presents the basic descriptive statistics emerging from the analysis of Botswana's customs data, capturing export composition.

The results as depicted by Table 4 show that Botswana's exporters have increasingly become diversified over time in terms of products. In 2003, the average number of products per firm stood at 5.8. This increased to 9.2 products per firm by the end of 2012. Diversification in terms of destinations has been modest, registering an average of 1.3 in 2003 and increasing only to 1.5 destinations per firm by the end of 2012. The interesting fact about Table 4 is that while the average number of products (destinations) per firm has increased over time, the median number of products (destinations) per firm remained stable.

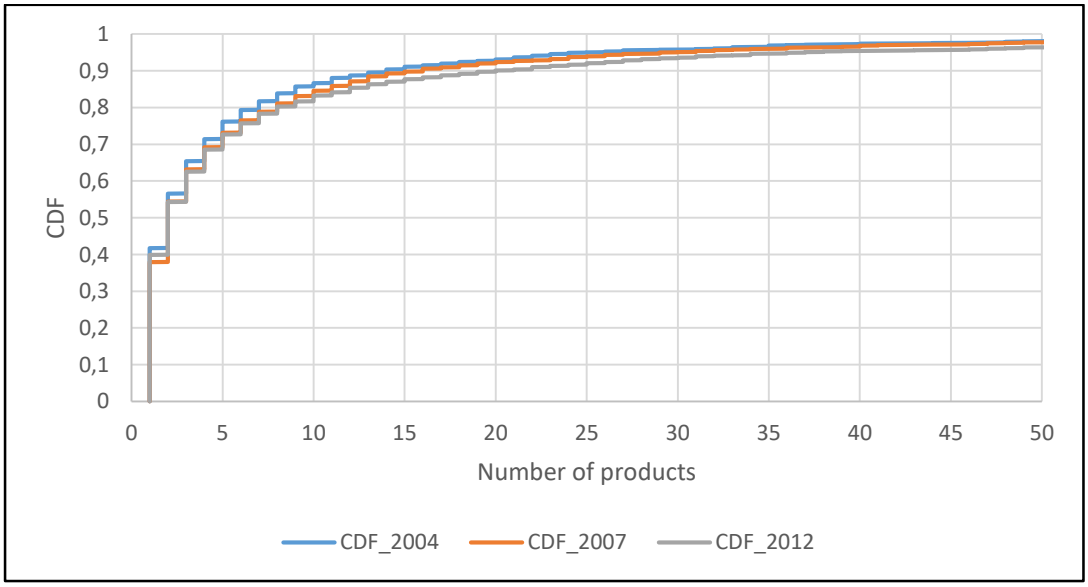
Table 4: Descriptive statistics from Botswana's customs data

	No. of products/firm		No. of destinations/firm		No. of firms/product		No. of firms/ destination	
	mean	median	mean	median	mean	median	mean	median
2003	5.8	2	1.3	1	3.4	2	25	3
2004	6.4	2	1.3	1	3.5	2	25.4	3
2005	7.1	2	1.3	1	4.1	2	29.7	3
2006	7.4	2	1.4	1	4.3	2	28.2	2
2007	7.2	2	1.4	1	4.4	2	29.6	2
2008	7.8	2	1.4	1	4.5	2	29.7	2
2009	7.7	2	1.4	1	4.6	2	31.3	3
2010	8	2	1.4	1	4.9	2	31.5	2
2011	9	2	1.5	1	5.3	2	34.7	3
2012	9.2	2	1.5	1	5.4	2	33.8	3

Source: Botswana – author's calculation based on customs data

The use of mean and median is not without limitations. To better understand what is really driving the change in the firm-product-destination trends led to the analysis of the cumulative distribution functions. Figure 3 confirms our speculation and suggest that over time the rise in export diversification stemmed from the increase in the number of products per exporter as reflected by the shifting to the right of the cumulative distribution function from 2004 to 2012. Although the median number of products remains at 2 (Table 4), what the cumulative distribution function in Figure 3 shows is that the proportion of firms exporting more than 1 product has risen. The same holds with the proportion of firms exporting more than 2 products.

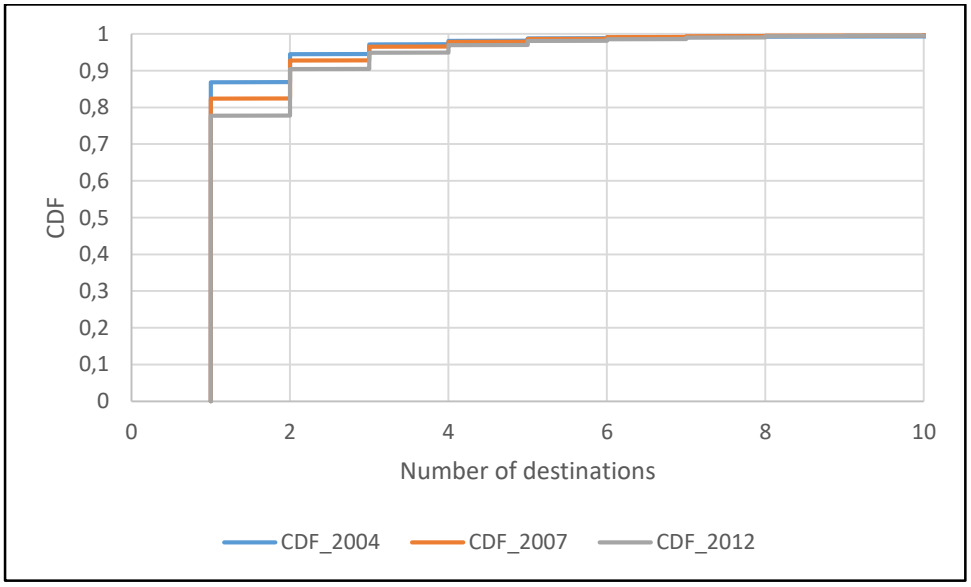
Figure 3: Distribution Dynamics of Number of Products per Exporter



Source: Computed from Customs data

This aside, it should however be emphasized that market diversification is also important in the export diversification prospects of the country since it reduces the market risks associated with relying heavily on a few export markets. The limited variation in the mean and median number of destinations per firm is a reflection of limited market access and evidence enough that Botswana's destination markets are highly influenced by the existing international trade agreements that the country has signed with her trading partners (as shown in Section 2). These results are substantiated by Figure 4 that depicts cumulative distribution functions between 2004 and 2012. Contrary to Figure 3, Figure 4 depicts stability over time in the number of export destinations, corroborating the earlier evidence regarding the extent of market of diversification reflected in Table 4. What is also evident is that the proportion of firms exporting to 1 destination has fallen from 2004 - 2012.

Figure 4: Distribution Dynamics of Number of Destinations per Exporter



Source: Computed from Customs data

It is important to assess how Botswana is faring in comparison to other countries with regard to export diversification prospects. Table 5 below depicts the results for other countries for 2006[16]. Comparing Botswana's exporters with that of these countries, it is clear that during the

[16] Pioneering work on the role of firms in international trade is documented in Bernard et al., 1995 and thereafter studies have been done for some other developed countries benchmarking on the US's evidence. Although Cadot et al., 2013 used transaction-level export data to study the success and failure of African exporters in Malawi, Mali, Senegal and Tanzania, they do not look at firm-level export diversification as in this study. Moreover, Botswana differs substantially from these countries in areas such as economic management of its diamond revenues. Hence, the findings from these existing studies cannot be generalized for countries such as Botswana.

period that the studies for these countries were conducted, Botswana's exporters were more diversified in terms of products[17]. However, exporters of other countries such as Mali, Malawi, Tanzania, Portugal and Senegal were more diversified than Botswana's exporters in terms of geographic diversity. (Cadot et al., 2013; Stirbat et al., 2011).

Table 5: Comparison of Botswana with other countries (2006)

	No. of products/firm		No. of destinations/firm		No. of firms/product		No. of firms/ destination	
	mean	median	mean	median	mean	median	mean	median
Lao PDR	1.9	1	1.4	1	3.5	1	19.9	3
Mali	2.5	2	3.9	2	1.9	1	7.2	2
Malawi	1.6	1	4.1	2	3.8	1	13.2	3
Senegal	3.1	1	6.8	2	2.9	2	22.2	5
Tanzania	2.5	1	3.6	1	2.9	1	24.7	7
Dom. Rep	6.2		2.2					
Botswana	7.4	2	1.4	1	4.3	2	28.2	2

Source: Lao PDR, Mali, Malawi, Senegal, Tanzania, Dominican Republic and Portugal (Stirbat et al., 2011; Cadot et al., 2013).

2.5.1.2. Product-Firm Entry and Exit Dynamics

Firm as well as product entry and exit dynamics are important for understanding the dynamics of export diversification in any country. For Botswana, Cebeci et al. (2012) find that average first year survival rate of new exporters was only 39 percent during the period 2006-2008. To assess the entry-exit dynamics over the longer 2004-2012 period, Table 6 decomposes the number of exporters in each year into continuing exporters, new firms and firms that exit. In addition, the table disaggregates new exporters into first-time exporters and returning exporters, given the high levels of churn found.

The results in Table 6 point to a gradual increase in the number of exporters but significant churn. This is evidenced by high exit rates with on average 40 percent of exporters exiting per year. We also observe high entry rates of about 41 percent per year. This churn is in part driven by firms that exit and re-enter the export market. On average, re-entry rates are around 9-19 percent per year. Overall, the results point to a lot of experimentation and dynamics behind the total firm numbers.

[17] These results may not be directly comparable as Botswana's products are classified according to the HS 8 while product analysis of the comparator countries are based on HS6 classification.

Table 6: The Evolution of the Number of Exporting Firms

Year	Beginning	Continuing	Exit	Entry		Total Exporters	Exit Rate	Entry Rate		Total Entry Rate
				Entry First Time	Entry Restart			First Time Entry	Entry Restart	
2004	1823	1054	769	712	0	1766	42%	40%	0%	40%
2005	1766	1062	704	659	248	1969	40%	33%	13%	46%
2006	1969	1320	649	500	187	2007	33%	25%	9%	34%
2007	2007	1188	819	547	261	1996	41%	27%	13%	40%
2008	1996	1196	800	559	326	2081	40%	27%	16%	43%
2009	2081	1254	827	524	357	2135	40%	25%	17%	42%
2010	2135	1289	846	505	357	2151	40%	23%	17%	40%
2011	2151	1302	849	502	407	2211	39%	23%	18%	41%
2012	2211	1301	910	471	409	2181	41%	22%	19%	41%

Source: Author's calculations from Customs data

Notes: i) Entry first time refers to a firm that enters the export market for the first time; ii) A continuing firm is the one with previous export experience and it has never took a break from exporting in the past; iii) An exiter is no longer exporting (has exited the export market); iv) Entry restart refers to a firm that is exporting in the current year but had taken a break from exporting in the previous period. The limitation of this classification is that some of the firms may have exported before 2004 and we do not have the data to reveal this. Hence, this may bias the entry restart rates, particularly in the early years.

ii) Total exporters = beginning exporters + entry – exit

iii) Total exporters = continuing exporters + entry

iv) Exit rate = Exit / Beginning

v) First time entry rate = Entry first time / Total exporters

vi) Entry restart rate = Entry restart / Total exporters

The evolution of the number of exported products depicts a similar pattern that emerged for firms (Table 6). The number of total exported HS-8 products[18] has increased over time, while the number of new products has declined. This is expected as the total number of products is fixed. Entry rates of new products will also decline partly due to the fact that many of these products were probably previously exported in the early period (and are hence re-entry). We also observe that on average, exit rates are around 21 – 28 percent per year. The emerging trend in the evolution of the number of exported products suggest that product churning is a key feature. Although the number of exporting firms has generally been increasing over time (as shown in Table 6), there has been significant churn evidenced by entry and exit rates that exceed 40 percent in many years. These results suggest that Botswana's exports may be driven by the intensive margin[19], that is, established exporters exporting existing products, as shown

[18] The last change in product classification was done in May 2002. Therefore, the sample period spanning 2003 to 2012 covers the period where no product classification changes were made.

[19] These results were also confirmed when we decomposed the theil index (Lopez-Calix et al., 2010) – a measure of inequality that enables us to decompose changes in export concentration into "within" component (which reflects the intensive margin of trade) and into the "between" component (which reflects the extensive margin). The decomposition of the theil index shows that traditional exports

by the increasing number of continuing products over the years. However, these results should be taken with caution as proper growth decompositions have not been conducted.

Table 7: The Evolution of the Number of Exported Products

Year	Beginning	Continuing	Exit	Entry		Total Products	Exit Rate	Entry Rate		Total Entry Rate
				Entry First Time	Entry Restart			First Time Entry	Entry Restart	
2004	2897	2171	726	830	0	3001	25%	28%	0%	28%
2005	3001	2286	715	580	360	3226	24%	18%	11%	29%
2006	3226	2535	691	357	337	3229	21%	11%	10%	21%
2007	3229	2331	898	257	459	3047	28%	8%	15%	23%
2008	3047	2349	698	294	640	3283	23%	9%	19%	28%
2009	3283	2463	820	253	545	3261	25%	8%	17%	25%
2010	3261	2436	825	202	588	3226	25%	6%	18%	24%
2011	3226	2525	701	279	636	3440	22%	8%	18%	26%
2012	3440	2593	847	313	582	3488	25%	9%	17%	26%

Source: Author's calculations from Customs data

Note: i) Entry first time refers to a product that enters the export market for the first time; ii) A continuing product is the one with previous export experience and it has never exited; iii) Exit refers to a product that is no longer being exported (has exited the export market); iv) Entry restart refers to a product that is being exported in the current year but had taken a break from being exported in the previous period. The limitation of this classification is that some of the products may have been exported before 2004 and we do not have the data to reveal this. Hence, this may bias the entry restart rates, particularly in the early years.

ii) Total products = beginning products + entry – exit

iii) Total products = continuing products + entry

iv) Exit rate = Exit / Beginning

v) First time entry rate = Entry first time / Total products

v) Entry restart rate = Entry restart / Total products

2.5.1.3. Multi-Product Multi-Destination Exporters

Table 8 combines information about the number of products exported by a firm and the number of destinations each firm is exporting to, with a view to depict the significance of multi-product and multi-destination firms. The table shows that even for Botswana, just like in other countries where similar studies have been undertaken, international trade is highly concentrated across firms[20]. 87.71 percent of Botswana's exporting firms exported to a single destination country

constitute almost 99 percent of the country's exports. These results are shown in Figure ch2A of Appendix ch2.

[20] We estimated the Gini coefficients of exports to confirm the extent of trade concentration. The Gini coefficients are 0.994 and 0.990 for 2003 and 2012, respectively, suggesting that overall economic activity has remained highly concentrated in the country. Over time, exports' concentration has remained fairly stable (albeit a modest reduction). Although a modest reduction in export concentration has been witnessed over time in Botswana, for developed countries such as Italy, Belgium and the US, export

in 2003. These exports accounted for 78 percent of aggregate export value. Firms exporting to at least 5 destinations accounted for just 1.70 percent of exporters and 14.7 percent in export value. Unlike for the US in 2000 (Bernard, 2007) where multi-destinations firms accounted for the bulk of export value (92.9 percent), for Botswana, the reverse is true. Single-destination firms accounted for the bulk of the export value in 2003.

The importance of multi-product firms in the overall Botswana's exports is evidenced from Table 8. In 2003, 41.52 percent of exporters exported a single product. However, these exporters accounted for only 0.5 percent of aggregate exports in 2003. Firms exporting at least 5 products accounted for 26.49 percent of exporting firms and 21.9 percent in export value. In contrast, firms exporting 4 products (to one destination), albeit their limited number, contributed 76 percent in export value. A look at the data reveals that the four products are diamonds in different forms, exported to the United Kingdom. Specifically, these are basically non-industrial diamonds, industrial diamonds, precious or semi-precious stones as well as unsorted diamonds[21]. The above analysis shows that Botswana presents a unique and interesting case study in that exports are dominated by diamonds. Even in 2004, exports were dominated by diamonds (classified in two different forms) contributing73 percent of the total export value in that year. This is the striking feature characterizing exporting behaviour of Botswana's firms pointing to the importance of product variety (in the form of diamonds) in driving export growth[22], in comparison to variation in destinations.

Cebeci et al. (2012) also established that Botswana's export sector is mainly characterized by single-product single destination firms (38.9 percent) which accounted for only 0.4 percent of total export value for the period between 2006 and 2008. Their study also established that albeit the limited presence of multi-product multi-destination firms in the country, their contribution to exports was very significant amounting to 53 percent of exports during the period under consideration. Their results and what has been established in this paper reinforce the need to explore further the challenges towards export diversification in Botswana such as low export survival, high input costs and promote multi-product multi-destination firms (Besedes and

concentration has increased over time (Bernard et al., 2007; Muuls et al., 2009). These findings coincide with theoretical models on firm heterogeneity such as the Melitz (2003) model as well as empirical evidence suggesting that only the largest and most productive firms will do exporting activity.

[21] The HS-8 codes of the four products are 71023100, 71022100, 71031000 and 710211000.

[22] Firms that export more than one 8-digit Harmonised System product comprised 58.48 percent of exporting firms in 2003 and accounted for 99.5 percent of export value.

Prusa, 2011; Besedes and Prusa, 2006). Just like in existing empirical studies, trade concentration is a stylized fact in Botswana's international trading landscape.

Table 8: Distribution of Exporters and Export Value by Number of Products and Export Destinations, 2003

Panel A: Share of Exporting Firms

	Number of Countries					
Number of Products	1	2	3	4	5+	**Total**
1	41.09	0.38	0.00	0.00	0.55	**41.52**
2	15.91	1.59	0.11	0.00	0.16	**17.77**
3	7.08	1.04	0.05	0.11	0.16	**8.45**
4	5.05	0.55	0.16	0.00	0.00	**5.76**
5+	18.60	4.83	1.43	0.33	1.32	**26.49**
Total	**87.71**	**8.39**	**1.76**	**0.44**	**1.70**	**100**

Panel B: Share of Export Value

	Number of Countries					
Number of Products	1	2	3	4	5+	**Total**
1	0.22	0.05	0.00	0.00	0.20	**0.5**
2	0.11	0.13	0.008	0.00	0.08	**0.3**
3	0.08	0.53	0.008	0.27	0.01	**0.9**
4	76	0.03	0.01	0.00	0.00	**76.0**
5+	1.63	1.07	3.69	1.14	14.4	**21.9**
Total	**78.0**	**1.80**	**3.7**	**1.41**	**14.7**	**100**

Source: Customs data

The distribution of exporters and export value by number of products and destinations was also done for 2012. The results are depicted in Table 9 and they portray a different picture from the one found in 2003. Table 9 portrays similar patterns established in similar studies done for countries such as the US and Denmark (Bernard et al., 2007; Eriksson et al., 2009), showing the importance of multi-product and multi-destinations firms in driving export value in 2012. While single-destination firms were driving export value in 2003, this trend has since been reversed in 2012, resulting in firms exporting to more than one destination accounting for 91.6 percent of export value. Single-product firms accounted for the majority of exporting firms in 2012, representing 40.62 percent of firms, yet they accounted for a mere 0.5 percent of the total export value (same as in 2003). Firms exporting more than one HS-8 product accounted for the remaining 99.5 percent of the exports. This shows that over time, variation in destinations, just like variation in products, has played a key role in driving export value in the country, although

for destinations, firms exporting to 3 and 4 destinations accounted for 78.2 percent of the total export value in 2012.

Table 9: Distribution of Exporters and Export Value by Number of Products and Export Destinations, 2012

Panel A: Share of Exporting Firms

	Number of Countries					
Number of Products	1	2	3	4	5+	**Total**
1	40.03	0.50	0.05	0.05	0.00	**40.62**
2	11.92	2.48	0.37	0.09	0.09	**14.95**
3	5.96	1.65	0.50	0.14	0.05	**8.30**
4	4.36	0.92	0.28	0.18	0.23	**5.96**
5+	15.50	7.15	3.26	1.60	2.66	**30.17**
Total	**77.76**	**12.70**	**4.45**	**2.06**	**3.03**	**100**

Panel B: Share of Export Value

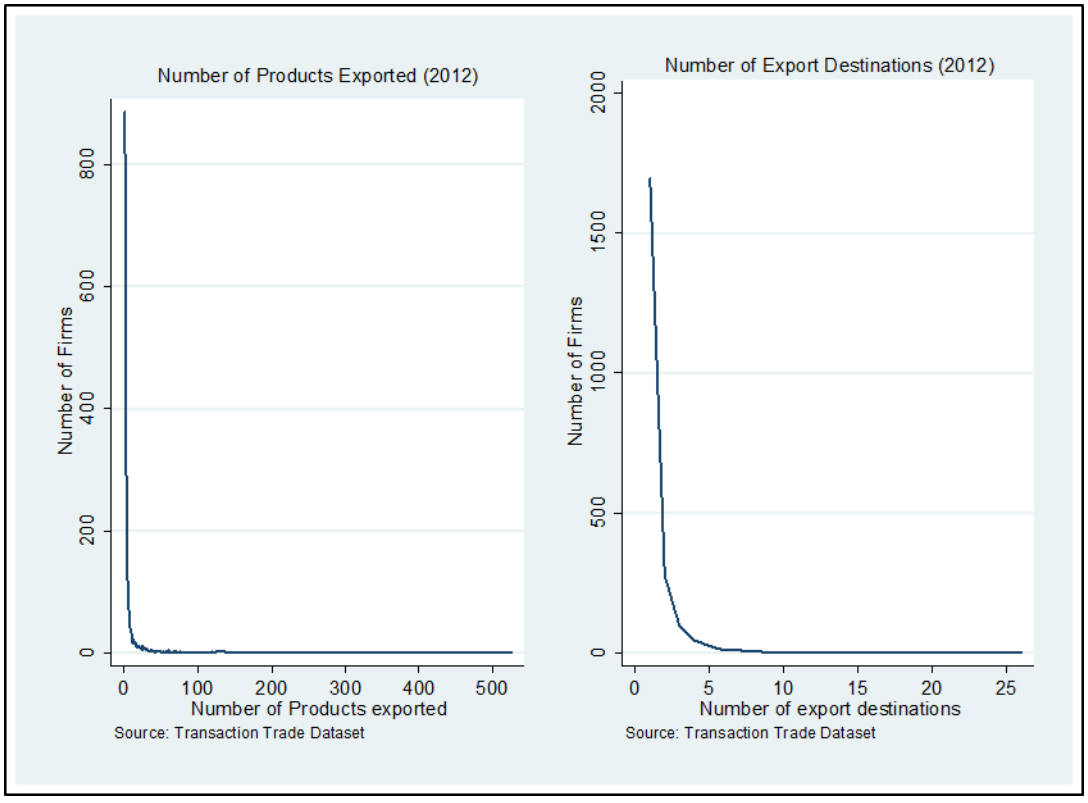
	Number of Countries					
Number of Products	1	2	3	4	5+	**Total**
1	0.42	0.04	0.0005	0.0007	0.00	**0.5**
2	2.18	1.33	37.04	0.25	0.25	**41.1**
3	1.65	0.26	0.65	0.001	0.03	**2.6**
4	0.49	0.15	0.87	0.003	1.20	**2.7**
5+	3.62	2.37	4.80	34.59	7.79	**53.2**
Total	**8.4**	**4.2**	**43.4**	**34.8**	**9.3**	**100**

Source: Customs data

The differential export outcomes driven by single-product-single-destination firms as well as multi-product-multi-destination firms might suggest productivity differentials amongst exporting firms as suggested by Figure 5 below. The Figure illustrates the "country extensive margin" of trade which captures how many countries a firm trades with and the "product extensive margin" which captures how many products a firm trades in (Muuls et al., 2009). A negative relationship between the number of exporting firms and the number of countries firms trade with is depicted by the Figure. Similarly, a clear negative relationship between the number of products exported and the number of exporting firms is shown. These results are in line with what was established for the US, Italy, France and Belgium and they predict the possible existence of fixed costs of exporting, which is in line with the fact that only the most productive firms will export (Muuls et al., 2009; Castellani et al., 2010; and Eaton et al., 2004).

Due to fixed costs of exporting, as the number of destinations increases, the number of firms exporting to those destinations will fall, indicating that an additional export destination market is associated with additional cost to the exporting firm. Likewise, as the number of exported products increase, the number of exporting firms will reduce due to costs associated with addition of products. The above might suggest that only the most productive firms can be multi-product-multi-destination firms[23]. The Figure further depicts convergence to zero as the number of products and export destinations increase in number. These results are in line with the predictions of models of heterogeneous firms in international trade in which exporting firms incur sunk costs in every product and geographical market they serve (Melitz, 2003; Bernard et al., 2011; Kasahara and Lapham, 2013).

Figure 5: Number of Export Destinations and Exported Products (2012)



2.5.2. Empirical Results

2.5.2.1. Exporter Value and Firm Export Destination Status

Given the importance of multi-product multi-destinations firms to export growth and diversification, we now use the Multinomial logit regression model to establish the extent of

[23] This issue will be investigated further in the next Chapter by employing proper econometric approaches to confirm the causal relationships.

mobility of firms between the different categories defined in terms of number of products and destinations as well as the contribution of the different categories of firms to exports measured in terms of log export value. The regression is estimated through the Maximum Likelihood Estimation. Table 10 presents the results, where the first model presents the baseline results, focusing on our variable of interest being exports value (log), while the second model displays the extended model results, which controls for year fixed effects, exporting experience of a firm measured in number of years as well as controlling for interdependence within firm over time by clustering at the firm level.

To investigate the exports value gap between exporter status defined in terms of Single Product Single Destination firms; Single Product Multi Destinations firms; Multi Product Single Destination firms; as well as Multi Products and Multi Destinations firms, we hypothesize that export value is dependent upon the exporter status (entry mode choice). As per theoretical expectations, export value is statistically significant and positively related to choosing all the three categories relative to Single Product Single Destination firms. In both models, the variable of interest is significant at the 0.01 level. Comparing the magnitude of coefficients, we can conclude that the export value is the highest for Multi-product multi-destination firms, followed by Single product multi-destination firms and then Multi-product single destination firms in both models.

The importance of exports value is substantiated in the extended model after controlling for factors such as years of exporting experience, as shown by the reduction in coefficient value of the log of export value. The results in Table 10 conform to the expectations in Botswana's trading landscape in that we expect Single product multi destination firms to perform better than multi-product single destination firms, given that attaining access to new export markets is relatively less challenging than firms innovating new products.

Table 10: Exporter Status-Exports Value Gap for Botswana's Formal Cross-Border Traders

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline Model			Extended Model		
VARIABLES	SPMD	MPSD	MPMD	SPMD	MPSD	MPMD
Log export value	0.597***	0.353***	0.727***	0.576***	0.341***	0.697***
	(0.021)	(0.008)	(0.011)	(0.030)	(0.009)	(0.016)
Experience				0.239***	0.170***	0.325***
				(0.038)	(0.009)	(0.020)
Constant	-9.099***	-3.350***	-8.480***	-9.456***	-3.643***	-8.587***
	(0.255)	(0.078)	(0.128)	(0.381)	(0.104)	(0.193)
Year fixed effects	No	No	No	Yes	Yes	Yes
Observations	18,562	18,562	18,562	18,562	18,562	18,562

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: The base category is Single Product Single Destination, SPMD= Single Product Multi Destination, MPSD= Multi-Product Single Destination, MPMD=Multi-Product Multi-Destination.

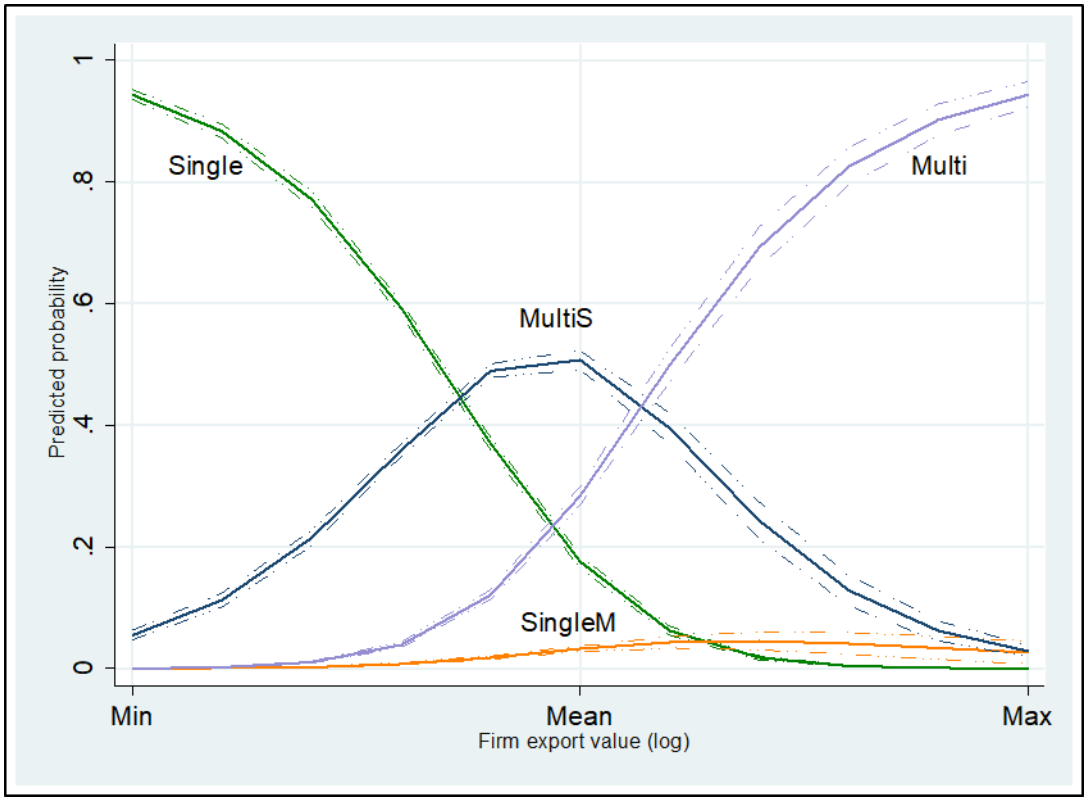
Notwithstanding the above discourse, coefficients obtained from multinomial logit models are subject to change over time, a trait suggesting that the association between the predictor and probability of choosing a category may be non-linear. Thus relying on the signs and magnitudes of the coefficients alone fails to account for the possibility that the direction and magnitude of the association between the variable of interest and the various alternatives may change over time (Wulff, 2015; Long and Freese, 2006). Specifically, the coefficient of a predictor with regard to a specific category only tells us about how that predictor relates to the probability of observing a particular category relative to the base category (Wulff, 2015). As such, we cannot wholly rely on model coefficients to give us a holistic picture of firm export diversification dynamics in the country.

One way of interpreting the association between a predictor and the probability of a choice of an alternative in a multinomial logit model is by computing and plotting predicted probabilities. We therefore go further by estimating the predicted probabilities of being in each category. Figure 6 displays the predicted probabilities for the four different firm categories and export value. Interestingly, it confirms that the association between export value and the probability of choosing a specific category is a non-linear one, undermining the validity of interpreting results solely on coefficient interpretation. Specifically, three key insights are deduced from Figure 6. Firstly, at low export values, firms are almost entirely SPSD firms. As firms grow in size (measured in export value), they do so by expanding the number of products to the destination but not destinations of that product. Then at higher level of export values, firms transition into exporting to multi-destinations. These firm dynamics illustrate the complexities of analysing relationships using a Multinomial logit model focussing only on the coefficients

of the model.

It is in this light that the above analysis provides a clear and intuitive way of understanding how firm export value and diversification category relate to each other. Conversely, it is difficult to reach similar conclusions by assessing the model coefficients in Table 10. The Table has portrayed a positive, linear and significant trend between export value and the probability of choosing all the four categories. We can further make concise statements about the predicted probabilities given specific values of the predictors (see Table ch2B and Table ch2C in appendix ch2). For example, small firms (5^{th} percentile) have a predicted probability of 0.7763 of entering through the SPSD mode while they have just 0.0099 of choosing MPMD as a mode. On the contrary, large firms (95^{th} percentile) have a predicted probability of 0.0505 of entering as SPSD and 0.5389 of choosing the MPMD mode.

Figure 6: Analysis of the Predicted Probabilities of Entry Mode Choice



Notes: 1) Dashed lines signify 95 percent confidence intervals. The predicted probabilities are point estimates and thus computing a confidence interval takes into account sampling variability (Wulff, 2015).
2) Single refers to Single Product Single Destination; SingleM is Single Product Multi-Destination; MultiS is Multi-Product Single Destination; and Multi refers to Multi-Product Multi-Destination.

2.5.2.2. Post-Estimation Results

After estimating the multinomial logit model, we executed some tests to validate the

importance of independent variables used, whether categories comprising the dependent variable can be combined and whether the assumption of Independence of Irrelevant Alternatives (IIA) holds for the data used in this study. The multinomial logit model works best when categories are different and not just substitutes for one another (Wulff, 2015). The independent variables used in the model are exports value (log), export experience (in years) and we also controlled for year fixed effects. When testing for each independent variable's effects on the model using the Likelihood-ratio (LR) test, the results as depicted by Table 11 show that all independent variables' effects are significant at 0.05 level. Wald tests for independent variables yielded the same conclusions. This is suggestive of the fact that the independent variables used in the regression model are all relevant.

Table 11: Test of independent variables

	Chi2	**df**	**P>Chi2**
Export value (log)	5692.707	3	0.000
Experience (years)	689.176	3	0.000

Source: Customs data
Note: 1) The null hypothesis says all coefficients associated with given variable(s) are zero.

It is also important to undertake tests for combining dependent categories. We use the LR test for combining alternatives. The null hypothesis is that all coefficients except intercepts associated with a given pair of alternatives are zero, that is, alternatives can be collapsed. The results as shown in Table 12 provides no evidence that categories should be combined. The Wald tests reached the same conclusions as well.

Table 12: Test for combining dependent categories

Entry modes	**Chi2**	**df**	**P>Chi2**
SPMD & MPSD	160.099	11	0.000
SPMD & MPMD	62.603	11	0.000
SPMD & SPSD	839.965	11	0.000
MPSD & MPMD	2258.879	11	0.000
MPSD & SPSD	2834.510	11	0.000
MPMD & SPSD	6949.780	11	0.000

Source: Customs data

In order to ascertain the validity of the results of the multinomial logit model, we tested for the assumption of Independence of Irrelevant Alternatives (IIA) using the Small-Hsiao tests. The results are depicted in Table 13 and point to no evidence of violation of IIA, justifying the usage of the multinomial logit model for our empirical purposes. In all cases, the null hypothesis of outcome-J versus outcome-K are independent of other alternatives is supported.

Table 13: Independence of Irrelevant Alternatives (IIA) tests

Omitted	InL (full)	lnL (omit)	Chi2	P>Chi2	Evidence
SPMD	-7720.958	-7719.310	3.295	0.771	for Ho
MPSD	-2619.546	-2616.351	6.390	0.381	for Ho
MPMD	-5247.661	-5246.537	2.247	0.896	for Ho

Source: Customs data

2.5.2.3. Fixed Effects Multinomial logit regression

The limitation of the current model presented in Table 10 is that it assumes all action take place between categories. It does not take into account changes in the product and destination composition of firm exports within categories. For example, the above model does not differentiate between a MPSD firm that sells two products to a single destination and a firm that sells 100 products to a single destination. A further limitation is that the analysis does not differentiate between firms exporting mining products compared to manufacturing products where we anticipate greater opportunities for diversification. To minimize these limitations, we have estimated fixed effects multinomial logit regression for all exporters as well as for exporters of manufactured goods. We however, note that these estimates do not consider changes within categories. They only deal with changes between categories within firms over time.

Table 14 thus estimates fixed effects multinomial logit regression, for all firms in the export transaction dataset (columns 1-3) and non-mining firms (columns 4-6). The essence of firm fixed effects is to control for firm characteristics that are not included in the regression and minimize potential endogeneity issues. When estimating the fixed effects multinomial logit regression, the number of observations will reduce as some observations will be dropped due to no variance in the dependent variable across waves for those firms (Pforr, 2014). Furthermore, the option of predicted probabilities is not offered for the fixed-effects multinomial logit model (Pforr, 2014).

The results show that the association between firm export diversification category and firm size remains the same whether we look at the across-firm variation (Table 10) or within-firm variation (Table 14). Interestingly, the firm exporting experience variable confirms the conclusions reached in Figure 6 and deviates from Table 10 where the variable witnessed a positive and significant coefficient across all export diversification categories of firms. Specifically, as firms grow in their exporting experience, they expand in the number of

products to the destination as shown by the positive and significant coefficient of the exporting experience variable for the MPSD firms (in columns 2 and 5). Finally, these results suggest that the export diversification dynamics of firms depicted in Figure 6 are consistent, even when we consider firms dealing with non-mineral products.

Table 14: Exporter Status-Exports Value Gap for whole sample versus Non-mining sample

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All firms			Non mining Firms		
	SPMD	MPSD	MPMD	SPMD	MPSD	MPMD
Log export value	0.497***	0.460***	0.787***	0.549***	0.471***	0.798***
	(0.052)	(0.019)	(0.031)	(0.054)	(0.020)	(0.033)
Experience	-0.066**	0.039***	-0.081***	-0.078**	0.037***	-0.085***
	(0.031)	(0.011)	(0.017)	(0.032)	(0.011)	(0.017)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,291	12,291	12,291	11,804	11,804	11,804

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2.5.2.4. Robustness Checks

One extension to Table 10 and Figure 6 is to calculate the transition probabilities of firms moving between different states defined in terms of products and destinations. Table 15 shows the results of the transition probabilities of exporting firms as well as non-exporting (exiters) firms[24] defined as the probability that a firm in category *i* at *t-1* will be in category j at year *t.* Two features are noteworthy; persistence and upward mobility. Firms are likely to remain in the category where they are, indicating the prevalence of persistence. The two most persistent categories are the exiters as well as the multi-product multi-destination firms, followed by the multi-product single destination firms. Interestingly, firms in the single product multi-destination as well as single product single destination categories are the only ones that are not persistent. The transition probabilities also depict upward mobility. For example, single product single destination firms face 33.7% probability of moving up to being in the category of multi-product multi-destination firms, compared to 15.47% probability of staying in the same category. However, it is less likely that large exporters would move up. For example, single product multi-destination as well as multi-product single destination firms move up with a probability of 3.97% and 19.84%, respectively.

[24] The non-exporting firms consist of firms that exported for at least one year between 2003 and 2012, but did not export in the year under consideration.

While these results depict a high persistence of exiters which is not a welcome development, they also portray a positive projection for Botswana's export diversification prospects in that the highest persistence probability for exporting firms is registered for the multi-product single destination as well as multi-product multi-destination firms. These firms have a positive impact on the value of exports as shown by the predicted probabilities in Figure 6, although the contribution of MPSD decreases over time. On the contrary, single product multi-destination firms are not persistent and their action as portrayed by the predicted probabilities had been modest. While the earlier regression results have identified single product single destination firms as the least performers, the positive development is that these firms face a high likelihood of upward mobility[25].

Table 15: Transition matrix for the category of exports to which a firm belongs

		Year (t) Product_Destination_Status					
	Product_Destination_Status	No trade	SPSD	SPMD	MPSD	MPMD	Total
Year (t-1)	No trade	83.42	10.31	0.18	5.07	1.02	100.00
	SPSD	65.02	15.47	0.54	15.02	3.95	100.00
	SPMD	22.59	11.11	14.81	11.85	39.63	100.00
	MPSD	32.90	15.09	0.61	41.41	10.00	100.00
	MPMD	13.08	7.50	3.36	19.84	56.22	100.00
	Total	72.43	11.27	0.48	10.78	5.05	100.00

Source: Customs data

2.6. Conclusions and Policy Implications

Utilizing a rich dataset that contains firm exporting activities, we unearth evidence supporting new-new trade theories on firm heterogeneity and international trade, with some new facts as well. We document the findings as follows:

International trade in Botswana is concentrated, with exports mainly dominated by traditional exports in the likes of diamonds as well as Single Product Single Destination exporters. The diamond exports are largely exported to a single destination (United Kingdom). Significant concentration is also evidenced across product- and country- extensive margins in that very few firms export multiple products to multiple countries while the majority of the firms export few products to few countries. These facts support theories of trade with heterogeneous firms that predict that due to fixed costs of exporting, only the most productive firms can be multi-

[25] The transition matrix that does not take into account exiters can be viewed in Table ch2D in appendix ch2.

product multi-destination exporters. Some positive developments have also been noted in terms of product diversification and change in the profile of export destinations to include countries such as India and China.

Secondly, the study confirms that firm export value and its product-destination category are positively related using the multinomial logit estimation model. However, the predicted probabilities confirm the presence of some non-linearities, supported by these three key insights: (i) At low export values, firms are entirely single product single destination exporters; (ii) As firms continue to grow, they expand the number of products to the destination but not the destinations of that product. This is a striking contrast in relation to other countries that have been found to perform better in terms of destination diversification (see Stirbat et al., 2011; Cadot et al., 2013); (iii) At higher level of export values, firms in Botswana transition into exporting to multi-destinations. Hence, firms need to break into new markets in order to grow their exports.

Some persistence and upward mobility in terms of transition probabilities have also been noted, with categories of firms (such as MPMD) that contribute more to export value being highly persistent and the least performers (SPSD) having the potential of upward mobility. Furthermore, the entry and exit dynamics of firms and products in Botswana may point to the possibility that export diversification is driven by the intensive margin rather than the extensive margin as evidenced by a drop in the number of new firms entering the export market which is outnumbered by continuing firms and products. Product and firm turnover also pose as a threat to the realization of export diversification in the country. This study therefore concludes that there has not been much dynamism in changing export diversification in Botswana.

However, the low levels of export entry by new firms and products call for a robust policy direction if export concentration in the country is to be ameliorated. Given the evident firm heterogeneity resulting from export value differentials attributed by the different product-destination categories, industrial policy should be tailor-made to address the peculiar needs of the different firm categories so as to stimulate firm survival. Focussed industrial/trade policies should endeavour to promote joint ventures between foreign-owned firms with small to medium-sized citizen firms, in order to stimulate firm productivity.

Notwithstanding the study's potential contribution, we suggest that it would be useful in future to extend the research to the analysis of the relationship between firm export diversification status and its initial entry into the export markets. To this end, given the low concentration of exports in multi-destination exporters, pointing to a constraint to this particular type of diversification, the next chapter aims to investigate the firm characteristics driving firm export destination diversification success.

Chapter 3

3. Export Destinations and Firm Heterogeneity: Evidence from Botswana's Manufacturing Firms

3.1. Introduction and Background

In the wake of a decline in the cost of transportation and telecommunications across countries, policymakers (in both developing and developed countries) have encouraged domestic firms to expand their export destinations, with the anticipation that diversification of export sales can improve the terms of trade, lower volatility and boost economic growth (Shepherd, 2010; Xuefeng et al., 2016). Recent studies such as Eaton et al. (2008) and Xuefeng et al. (2016) that focus on diversification of export destinations suggest that an analysis of export market diversification at the firm or sector level, rather than country level, can be more informative for understanding whether export market expansion is effective and how firm productivity may influence it.

For example, Eaton et al. (2008); Xuefeng et al. (2016) show that there is high entry of Colombian exporters into the export markets, but most of these entrants have a very small export share and exit the market within a year. Some firms, however, succeed in these markets and gradually break into other export destinations, thereby becoming multi- destination exporters. Hence, understanding the dynamics of introducing new export destinations at the firm level constitutes the first step in understanding how a country can upgrade its export structure (Iacovone and Javorcik, 2010). To this end, the question of whether and to what extent firm characteristics drive geographic market expansion or export sales diversification remains relevant and crucial. Notwithstanding this, our understanding of how to diversify geographically still remains limited in developing countries.

From the existing literature, firms use neighbouring countries as stepping stones to learn about and improve their foreign market capabilities. If these firms succeed in these markets, they then begin to test their capabilities in larger and more advanced countries (Xuefeng et al., 2016). This market expansion can initially erode the economies of scale achieved through the firms' foreign market involvement as this involves incurring production and transaction costs associated with advertising, legal representation as well as development of an agent/distributer network (Seyoum, 2014). This implies that it is not every firm that will be able to accomplish geographic market expansion. Understanding the type of firms that drive geographic export diversification is therefore an important developmental concern. As it is, empirical literature

shows vast heterogeneity in terms of firm destination export diversification (Eaton et al., 2004). The stylized fact coming from empirical literature is that the majority of exporting firms export to a single export destination while only a small fraction of firms export to multiple export destinations. Evidence also points to multi-product multi-destination exporters as being different and thus account for disproportionate share of export value relative to single product single destination exporters[26] (Chaney, 2008).

In light of the above, with this study we seek to provide insights into firm characteristics determining selection into export destinations. Specifically, we seek to answer the following questions:

- How distributed are Botswana firms' export destinations?
- Do more productive firms export to multiple export destinations?
- Is there a productivity premium of exporting out of the Southern African Customs Union (SACU) region?

Botswana is an interesting case study for the analysis of the productive impact of the number of export destinations at the firm-level. Firstly, destination export diversification has been identified as a policy priority of the Government of Botswana since the earlier National Development Plans (NDPs). Yet, Botswana's manufacturers are predominantly single destination exporters largely exporting to the SACU region, thus making the country prone to regional shocks[27]. Over the period 2003 – 2012, of the total Botswana's manufactured exports, about 67% were destined to the SACU region. During the same period, South Africa was the predominant export destination, accounting for 61% of Botswana's manufactured exports. Hence, the big challenge for the country remains reducing dependency on the South African (or SACU) market. The urgency of the need of Botswana's export manufacturers to consider exporting outside the SACU region is further induced by the volatile diamond and SACU revenues accruing to the country[28]. Secondly, the country's manufacturing sector is plagued by low levels of productivity (Habiyaremye, 2013).

[26] This finding has also been found in the previous chapter of this thesis.
[27] Hence, firms that do not export to SACU are more likely to be multi-destination exporters.
[28] SACU revenues are shared across member countries based on the countries' imports and GDP levels. Given the current projections of low GDP growth in South Africa, SACU receipts are expected to decline in the subsequent years (IMF, 2017).

This study contributes to the existing literature on geographic export diversification in the following ways: Firstly, it adds to the productivity-exporting literature by incorporating the role of trade integration and hence shows that for countries that rely heavily on a trade bloc for its exports, the link between firm productivity and export destinations is dependent upon whether firms export outside the trading bloc or not[29]. To the best of our knowledge, no other study has analysed determinants of geographic export diversification in an African context in the manner proposed in this chapter. Secondly, by combining two literatures, being firm heterogeneity as well as bilateral trade flows, we add to the methodological contribution by using the Zero-inflated Poisson regression model, an estimation method that accounts for the excess zeros in the bilateral trade flows as well as over-dispersion.

To this end, the chapter uses a unique dataset comprising firm characteristics and export transactions to evaluate two hypotheses: The first hypothesis being that destination count is positively related to firm productivity while the second one is that productivity differentials matter more for exporting out of the SACU region.

The chapter is structured as follows. Section 3.2 reviews existing literature and related evidence on the relationship between firm productivity and number of export destinations. Then the theoretical model of firm-based geographic export diversification and the description of data used in the analysis follows in Section 3.3. Section 3.4 presents the results on profile of Botswana's manufacturing sector as well as empirical results while Section 3.5 concludes, drawing some policy implications.

3.2. Literature Review

3.2.1. Theoretical Background

The question of whether more productive firms export to multiple export destinations, and whether the productivity effect is accentuated when exporting outside a dominant trade bloc is anchored on the recent literature on firm heterogeneity and international trade based on work by Melitz (2003). This literature argues that only the more productive firms will find it profitable to export, which suggests that the sunk costs associated with foreign market entry can only be met by larger and more productive firms. According to Wagner (2007), these sunk costs relate to distribution or marketing, additional workers to man foreign networks, etc. It is

[29] As a member of SACU, firms in Botswana face no tariff barriers in exporting to the other members. Essentially, the SACU region can be considered as an enlarged domestic market.

on that basis that Helpman, et al. (2004) argue that the least productive firms will serve only the domestic market, while the more efficient firms will export. The implication of the preceding discussion is that highly productive firms self-select themselves into exporting and this is what has brought birth to the self-selection hypothesis[30].

Interestingly, the theoretical models that unite heterogeneous firms with the determination of bilateral trade flows came into existence in 2008 and they are all based on the Melitz (2003). The leading models have been introduced by Chaney (2008), Helpman et al. (2008) and Melitz and Ottaviano (2008). These models are well-suited for the present chapter that mainly focusses on the determinants of diversification in export destinations. Melitz and Ottaviano (2008) were the first to develop a model that unites heterogeneous firms with the determination of bilateral trade flows at the firm-level. They developed a monopolistically competitive model of trade with firm heterogeneity that encompasses productivity differences amongst firms as well as endogenous differences in market characteristics. This model can further be extended to an open-economy with multiple countries. The model predicts that trade forces the least productive firms to exit and reallocates market shares towards more productive exporting firms. The model however, departs from the Melitz (2003) model by providing a link between bilateral trade liberalization and reductions in mark-ups, thereby signifying the potential pro-competitive effects invariably associated with episodes of trade liberalization.

The main contribution of this model is that it integrates the welfare effects emanating from both the multilateral and unilateral liberalization into a single, unified framework, while simultaneously incorporating the important selection and reallocation effects among heterogeneous firms that were previously emphasized.

Helpman, et al. (2008) develop a model of international trade with heterogeneous firms that predicts positive as well as zero trade flows between countries. In this model, which is in line with Melitz (2003), firms face both fixed and variable costs of exporting. Firms therefore vary by productivity, and only the more productive firms find it profitable to export. By extension, the profitability of exports is higher for exports to countries with higher demand levels and lower variable and fixed costs.

Finally, Chaney (2008)'s model is favourable to this study and is premised on firm heterogeneity in a general equilibrium model of international trade. The model assumes a world

[30] The self-selection hypothesis is explained by a positive and significant link between lagged productivity and export status.

comprising of many asymmetric countries, separated by asymmetric trade barriers. This model is then used to study the strategic choice of firms to export or not, and if they export, which countries to target. The advantage of this model is that it precisely predicts the structure of bilateral trade flows such that the researcher can be able to tell which firm from which country is able to enter a given market. The model further explains how the particular firm is affected by competition from local and other foreign firms, even in the presence of asymmetric bilateral trade barriers. As such, the model predicts that as firm sizes are magnified, fixed costs have a lesser impact on exports in that large firms can easily overcome the fixed costs of exporting.

In conclusion, the synthesis of this section is that the preceding theoretical models underpinning the link between firm productivity and export destinations have important implications in modelling firm export decisions. Firstly, these models emphasize the importance of self-selection and of productivity ordering associated with accessing the export markets. The implication of these insights is that only the most productive firms will be able to pay the fixed costs of exporting associated with each export market and thus be able to export to many destinations. Additionally, two important insights have been identified as avenues for the successful matching of these models to firm-level data. The first insight involves accounting of zero trade flows inherent in bilateral trade flows, while the second insight relates to the choice of estimation method to address the zero trade flows. Because zero bilateral trade flows reflect a firm's export decision, this information should be accounted for in the form of a theoretically-consistent estimation strategy. The empirical method used in this chapter will consider this fact.

3.2.2. Related Empirical Literature

Empirical studies with a focus on geographic export diversification are limited in emerging economies due to the unavailability of datasets that have both firm characteristics and bilateral trade flows. Eaton et al. (2008) and Roberts and Tybout (1997) provide evidence on Colombian exporters into the export markets, suggesting that there is high entry of Columbian exporters into the export markets, pointing to the fact that most of these entrants have a very small export share and exit the export market within a year. Some firms, however, succeed in the various export markets and gradually break into other export destinations (Xuefeng et al., 2016 for Chinese firms; Rodríguez-Pose et al., 2013) for the Indonesian firms. Therefore, investigating more about what firm characteristics motivate individual firms to diversify their exports across destinations deserves particular attention.

Empirical literature in this research is largely confined to developed countries. These studies include Eaton et al. (2004) for French firms; Lawless (2009; 2010) for Irish firms; Damijan et al. (2007) for Slovenian firms; Love et al. (2016) for UK firms; Andersson et al. (2008) for Sweden firms; and Bernard and Jensen (2004) for US firms.

The empirical findings on the link between firm productivity and geographic export diversification fall mainly into 3 issues. Firstly, there is the issue of definition/measurement of geographic export diversification. Several studies have used export intensity (or foreign sales over total sales) and geographic export diversification interchangeably (Contractor et al., 2007; Rodríguez-Pose et al., 2013). We concur with Verbeke and Brugman (2009) and Boehe et al. (2016) that this can be misleading. This emanates from the fact that two firms with the same export intensity can show entirely different degrees of geographic export diversification in terms of the number of countries or regions covered. In this chapter, we define geographic export diversification as the number of export destinations per firm. More specifically, a multi-destination exporter means a firm that exports out of the SACU region.

Secondly, estimation methods vary across the relevant studies ranging from the probit or logit regression models (Evenett and Venables, 2002) to sample selection regression models such as Heckman regression model. Recently the estimation methods used have extended to count data models such as standard Poisson models (Shepherd, 2010) and zero-inflated regression models (Lawless, 2010) to take into consideration the high proportion of non-exporters in the datasets.

Thirdly, the control variables constituting the firm characteristics that influence firm labour productivity have been identified from theoretical and empirical literature and these variables have been found to have mixed effects on geographic export diversification[31]. Studies such as Roberts and Tybout (1997); Alvarez and Lopez (2005) and Lawless (2010) have identified these variables to include, *inter alia*, firm age, capital stock, ownership status of the firm, previous exporting experience, firm size and lagged investment. Although the importance of firm heterogeneity on firms' export decisions has been reaffirmed by these studies, the results remain entirely country-specific[32].

[31] It is evident from the extant literature that geographic export diversification is regarded as an independent strategic choice, suggesting that geographic export diversification is an exogenous driver of firm performance. However, foreign market entry decisions may be a function of firm capabilities, suggesting that geographic export diversification may be endogenous (Shaver, 1998).

[32] A common feature of firm heterogeneity models is that higher firm productivity induces the firm to serve more destinations and export more products per destination (Bernard et al., 2014).

Empirical analysis relating to the geographic coverage of a firm's exports has been carried out by Eaton et al. (2004) using French data for 1986. They find great heterogeneity in firms' export participation underpinning a stylized fact. In particular, they find that the majority of exporting firms export to a single export market and only a small fraction of firms export to a large number of export markets[33]. Understanding the types of firms that are multi-destination exporters is thus of paramount importance.

Consistent with previous studies (Eckel and Neary, 2010; Lawless, 2009; Mayer et al., 2014; Xuefeng et al., 2016) found that firms exporting to multiple markets have higher productivity levels and growth rates. Additionally, some studies found the relationship between firm productivity and geographic export diversification to be non-linear (Xuefeng et al., 2016). This implies that firms need to reach a particular productivity threshold before positive spillovers in firm productivity could translate into export market diversification, underscoring the importance of this study.

The limitation of the above-stated empirical studies is that although they discuss the link between firm productivity and number of export destinations, the studies do not explicitly consider exporting out of a predominant customs/trade bloc as a potential channel to enhance the productivity effect. The few exceptions are the Andersson et al. (2008) and Lawless (2009) using the Swedish and Irish data, respectively, who have attempted to deal with this issue although implicitly. It is argued that the customs unions extend the domestic market and hence the productivity premium over domestic-oriented firms required to access the market is very small.

While theoretically, we expect exporting experience of the firm to positively influence geographic export diversification (by virtue of its picking the international engagement of the firm), empirical evidence remains ambiguous. This is mainly due to data limitations which usually use firm age and exporting experience interchangeably (Love et. al., 2016). D'Angelo et al. (2013) argue that some studies use firm age as a proxy for the length of firms' exporting experience. It is imperative therefore to differentiate between firm age and exporting experience so as to tease out the differential effects of these two variables thereby ironing out some of the ambiguity in the empirical literature.

[33] Similar finding has been found by Andersson et al. (2008) and Xuefeng et al. (2016).

After controlling for export status, Lawless (2010) found that larger firms are most likely to export to more export destinations. This is largely attributable to the fact that large foreign firms in export sectors are more productive than domestic owned firms as was established for South African manufacturing firms by Edwards (2004) and for the US manufacturing firms (Bernard et al., 2003)[34]. In particular, by being able to incur the substantial sunk costs associated with the initial entry to the export market, large firms may be able to export to many destinations as they usually have prior exporting experience (Lawless, 2010). We thus caution that prior exporting experience helps in reducing the sunk costs of accessing subsequent export markets.

The above literature can therefore be synthesized in this way. It is noteworthy that there is extant research in both theoretical and empirical work on the link between firm productivity and number of export destinations, particularly for developed countries. This kind of research is of particular importance to Africa, where most countries are still struggling with continued export concentration in terms of products and destinations.

3.3. Methodological Framework

3.3.1. Modelling Firm-Based Geographic Export Diversification

The theoretical foundations informing the analysis of the determinants of export destination diversification at the firm level is inspired by the gravity model of heterogeneous firms, which captures bilateral trade flows at the firm level. According to this theory, heterogeneity in firm behaviour is as a result of the fixed costs of entry which are market specific and higher for international markets than for the domestic market (Chaney 2008; Melitz 2003). The implication of this result is that only the most productive firms are able to cover these fixed costs. By and large, firm productivity is correlated with a large array of other observable firm characteristics.

It should be emphasized that introducing firm heterogeneity in models of international trade ensures that not all firms in a country export and that not all products are exported to all destinations. Furthermore, this means that not all countries in the rest of the world are necessarily served. To this end, by virtue of considering asymmetric countries which are divided by asymmetric trade barriers, Chaney's (2008) model analyses the strategic choice of

[34] Since firm productivity is not included in the regression analysis of Lawless (2010), the firm size association reflects the effects of firm productivity. In this case, the firm size variable is biased upwards by the correlation between omitted firm productivity and firm size.

firms to export or not, and if they export, which countries to target. This model therefore best predicts the structure of bilateral trade flows.

In view of this, we adopt the theoretical framework developed by Chaney (2008) by incorporating firm heterogeneity in productivity and fixed costs of exporting. In this framework, Chaney (2008) developed a model of steady-state trade flows between many countries, based on the assumption that productivity shocks are pareto distributed, hence providing a theoretical model of firm selection into export markets. Export earnings in different export destinations vary by capability (characteristics) level of each exporting firm and each firm follows an export marketing strategy that maximizes its profit. Following the Chaney (2008) model of heterogeneous firms exporting to multiple countries, we assume that a firm located in country *i* and indexed by its unitary productivity level α, exports the following value to country *j*:

$$x_{ij}(\alpha) = \begin{cases} \lambda_3 \times \left(\frac{Y_j}{Y}\right)^{(\sigma-1)/\gamma} \times \left(\frac{\theta_J}{w_i \tau_{ij}}\right)^{\sigma-1} \times \alpha^{\sigma-1}, if\ \alpha \geq \bar{\alpha}_{ij} \\ 0 \text{ otherwise} \end{cases} \quad (1)$$

Equation (1) shows that exports are a function of country sizes[35] (Y_j and Y), workers' productivity(w_i), bilateral trade costs (τ_{ij}) and the measure of country *j*'s remoteness from the rest of the world. The firm heterogeneity parameter is captured by $\frac{\gamma}{(\sigma-1)}$ (Chaney, 2008).

A firm's export earnings are not observed for all export destinations, but only for the destination in which the firm exports to. Additionally, it is assumed that when firm α decides not to export to any of the export destinations, the export earnings are zero. To this end, this model predicts that in view of the productivity cut-off differentials across export markets, which is attributable to each destination having a specific fixed cost, the more productive firms will export to more export markets. These productivity cut-off differentials also imply that firms will enter export markets sequentially. The model further predicts a positive link between a firm's export sales and number of export markets, suggesting that multi-destination exporters will contribute more to export value (Chaney, 2008).

Equation (1) posits that in the event the firm-specific productivity parameter α is below the level which a firm can cover the fixed costs, then that firm will not export. However, if the reverse holds true, then the firm will export and will earn positive export earnings. This

[35] Y is world output.

analytical framework allows us to identify two effects espoused by the Chaney (2008), namely the selection into the export markets as well as the market coverage effect.

The application of the model to Botswana poses a particular problem when dealing with exports to SACU. As a member of the customs union, firms in Botswana face no tariff barriers in exporting to the other members. Essentially, the SACU region can be considered as an enlarged domestic market.

While the trade statistics treat sales by Botswana firms to other SACU members as exports, these could feasibly be considered as domestic sales, and not exports. Consequently, we would not expect to find a large productivity premium associated with firms exporting solely to the SACU region. To deal with this concern, the analysis is extended such that it considers the possibility of an additional productivity premium that may exist for exporters to outside of the SACU region.

To this end, this study investigates two hypotheses being: (i) destination count is positively related to firm productivity; and (ii) Productivity differentials matter for exporting out of the SACU region.

3.3.2. Econometric Model

In order to identify the impact of firm productivity on geographic export diversification, we estimate a reduced form variant of the model in equation (1), which is estimated in two stages. A similar version of the model has also been used by Lawless (2010). The first stage of the estimation measures the export decision of the firm, based on expected profits from exporting after taking into consideration the fixed costs of exporting. Hence, the firm will export if the expected profits are positive. The export status ($Q_{\propto t}$) of firm α in year *t* is shown as thus:

$Q_{\alpha t} = 1$ if $\beta Z_{\alpha t} + \varepsilon_{\alpha t} > 0$ (2)

$Q_{\alpha t} = 0$ otherwise (3)

The export profits depend on firm-specific factors denoted by $Z_{\alpha t}$ and the error term $\varepsilon_{\alpha t}$which captures any other non-firm-specific effects.

The second stage of deciding on destination coverage, measured as the number of export destinations (M), is made after the firm has made a decision to enter the export markets. The market coverage equation is estimated as thus:

$$M^*_{\alpha t} = \beta X_{\alpha t} + v_{\alpha t} \quad (4)$$

where:

$$M_{\alpha t} = M^*_{\alpha t} \text{ if } Q_{\alpha t} = 1 \quad (5)$$

$$M_{\alpha t} = 0 \text{ if } Q_{\alpha t} = 0 \quad (6)$$

The observed market coverage is zero if the firm is not exporting. If the firm exports, its market coverage will be determined by a vector of firm characteristics, $X_{\alpha t}$ and by other effects captured by the error term $v_{\alpha t}$. In our case, the main variable of interest influencing market coverage is firm productivity.

From the above discussion, identifying the link between firm productivity and geographic export diversification is plagued with the potential problem associated with zero trade flows. If not addressed, this potential problem will make it hard to get unbiased estimates of the link between firm productivity and geographic export diversification. The large number of zeros in the dependent variable emanating from the fact that many firm-year observations are zeros, are primarily caused by the fact that not all firms are able to overcome the fixed costs of exporting (Melitz, 2003).

We propose to address this potential concern through the Zero-Inflated Poisson regression approach[36]. In this regression approach, 1 denotes a firm that exports while 0 denotes firms that do not export and only sell to the domestic market. However, as shown by the high churn into and out of exporting (Table 6 in chapter 2), some of these domestic sales firms may have exported in the past. The Zero-inflated Poisson regression includes a first stage correction for the large number of zeros, which controls for the sample selection bias effect when determining whether a firm exports (Lawless, 2010). Hence, with this approach, we are able to analyse the determinants of export destination decisions utilizing firm-level information and also taking into cognizance the fact that not all firms export in every given year and that those that do export do not export to all destinations in the world. With this empirical methodology we are able to assess why a firm decides to export or not in a given year, and if it exports why it chooses this particular number of export destinations and not another one (this being captured by the number of destinations a firm exports to in our context).

[36] The empirical analysis started off first by employing the logit and count models such poisson model and mundlak-augmented negative binomial model.

Literature on firm heterogeneity argues that the more productive firms are more likely to export and to export to multiple export destinations as they are most likely to be able to cover the fixed costs of exporting (Melitz, 2003). To this end, in line with answering the first research question of this study, our baseline empirical model, which takes two stages being the non-exporting decision as well as the second step of deciding market coverage[37], is as shown in equation (7) below. As in Lawless (2010), the market coverage equation follows a Poisson distribution and is estimated as:

$$M_{it}^{*} = \beta_0 + \beta_1 LP_{i,t-1} + \beta_2 X_{it} + \varepsilon_{it} \quad (7)$$

where:

$$M_{it} = M_{it}^{*} \text{ if } Q_{it} = 1 \quad (8)$$

$$M_{it} = 0 \text{ if } Q_{it} = 0 \quad (9)$$

where Q_{it} is the export status of firm *i* and the observed market coverage is zero if the firm is not an exporter. In the event the firm is an exporter, its market coverage will be determined by equation (7) where $LP_{i,t-1}$ is one period lag of firm labour productivity[38] (proxied by log turnover per worker). The matrix X_{it} captures other determinants of market coverage including ownership status of a firm, age (in years), firm size (proxied by number of employees), exporting experience (years) as calculated by the difference between ((last exporting year and the first year the firm exported) plus 1), turnover and investment. These explanatory variables have been identified from existing studies such as Roberts and Tybout (1997); Alvarez and Lopez (2005); and Lawless (2010).

To answer the second research question of this study, whose hypothesis indicates that productivity differentials matter more for exporting out of the SACU region, we extend the baseline equation (7) by including the out_of_SACU dummy as well as the interaction term between labour productivity and Out of SACU dummy. The extended market coverage equation is thus as follows:

$$M_{it}^{*} = \beta_0 + \beta_1 LP_{i,t-1} + \beta_2 Out\_of\_SACU + \beta_3 LP_{i,t-1} * Out\_of\_SACU + \beta_4 X_{it} + \varepsilon_{it} \quad (10)$$

Where:

[37] In arriving at an estimable presentation of the firm-level gravity model, we take logs of equation (1), drop the source country index (because we are only dealing with one country, that is Botswana), add a time dimension to capture the panel structure of our dataset as well as a properly behaved error term.
[38] From the Melitz (2003) theory, productivity is potentially endogenous. In light of this, we use one period lag of log turnover per worker as a proxy for productivity.

$M_{it} = M_{it}^{*}$ if $Q_{it} = 1$ (11)

$M_{it} = 0$ if $Q_{it} = 0$ (12)

where the Out_of_SACU dummy is a dummy variable coded one for firms that export out of the SACU region, zero otherwise, and $LP_{i,t-1} * Out\_of\_SACU$ is an interaction term between labour productivity and Out of SACU dummy, respectively. The other variables are as defined as before.

3.3.3. Data and Data Overview

3.3.3.1. Data Description

To undertake this study, we integrated two sources of firm-level data obtained from the Botswana Unified Revenue Services (BURS) and Department of Industrial Affairs. The primary data source is the licensed manufacturing firm characteristics obtained from the Department of Industrial Affairs. Present in this dataset are firm characteristics such as labour productivity, age, investment, turnover, number of employees and ownership status. The data cover the years 2003 to 2012 and include all manufacturing firms that have been granted industrial licenses by the Department, subject to prior formal registration in Botswana as per the Registration of Business Names Act. The law in Botswana requires that all manufacturing firms must possess industrial licenses to enable them to manufacture or sell manufactured products (Government of Botswana, 2008). To compile the database, the Department of Industrial Affairs liaises with the various Councils in the country to ensure that the database includes all registered manufacturing firms in the country. This suggests that the database is representative of the manufacturing sector in the country.

However, the Department of Industrial Affairs database is skewed towards large licenced manufacturing firms. This means that small low productive sales firms are largely excluded from this database. Small firms generally do not export. The limitation of this data constraint is that it may lead to sample selection bias where the coefficient on firm productivity is biased downwards. However, this is the only firm panel data available in Botswana. The extent of the bias, particularly in the second stage of the estimates that look at productivity and number of destinations is expected to be marginal, as the first stage coefficient on determining whether a firm exports controls for the sample selection bias effect. Further, geographic export diversification is more common among large firms (Boehe et al., 2016; Bernard et al., 2009; Mayer and Ottaviano, 2007).

Using a concordance file that we developed (details of which are provided in the Appendix section), we then merged in the transaction export data provided by the Botswana Unified Revenue Services (BURS). The transaction database includes very detailed information on firm-level export transactions, including value, quantity, volume and destination at the 8-digit level of the Harmonized System (HS) over the period 2003 to 2012. The transactions dataset is used to identify manufacturing firms that export, as well as the value, range of products and scope of destinations an exporting firm deals with. The merged dataset[39] comprises of the licensed manufacturers, of which we are able to categorize firms into domestic-oriented manufacturers as well as exporting manufacturers.

Table 16 below presents a snapshot of the merged dataset. The data cover an average of 297 firm observations in each year between 2003 and 2012. While the total number of manufacturing firms has reduced over time, particularly during the onset and subsequent to the global financial crisis, the share of exporters has on average increased from 52.7% in 2003 to 61.3% in 2012. Although to a large extent, exporting has been viewed as a rare event in existing empirical literature, these statistics are in accordance to what has been found in emerging economies such as Slovenia[40] (de Loecker, 2007; Lawless, 2009). For example, Lawless (2009) established that in their sample of 751 Irish Manufacturing firms, 83% were exporters. Just like in Sweden, Botswana has a small domestic market, coupled with sharing a border with SACU countries (that share many characteristics with Botswana). This presupposes that Botswana firms face low entry costs to a number of adjacent countries in the SACU region and hence explain relatively high participation rates in international markets (Anderson et al., 2008).

[39] The merged dataset provide firm characteristics and export information required to estimate our specifications.

[40] The registration process conducted by the Department of Industrial Affairs targets large industrial manufacturers. This largely explains why the sample of manufacturing firms kept by the Department of Industrial Affairs comprises of a high proportion of exporters.

Table 16: The Number of Exporting Manufacturing Firms per year

Year	Domestic producers	Exporters	Total Manufacturing Firms in our merged dataset	Share of exporters in our merged dataset (%)
2003	150	167	317	52.7
2004	150	165	315	52.4
2005	161	171	332	51.5
2006	159	187	346	54.0
2007	175	202	377	53.6
2008	178	186	364	51.1
2009	128	133	261	51.0
2010	55	91	146	62.3
2011	162	159	321	49.5
2012	74	117	191	61.3
Total	**1392**	**1578**	**2970**	

Source: Author's elaboration from the merged dataset.

Note: In the BURS dataset, the manufacturing firms are identified through ISIC Rev 3.

Regarding the representativeness of this dataset, it is worth noting that although the dataset includes only about 20% of manufacturing firms in terms of number of firms as per the Statistical Business Register of Botswana (as well as an average of 9% of the total entities exporting manufactured goods in the BURS dataset), the dataset cover about 54% of manufacturing firms that do exporting, and about 54% of the total value of manufacturing exports (Appendix ch3, Table ch3B). These results therefore substantiate that the representativeness of the dataset is quite satisfactory[41], given that the focus of this study is on export destinations.

Relating to the data limitations per se, it is noteworthy to indicate that it is difficult to identify mergers and acquisition activities in the dataset that could potentially lead to the disappearance of some firms. This therefore suggests that the exit rates may be over-represented as missing values are not necessarily solely due to firms exiting export markets but could be due to reasons unrelated to export performance. Table ch3C in Appendix ch3 provides details of firms that are appearing in the BURS dataset but are non-existent in our merged dataset. There are two possibilities to explain these firms; either these firms represent mergers and acquisitions that have not been accounted for in the export transactions dataset (BURS) or these are firms that

[41] According to the Statistical Business Register (BSR) held by Statistics Botswana, there are 1313 operating establishments in the manufacturing sector. More details on the representativeness of the dataset could be found in the Appendix section.

may not have complied with the Department of Industrial Affairs to renew their industrial licenses in a given year[42]. We have ignored these firms in our analysis as it basically means they defaulted from renewing their industrial licenses with the Department of Industrial Affairs, yet were still operational.

3.4. Results and Discussion

3.4.1. Profile of Botswana's Manufacturing Sector

Before we can explore the firm characteristics that influence export destination choices in Botswana, we first need to understand the structure (profile) of the manufacturing sector in general (inclusive of domestic manufacturers and exporting manufacturers). This is viewed in terms of characteristics such as firm ownership distribution, size distribution as well as domestic manufacturers versus exporting manufacturers.

The distribution of Botswana's manufacturing firms by firm size and different ownership categories for the period between 2003 and 2012 is presented in Table 17. The results indicate heterogeneity in terms of firm ownership status and size. Interesting results are evident. Firstly, citizen firms make up 39.34% of small firms, but only 26.19% of large firms. These results further suggest that domestic ownership (citizen-owned firms) is inversely related to the size of the firm. On the other hand, foreign ownership is positively related to the size of the firm. This is evidenced by the fact that within the foreign-owned firms, the majority of these firms (50.11%) has at least 100 employees[43] while 41.21 % are small firms.

[42] Our preceding analysis has ignored these firms as insightful results are obtained even without these firms and we believe we are not missing anything by excluding them.

[43] From the merged dataset, out of the 2954 firms, 1342, 1169 and 443 firms are small, medium and large firms, respectively.

Table 17: Distribution of Firms by Firm Size and Ownership Categories (2003-2012)

	Firm Size		
	Small	**Medium**	**Large**
Citizen-owned firms	39.34	33.36	26.19
Joint venture firms	19.45	27.12	23.70
Foreign-owned firms	41.21	39.52	50.11
Total	**100%**	**100%**	**100%**

Source: Author's calculations using the Botswana Customs Trade Statistics and the Annual Survey of Industrial Firms from Botswana Industrial Affairs.

Note: Firm size categorization is as per the Botswana Trade Act (size of Enterprises) order, 2011. The firm size categorization is as follows: Small firms (1 - 24 workers); Medium firms (25 - 100 workers); and Large firms (100+ workers).

Table 18 depicts the distribution of firms by firm ownership status split in terms of domestic manufacturers and exporting manufacturers. On average, between 2003 and 2012, the Botswana manufacturing exporters were dominated by foreign-owned firms (43.75%), followed by joint ventures (23.91%) and then citizen-owned firms (32.34%).

Table 18: Distribution of Firms by Firm Ownership and Trading Status (2003-2012)

	Domestic Manufacturers	**Exporting Manufacturers**
Citizen-owned firms	38.06	32.34
Joint venture firms	22.30	23.91
Foreign-owned Firms	39.64	43.75
Total	**100%**	**100%**

Source: Author's calculations using the Botswana Customs Trade Statistics and the Annual Survey of Industrial Firms from Botswana Industrial Affairs.

The distribution of firms by firm size and trading status category as depicted by Table 19 reveals that exporters in the manufacturing sector are more likely to be medium-sized firms (43.65%) or large firms (22.40%) than small firms (33.95%). In contrast, domestic manufacturers are more likely to be small-sized firms (58.51%) than being medium or large firms (41.49%).

Table 19: Distribution of Firms by Firm Size and Trading Status (2003-2012)

	Domestic Manufacturers	Exporting Manufacturers
Small	58.51	33.95
Medium	34.97	43.65
Large	6.52	22.40
Total	**100%**	**100%**

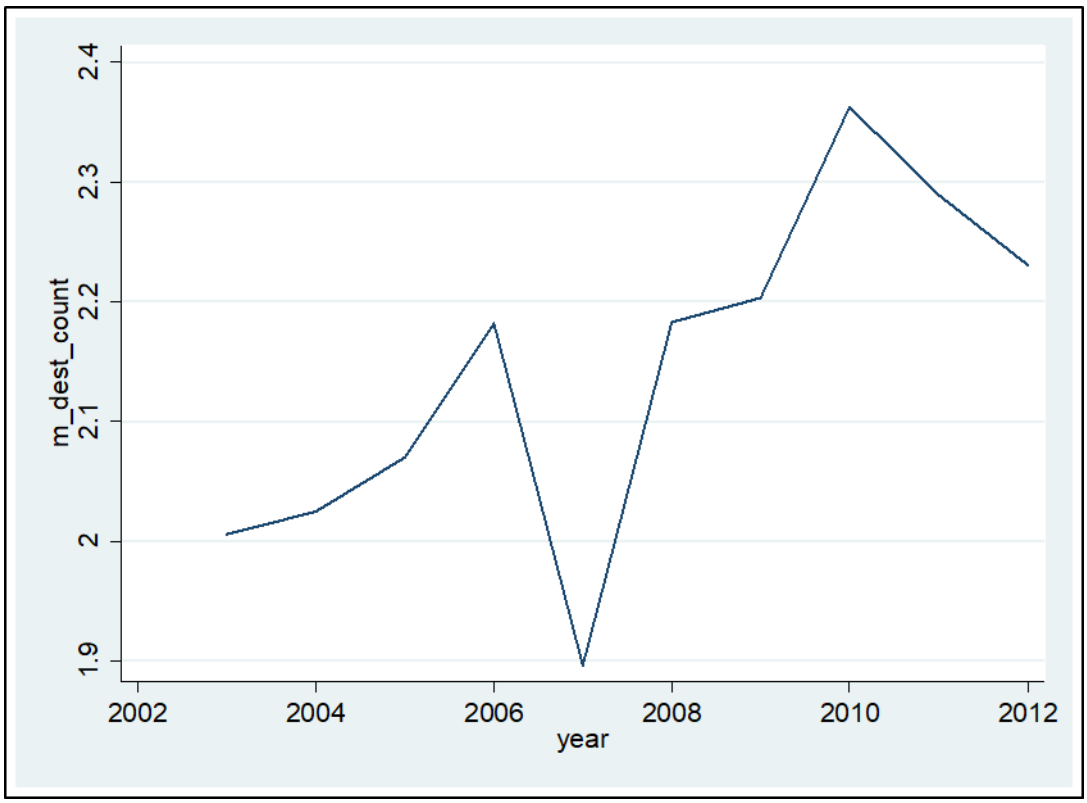
Source: Author's calculations using the Botswana Customs Trade Statistics and the Annual Survey of Industrial Firms from Botswana Industrial Affairs.

Note: Firm size categorization is as per the Botswana Trade Act (size of Enterprises) order, 2011. The firm size categorization is as follows: Small firms (1 - 24 workers); Medium firms (25 - 100 workers); and Large firms (100+ workers).

3.4.1.1. Exporter Heterogeneity

This section starts off first by discussing background evidence on exporter heterogeneity vis-à-vis export destinations before proceeding to discuss empirical results on how firm characteristics influence export destination choices. The background analysis on exporter heterogeneity on export destinations is based on a two-pronged approach, namely the macro approach as well as at the micro approach. We first start by exploring exporter heterogeneity at the macro-level by plotting average number of export destinations per firm over the period between 2003 and 2012. The results are shown in Figure 7 below. What is evident from Figure 7, is a pattern marked by ups and downs movements, but in general a rise, except for 2007, suggesting the presence of potential destination churning.

Figure 7: Average Number of Export destinations per firm over time (2003-2012)

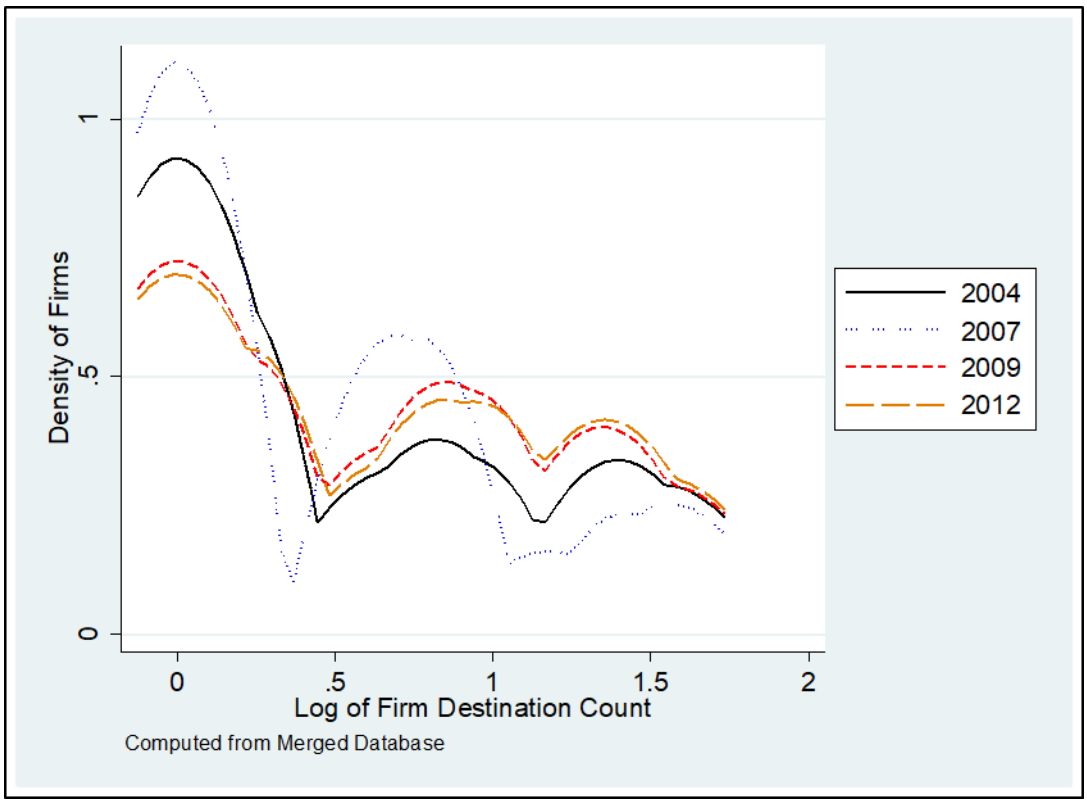


Source: Author's elaboration from the merged dataset.

Note: m_dest_count refers to mean destination count per firm.

We explore this further by unpacking this at the micro-level, as shown by Figure 8 which depicts kernel density distributions of the log number of export destinations per firm for the years 2004, 2007, 2009 and 2012. While the pattern of the distribution has remained the same over the years, Figure 8 depicts concurrent upward and downward movements in the distributions. This may point to the possibility that the distribution of the log number of export destinations per firm may not be driven by a normal distribution. As a general feature, Figure 8 suggests vast heterogeneity pertaining to the log number of export destinations per firm characterized by the presence of single destination exporters as well as multi-destination exporters. Evident from the below Figure is also the high proportion of firms that export to one destination. However, there is no clear pattern of distribution of firms by destination coupled with no clear trends in distribution, over time. These results substantiate the findings observed in Figure 7 above and are also in line with what has been obtained by Lawless (2010); Eaton et al. (2004) who find that majority of exporting firms in Ireland and France, respectively, were single destination exporters.

Figure 8: Distributions of log number of export destinations per firm (2004-2012)



Note: The sample used here only covers firms that are exporting in that year.

Further evidence pertaining to exporter heterogeneity relating to destinations is provided in Appendix ch3 (Table ch3D), which illustrates the distribution of firms across export destinations and their average exit and entry patterns in these destinations, over time.

Over the period 2003 to 2012, Botswana's manufacturing firms have had exporting relationships with 56 destinations per year on average, inclusive of countries from Africa (21 countries), Europe (14 countries), Asia (10 countries), the Americas (4 countries) and Middle East (4 countries) as well as Oceania (3 countries). 61.26% of Botswana's manufactured exports are destined to South Africa, giving evidence that South Africa remains the predominant export destination for Botswana's manufactured exports, given its proximity.

Table ch3D (in appendix ch3) offers two main insights: First, it suggests that although firms are able to break into the export markets, some are not efficient enough to survive. It is only in a few exceptions that the number of entrants is greater than the number of exiters, pointing to an increase in the net number of exporters. A case in point is for countries such as South Africa, China, Lesotho, Malawi, Namibia, Zimbabwe, Democratic Republic of Congo and Germany. Second, the top 10 export destinations account for 93% of the total exports in the sample, suggesting that exports are highly concentrated in these top ten trade partners. These findings

substantiate the importance of exploring the determinants of firm-based geographic export diversification for Botswana's manufacturing firms.

Figure 8 above has shown that a high proportion of Botswana's manufacturing exporters are single destination exporters, calling for the need to investigate where these particular firms export to. We categorize regions into Africa, Europe, Asia and Rest of the world [44].

The results as displayed in Table 20 show that whilst exporting firms are inclined to choose the closest region (Africa), these exporters are more likely to be single-destination exporters whilst firms exporting out of Africa are more likely to be multi-destination exporters. Specifically, manufactured exports destined to Africa are more likely to be done by single destination exporters (53.07%). This is in contrast to firms that export out of Africa as evidenced by 96%, 90% and 75% of firms exporting to Europe, Asia and Rest of the world, respectively, more likely to be multi-destination exporters. With South Africa being the dominant export destination during the review period (Table ch3D in appendix ch3), these results suggest that multi-destination exporter implies exporting out of Africa (or SACU region). The results seem to suggest that the geographic export diversity of the manufacturing firms may be enhanced by firms that export out of the SACU region.

[44] Rest of World category includes countries in the Americas and Oceania while countries in the Middle East form part of Asia.

Table 20: Distribution of export market diversification of firms with different regions (2003-2012)

	Number of export markets	Number of exporting firms	Firm-specific percentage (%)
Africa only	1	751	53.07
	2-4	510	36.04
	>=5	154	10.88
Europe only	1	3	4.00
	2-4	43	57.33
	>=5	29	38.67
Asia only	1	6	10.00
	2-4	35	58.33
	>=5	19	31.67
Rest of World	1	7	25.00
	2-4	13	46.43
	>=5	8	28.57

Source: Author's calculations using the Botswana Customs Trade Statistics and the Annual Survey of Industrial Firms from Botswana Industrial Affairs

Next, we provide the background evidence of exporter heterogeneity on export destinations with regard to firm ownership status between the period 2003 and 2012. The results as presented in Table 21 indicate that in all cases of firm ownership status, single destination exporters dominate. However, foreign-owned or joint-ventures are more likely to be multi-destination exporters as compared to firms with domestic ownership. Looking within firms, for example, about 53% of the citizen-owned firms export to only one export destination, while 47% export to more than one export destination. While 47% of citizen-owned exporters are multi-destination exporters, more than half of the joint-venture (52%) and foreign-owned (54%) firms are multi-destination exporters. These results substantiate the earlier findings on Table 3 that exporters are more likely to be foreign-owned firms or joint-ventures than citizen-owned firms.

Table 21: Distribution of export market diversification of firms with different ownership categories (2003- 2012)

	Number of export markets	Number of exporting firms	Firm-specific percentage (%)
Citizen-owned firms	1	271	53.14
	2-4	184	36.08
	>=5	55	10.78
Joint venture firms	1	180	47.75
	2-4	138	36.60
	>=5	59	15.65
Foreign-owned firms	1	315	45.65
	2-4	279	40.43
	>=5	96	13.91

Source: Author's calculations using the Botswana Customs Trade Statistics and the Annual Survey of Industrial Firms from Botswana Industrial Affairs.

Similarly, firm heterogeneity in respect to export market coverage is also evidenced among small, medium and large-sized firms as illustrated in Table 22. The results as depicted below are in sync with results already established in Table 19. Small firms are more likely to be single destination exporters while multi-destination exporters are more likely to be medium-sized firms or large firms than small firms. Specifically, larger firms are more likely to export to more than 5 destinations than small or medium firms. Hence, firm size is positively related to geographic export diversification. Within the firm, Table 22 below shows that about 25% of large firms export to a single destination, while 75% of them are multi-destination exporters. Furthermore, while only about 35% of small firms are multi-destination exporters, about 52% and 75% of medium-sized and large firms, respectively, are multi-destination exporters. To some extent, these results are in sync with the extant literature on this area which has also established exporter heterogeneity in terms of geographic export diversification (for example, Xuefeng et al., 2016), mainly because small firms are likely to lack the internal resources, thus inhibiting these firms to penetrate geographically and culturally distant markets (Love et al., 2016).

Table 22: Distribution of export market diversification of firms with different sizes (2003-2012)

	Number of export markets	Number of exporting firms	Firm-specific percentage (%)
Small firms	1	350	65.42
(1-24 workers)	2-4	151	28.22
	>=5	34	6.36
Medium firms	1	328	47.67
(25-100 workers)	2-4	280	40.70
	>=5	80	11.63
Large firms	1	87	24.65
(100+ workers)	2-4	170	48.16
	>=5	96	27.20

Source: Author's calculations using the Botswana Customs Trade Statistics and the Annual Survey of Industrial Firms from Botswana Industrial Affairs.

Note: Firm size categorization is as per the Botswana Trade Act (size of Enterprises) order, 2011.

3.4.2. Empirical Results: Zero-inflated adjusted Destination Choice Model

3.4.2.1. Descriptive Analysis

The results in this section are based on the Zero-inflated Poisson regression model given that there are a large number of zeros in the dependent variable emanating from the fact that many firm-year observations are zeros. However, we first present descriptive statistics of the key variables used in the empirical estimations, which are displayed in Tables 23 and 24 as well as Figure 9 before presenting empirical results on the impact of firm productivity on geographic export diversification in Table 25. It is important to assess upfront whether there are any significant heterogeneities between single destination exporters and multi-destination exporters, before we could proceed to the empirical estimation. To do this we follow Bernard and Jensen (1999), Xuefeng et al. (2016) and Lawless (2009), to come up with a comprehensive descriptive regression that combines exporter premia as well as multi-destination premia, with a slight modification of differentiating between the regions (SACU vs non-SACU) that a single destination exporter exports to.

A comparison of single destination firms exporting to the non-SACU region relative to those that solely export to the SACU region as depicted in Table 23 confirms that there is no statistical difference between these two groups of firms in terms of performance premia. In

particular, Table 23 shows that single destination exporters to outside of SACU are not significantly different from single destination exporters to SACU. However, performance premia is evidenced when firms start becoming multi-destination exporters relative to single destination exporters exporting to the SACU region[45]. What is surprising is that labour productivity (proxied by turnover/worker) is not significant. This could be because sales/worker is a poor measure of labour productivity.

Overall, these results are in accordance to theoretical expectation and to the extant empirical literature (Lawless, 2009); Xuefeng et al., 2016). Specifically, at any point in time, multi-destination exporters are larger, invest more, are more productive, older and have many years of exporting experience relative to single destination exporters. Additionally, contrary to existing empirical literature where the firm age variable is invariably negative and insignificant, for Botswana's case, the firm age variable is positive and significant. This suggests that multi-destination exporters are older than the other firms. These results are consistent with those of chapter two[46].

[45] Exporting out of the SACU region is associated with being a multi-destination exporter whereas SACU only exporters are more likely to be single destination exporters.

[46]Further evidence on exporter premia, reflecting differences between exporters and non-exporters can be viewed in Appendix ch3 (Table ch3E). The results generally point to the fact that exporters are positively different from non-exporters in terms of firm characteristics. We followed the approach used by Bernard and Jensen (1999) to estimate the regressions.

Table 23: Multi-Destination Exporter Premia (2007- 2012)

VARIABLES	(1) Investment	(2) Turnover	(3) Employment	(4) Age	(5) Turnover/Worker	(6) Exporting Experience
Out of SACU Single Destination Exporter	-0.065	-0.059	-0.133	-1.353	0.074	-0.113
	(0.224)	(0.275)	(0.141)	(1.700)	(0.245)	(0.100)
Multi-destination Exporter	0.829***	0.686***	0.579***	2.163***	0.098	0.372***
	(0.117)	(0.130)	(0.073)	(0.730)	(0.106)	(0.048)
Industry Control	Yes	Yes	Yes	Yes	Yes	Yes
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
Constant	15.415***	14.186***	2.988***	25.157***	10.633***	0.546***
	(0.211)	(0.348)	(0.126)	(2.195)	(0.297)	(0.079)
Observations	879	845	885	823	845	886
R-squared	0.278	0.265	0.298	0.175	0.220	0.166

Robust standard errors in parentheses clustered at the firm-level

Note: 1) Values are given in natural logarithms, except for firm age and exporting experience.

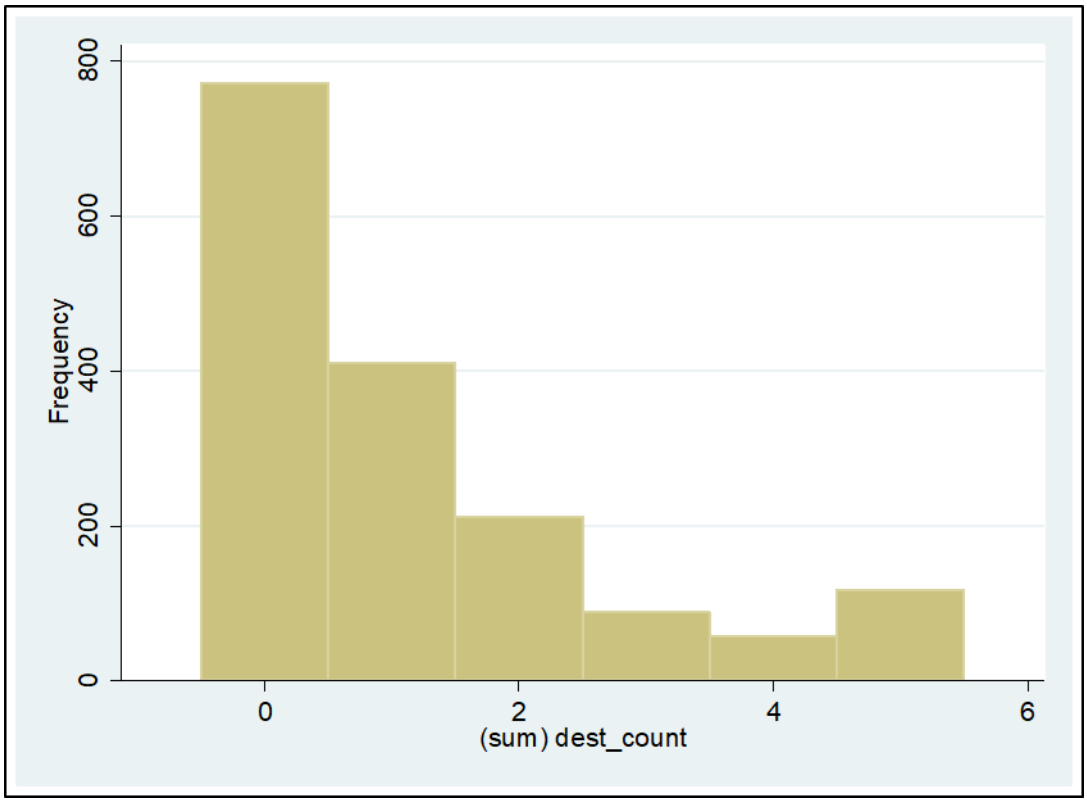
2) Data pooled over the period 2007 – 2012.

3) The purpose of this table is simply to describe heterogeneity.

Source: Author's calculation using the merged dataset.

Figure 9 plots frequencies of counts of export destinations. The sample used is comprised of firms that export at least once as well as domestic manufacturers. Striking in the Figure is the high proportion of firms that report zero number of export destinations. Out of the 1660 firm-year observations, 772 (47%) of these report zero number of export destinations. These statistics present first-hand evidence justifying that the use of probit or logit models may not be appropriate given the potential biased results emanating from the correlation of the error term with the explanatory variables (De Benedictis and Salvatici, 2011).

Figure 9: Destination Count Frequencies



Note: The last bar of the histogram represents destinations that are 5 or more.

It is important to explore how, over time, firms are transitioning into the different states defined in terms of number of export destinations before we can proceed to the empirical analysis. Table 24 therefore provides some insights into the variation of number of destinations over time via the aid of transition probabilities. The Table portrays evidence of considerable persistence particularly in the zero category as well as the five or more export destinations category. 74% of firms with zero number of export destinations in the previous year also have zero number of export destinations the current year. About 33% of firms with five or more export destinations in the previous year will serve the same export destinations in the current

year. Hence, the results suggest that once a firm is in the zero category it will remain difficult for it to engage in bilateral trade in the future. This finding on persistence in the export process was also found by Lawless (2009) – that firms seldom change their status as exporters or non-exporters.

Table 24: Year to Year Transitions in number of export destinations

		t						
		0	**1**	**2**	**3**	**4**	**5+**	**Total**
t-1	**0**	73.78	15.23	5.36	1.50	1.69	2.44	100
	1	61.00	24.23	9.75	1.95	1.39	1.67	100
	2	43.62	19.68	18.62	7.98	3.72	6.38	100
	3	31.51	10.96	19.18	16.44	6.85	15.07	100
	4	29.17	14.58	10.42	16.67	12.50	16.67	100
	5+	25.24	2.91	10.68	17.48	10.68	33.01	100
	Total	62.62	16.57	8.56	4.14	2.83	5.29	100

3.4.2.2. Empirical Analysis

The descriptive analysis above (Table 23) seems to suggest that there is no productivity premia between multi-destination and single destination exporters. This contradicts theoretical expectations and hence further empirical investigation is performed to investigate this. The empirical estimation of this chapter relies on a sample of manufacturing firms that includes both exporters and domestic manufacturers. It follows a two-pronged approach.

As a first approach to testing the underlying hypothesis that more productive firms are more likely to be multi-destination exporters, we estimate the baseline model using the logit model, focussing on exporting firms and ignoring domestic manufacturers. These results are shown in column 1 of Table 25. In column (1) geographic export diversification is defined by a dummy variable coded one if a firm exports to more than one export destination and zero otherwise. Labour productivity is proxied by a one period lag of log turnover per worker. The coefficient on the measure of labour productivity takes an unexpected negative sign and is significant. This is a striking result that seems to suggest that firm productivity has a dampening role on the determination of the number of export destinations served by a firm. This result does not make intuitive sense and it contradicts theoretical predictions of firm heterogeneity models (Melitz, 2003; Chaney, 2008).

On the other hand, domestic ownership has the expected negative sign and is significant at the 10% level. Other control variables with theoretically expected signs are firm size (proxied by number of employees employed by a firm) and firm exporting experience (in years) as calculated by the ((difference between the last year and the first year the firm exported) plus 1) with positive impacts on number of export destinations. These results make intuitive sense and

are in accordance with findings of earlier empirical studies such as Lawless (2010) and Love et al. (2016).

Given the potential shortcoming of the logit model estimation attributed to its inability to conform to the process that generates the trade data, we next proceed to the second approach of this analysis. This is done by considering exporting, including to multiple destinations, as an event of rare occurrence that is better depicted by a Poisson distribution rather than a normal or logistical distribution. To distinguish amongst multi-destination exporters, the dependent variable is defined as the number of export destinations served by a firm in a given year, starting from 0,1,2,3, etc, where a firm records a zero destination count if it is a domestic manufacturer. The advantage of this approach is that it considers both exporting and domestic manufacturers, as well as the number of destinations a firm exports to. Columns 2 - 5 of Table 25 provide results for the count data models estimated.

We will start by focussing on the results of the Pooled Poisson in column 2. It is interesting to note that when we consider the process that generates the trade data, the firm productivity variable takes the expected positive sign and is significant. Firm size is also found to positively influence firm's export destination diversification. The analysis further considers the Mundlak-augmented Negative Binomial regression model (column 3) which attempts to address the issue of the presence of correlation between the error term with the explanatory variables, a feature that is more common in panel data (Mundlak, 1978; Papke and Wooldridge, 2008; Wooldridge, 2010; Gebreeyesus, 2015). This is achieved by introducing averages of the time-varying variables as additional explanatory variables. The results of the joint significance test of the time-averaged explanatory variables (column 3) rejects the hypothesis that the group-mean variable is zero, confirming that unobserved heterogeneity is correlated with the time-averaged variables. However, the results show no conclusive evidence with regard to the productive impact of geographic export diversification, except that exporting experience matters for geographic export diversification.

Next due to the fact that firm selection into the export markets may be correlated with unobserved heterogeneity, we focus on the results of the Zero-inflated Poisson regression model (columns 4 - 5), which is estimated using equation (3)[47]. This is largely because of the high proportion of zero number of export destinations (see Figure 9) and that trade data,

[47] The reasoning being the significant over-dispersion test (see Table ch3F in Appendix ch3) suggesting that the Zero-inflated Poisson model is favoured relative to the standard Poisson model.

particularly in the context of geographic export diversification (that is, number of export destinations) is produced in a discrete and countable manner.

The regression results in columns 4 – 5 encompass the two-stage procedure of the Zero-inflated Poisson regression model, where column 4 is the first stage that corrects for the large number of zeros (domestic producers). We first present results in column 4. The firm productivity variable measures the average productivity for each firm (lag productivity (average)). The results reveal that the more productive firms are most likely to enter the export markets. That is, the more productive firms are less likely to sell to domestic market only. This finding is consistent with theoretical expectations (Melitz, 2003). The results as depicted by the control variables are also in line with theoretical expectations in that foreign-owned and large firms are those that are most likely to export. Specifically, domestic ownership is found to dampen firm entry into the export markets. The age variable remains insignificant.

The destination count regression is depicted in column (5). It is interesting to note that when we take into consideration the selection effect that address the large number of zeros in the dependent variable, the coefficient of lag productivity takes the expected positive sign, but is insignificantly different from zero. This is counterintuitive and may point to the measure of turnover/worker as a poor proxy for firm productivity. What is also striking is that firm foreign ownership does not influence firm destination count. The control variables that take the expected signs and are also significant are firm size and exporting experience. Specifically, the results show that large and highly experienced firms tend to export to more export destinations.

Table 25: Empirical Results of the Determinants of Geographic Export Diversification- All destinations (2007-2012)

	(1)	(2)	(3)	(4)	(5)
				Zero-inflated Poisson Model (Baseline)	
VARIABLES	Pooled Logit Model	Pooled Poisson Model	Mundlak-augmented Negative Binomial Model	Non-exporting Logit	Destination count
Lag productivity (average)			0.076	-0.407***	0.031
			(0.052)	(0.147)	(0.031)
Lag productivity	-0.137*	0.103***	-0.044		
	(0.076)	(0.033)	(0.038)		
Citizen_owned_dummy	-0.505*	-0.149	-0.113	1.437***	-0.123
	(0.301)	(0.134)	(0.103)	(0.510)	(0.080)
Joint_venture_dummy	-0.452	-0.124	0.012	-0.047	-0.087
	(0.284)	(0.136)	(0.106)	(0.984)	(0.094)
Log number of employees	0.532***	0.427***	0.038	-1.150***	0.157***
	(0.134)	(0.046)	(0.103)	(0.278)	(0.045)
Exporting experience (years)	0.449***		0.420***		0.366***
	(0.077)		(0.024)		(0.020)
Age in years		0.002	-0.016	-0.037	
		(0.006)	(0.025)	(0.027)	
Log number of employees (average)			0.141		
			(0.114)		
Age in years (average)			0.007		
			(0.026)		
Constant	-1.458	-2.564***	13.417	-10.848***	-2.074***
	(1.221)	(0.431)	(306.998)	(2.278)	(0.390)
Industry control	Yes				
Year control	Yes				
Observations	477	765	765	1,268	1,268
Zero Observations					551
Vuong test (z)					0
AIC		2330.871	1720.887		2892.515
BIC		2358.71	1776.565		2954.258
Likelihood ratio test			Chibar2(01)=28.79		
			(p=0.000)		
Number of unique_id	218		321		

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

One potential problem arising from the baseline Zero-Inflated Poisson Model in columns (4) and (5) of Table 25 could be because we have lumped destinations together and ignored the fact that Botswana manufacturing firms rely heavily on the SACU market. As the SACU market is an extension of the domestic market, exporters to SACU may not necessarily be characterized by a productivity premium relative to firms that only sell to the domestic market. This brings us to the second research question of this chapter, that is, is there a productivity premium of exporting out of the Southern African Customs Union (SACU)? We therefore extend the baseline model in Table 25 by including as explanatory variables the Out_of_SACU dummy (which is coded one if a firm exports outside the SACU region, and zero if it exports to the SACU region) as well as an interaction term between lag productivity and Out_of_SACU dummy.

The results as presented in Table 26 on the non-exporting logit model (in column 1) remain more or less the same as those depicted in the baseline non-exporting logit model in column 4 of Table 25. Interestingly, once the firms have entered the export markets, results on the destination count regression (column 2) show that for these firms, exporting outside the SACU region dampens firm export destination diversification[48]. However, for more productive firms, being a multi-destination exporter is associated with exporting out of the SACU region. This is evidenced by the positive and significant interacted term between firm productivity and the out of SACU dummy. Thus, these results confirm the hypothesis that there exists a productivity premium of exporting out of the SACU region. Control variables such as firm size and exporting experience have also been found to positively influence export destination diversification. Columns 3 -4 strictly focussed on firms that export out of the SACU region, by assuming that firms that export to SACU only region are domestic manufacturers. The results corroborate those in column 2, that is, there is a productivity premium associated with exporting out of the SACU region. Firm size and exporting experience also matter for firm export destination diversification, with domestic ownership stifling firm export destination diversification.

[48] Because of trade preferences (SACU), firms that enter the export markets largely export to the neighbouring South Africa, which has a low productivity threshold as compared to destinations out of SACU. This means that only the more competitive firms will be able to export out of SACU.

Table 26: Firm Productivity and Export Destination Diversification - Out of SACU destinations (2007-2012)

	(1)	(2)	(3)	(4)
	Zero-inflated Poisson Model (Extended)		Zero-inflated Poisson Model (out of SACU destinations)	
VARIABLES	Non-exporting Logit	Destination count	Non-exporting Logit	Destination count
Lag productivity (average)	-0.009	-0.032	-0.027	0.175***
	(0.141)	(0.033)	(0.132)	(0.055)
Citizen_owned_dummy	-3.018***	-0.093	0.490	-0.249**
	(1.111)	(0.073)	(0.306)	(0.126)
Joint_venture_dummy	1.040**	-0.124	0.095	-0.249
	(0.455)	(0.086)	(0.295)	(0.165)
Log number of employees	-0.898**	0.134***	-0.263*	0.219***
	(0.390)	(0.038)	(0.140)	(0.070)
Exporting experience (years)		0.353***		0.348***
		(0.019)		(0.058)
Age in years	0.081		-0.005	
	(0.051)		(0.014)	
Out_of_SACU dummy		-1.315**		
		(0.587)		
Lag productivity(average)*Out_of_SACU dummy		0.147***		
		(0.048)		
Constant	-17.345***	-1.302***	2.265	-3.770***
	(1.926)	(0.399)	(1.799)	(0.782)
Observations	1,268	1,268	1,268	1,268
Zero Observations		551		1086
Vuong test (z)		0		12.17
AIC		2808.463		1539.759
BIC		2880.496		1601.501

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In order to explore why firm productivity does not significantly influence firm export destination diversification in Table 25 (column 5), we extend the analysis by excluding primary products such as diamonds and beef from the sample. The poor productivity relationship may reflect that exports of these products may not be related to firm productivity. For example, Botswana has a preferential trade agreement with the European Union, specifically to provide a market for Botswana's beef exports. The results on the relationship between firm productivity and geographic export diversification using a sample of firms that export non-primary products are presented in columns 1-2 of Table 27. As anticipated, if firms that export primary products such as beef and minerals are excluded from the sample, firm productivity using the turnover/worker measure is now positive and significant at the 10% level (column 2). The relationship between firm productivity and export destination diversification works even better when the analysis considers out of SACU destinations, as the coefficient of firm productivity is now positive and significant at 1% level (column 4).

Table 27: Firm Productivity and Export Destination Diversification – Non- Primary Products Exports (2007-2012)

	(1)	(2)	(3)	(4)
	Zero-inflated Poisson Model (Non-primary Products)		Zero-inflated Poisson Model (Non-Primary Products & out of SACU destinations)	
VARIABLES	Non-exporting Logit	Destination count	Non-exporting Logit	Destination count
Lag productivity (average)	-0.319***	0.054*	-0.103	0.145***
	(0.122)	(0.028)	(0.129)	(0.056)
Citizen_owned_dummy	1.116***	-0.117	0.360	-0.221
	(0.428)	(0.078)	(0.318)	(0.135)
Joint_venture_dummy	-0.084	-0.061	0.152	-0.211
	(0.705)	(0.091)	(0.309)	(0.173)
Log number of employees	-1.093***	0.167***	-0.293**	0.218***
	(0.209)	(0.044)	(0.142)	(0.076)
Exporting experience (years)		0.367***		0.346***
		(0.020)		(0.061)
Age in years	-0.032		-0.005	
	(0.024)		(0.014)	
Constant	-10.912***	-2.334***	3.314*	-3.366***
	(1.683)	(0.362)	(1.773)	(0.843)
Observations	1,162	1,162	1,162	1,162
Zero Observations		506		991
Vuong test (z)		0		11.35
AIC		2686.677		1448.515
BIC		2747.372		1509.21

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.5. Conclusion

This study presents the first evidence in the context of Botswana on firm characteristics that influence export destination choice(s). Specifically, the study has explored the question of whether more productive firms export to multiple export destinations and whether there exists a productivity premium of exporting out of the SACU region. The study is based on a dataset that combines manufacturing firm characteristics with export transaction-level data. We find evidence suggesting the following stylized facts. Firstly, that domestic ownership is inversely related to firm size, implying that as firm size increases, firms are highly likely to be joint-venture firms or foreign-owned firms. In this regard, we found evidence that foreign-owned or joint-venture firms are more likely to be exporters (multi-destination exporters) than citizen-owned firms. Secondly, exporters in the manufacturing sector (particularly multi-destination exporters) seem to be more likely to be medium-sized firms or large firms than being small firms. As a general feature, vast firm heterogeneity pertaining to the log number of export destinations per firm is evidenced, suggesting that exporters frequently experience changes in their export destination portfolios. However, what remains a fact is that the bulk of Botswana manufacturing exports (93%) are concentrated in the top ten export destinations, with South Africa being the predominant export destination.

More importantly, the study also provides some empirical evidence on the firm characteristics associated with the decision to export and the extent of coverage of different export destinations relying mainly on the Zero-inflated Poisson regression model. The study has empirically explored the question of whether more productive firms are likely to be multi-destination exporters, and if in the affirmative, whether this positive effect is accentuated by exporting out of the SACU region. While the exporting-productivity literature has provided strong evidence on the positive relationship between the two, to the best of our knowledge, none of the previous empirical studies has explicitly considered exporting out of a predominant customs/trade bloc as a potential channel to enhance the productivity effect. This study intends to fill this gap by focussing on Botswana, where the majority of exporting firms in the manufacturing sector are heavily reliant on the SACU market for their exports. We argue therefore that for Botswana, the exporting-productivity nexus may be driven by whether firms export out of the SACU region or not.

The study therefore contributes to the exporting-productivity literature by bringing in the role of trade integration. Consistent with theoretical predictions, the study established that the more productive firms are less likely to sell in the domestic market only. That is, the more productive firms are most likely to enter the export markets. The results further show evidence that the more productive firms, especially those that export out of the SACU region are more likely to be multi-destination exporters.

Specifically, 3 key insights are supported by the empirical results: Firstly, for the sample including all exporters, the productivity relationship is entirely explained by entry into exporting, with no additional association with number of export destinations; Secondly, for non-primary products, firm productivity influences both entry into exporting and number of destinations. Thirdly, for out of SACU destinations, there is no significant association between entry into exporting and productivity, but a strong relationship between firm productivity and number of export destinations.

Related to other firm characteristics, the study provides evidence that foreign-owned, large and older firms are those that are most likely to export. Once these firms are exporting, firm size and exporting experience matter for geographic export diversification. These results have important policy implications and thus call for the development of market access strategies that address inefficiencies that hinder firms' success in the export markets. Second, Government tax policy should be geared towards encouraging joint-ventures with the small firms, with a view to encouraging more firms to export outside the SACU region. This is particularly crucial for Botswana, where policy makers expect firms to expand export destinations, in order to cushion the country against vulnerabilities associated with regional shocks.

Lastly, notwithstanding the study's potential contribution, its major weakness lies in a lack of a proper measure of firm productivity due to data limitations. Thus, we suggest that further studies be done in the future once there are data that enable estimation of Total Factor Productivity (TFP) at the firm-level. The next chapter will focus on importing as a potential channel that could directly foster firm productivity (as well as firm competitiveness) and thus export diversification.

Chapter 4

4. Imported Intermediate Inputs, Product Complexity and Export Destination Diversification: Firm-level Evidence from Botswana

4.1. Introduction

What determines firm export destination diversification? The growing interest in understanding the determinants of firm export destination diversification is inspired by the high export value that is associated with export destination diversification and hence aggregate export and economic growth (Chaney, 2008; Melitz, 2003). Theoretically and empirically, firm productivity has been cited as a contributory factor to the firm's realization of export destination diversification. The productivity gains enable firms to overcome the productivity thresholds specific to each export destination and product (Andersson et al., 2008). To this end, the firm's use of imported intermediate inputs has been cited as one of the potential channels of stimulating firm productivity through variety, learning or higher quality effects of imported inputs (Amiti and Konings, 2007; Halpern, 2015; Keller and Yeaple, 2009 and Yasar and Paul, 2008) and thus export destination diversification. Hence, firms are increasingly involved in the importation of intermediate goods and the export of intermediate goods or final goods, commonly known as global value chains. To this end, trade in intermediate goods now accounts for about half of global trade (OECD and WTO, 2013).

Studies by Dornbusch (1992); Amiti and Konings (2007); Keller and Yeaple (2009) and Yasar and Paul (2008) on the literature on international technology transfers posit that the use of foreign inputs by domestic firms is a potential channel of transmitting foreign technology to domestic firms given that the inputs are usually embodied with high technology. Similarly, Ethier (1982) as well as Turco and Maggioni (2013) argue from the perspective of the input complementarity hypothesis that a firm's use of a variety of imported intermediate inputs in its production process raises its productivity and subsequently its export performance. Thirdly, literature has established that firms that both export and import (two-way traders) have relatively large productivity premiums in comparison to those that solely do exporting (Muuls and Pisu, 2009; Bas, 2012). This productivity premium is attributable to the high degree of international globalisation that the two-way traders find themselves engaged in. Kasahara and Lapham (2013) and Cadot et al. (2013) have argued that if a firm imports from a country, it is most likely to export to the same country as importing entails establishing a network with foreign suppliers, learning government regulations, etc, hence enhancing the "cross-firm

synergy". In a similar vein, from the cost-saving hypothesis, literature argues that the origin of the intermediate inputs matters as it may serve as a proxy for technology transfer or lower cost, thereby increasing the profitability of a firm and its ability to bear the fixed cost of exporting (Bas, 2012; Turco and Maggioni, 2013).

Theory has also indirectly linked the strength of the input complementarity and technology transfer hypotheses to the complexity of the intermediate inputs. The productivity-enhancing effects of imported intermediate inputs are thus strongly linked to the spillover and competition effects associated with the product complexity of the inputs (Eaton and Kortum, 1999; Chaney, 2008). The growth in productivity of firms is thus determined by whether a firm produces heterogeneous or homogenous intermediate inputs, with differentiated intermediate inputs enhancing the strength of the input complementarity channel. Thus, confirming the Nelson hypothesis that predicts that multi-product firms have the ability to produce more basic innovations[49] (Bernard et al., 2011; Liu and Rosell, 2013). Specifically, the Nelson hypothesis predicts that due to uncertainty, product diversification will be a prerequisite for basic research (Link and Long, 1981).

To this end, in attempting to understand the direct effects of a firm's use of imported intermediate inputs on export destination diversification, through their impact on firm productivity, this chapter is inspired by the input complementarity hypothesis as well as the technology transfer channel. Specifically, the study intends to answer the following research questions:

1) How does complementarity of a firm's use of imported intermediate inputs affect its export destination diversification?
2) Does the complementarity effect work stronger through differentiated or homogenous products?

Although emerging empirical literature on the effects of access to imported intermediate inputs on export outcomes is well documented, the existing studies suffer from serious endogeneity concerns relating to the reverse causation between imports and exports. Not addressing this endogeneity bias will result in unbiased estimates. However, research on the importing-exporting nexus has been hindered by the absence of a valid instrument that could be used to provide exogenous variation in imported intermediate inputs.

[49] Trade literature has described multi-product firms as the most productive firms (Bernard et al., 2011).

Firstly, some existing studies have attempted to solve this potentially important concern by instrumenting with firm level input tariffs (Feng and Swenson, 2016). We argue that in the absence of a valid instrument that can be used to provide exogenous variation in imported intermediate inputs, input tariffs may suffer the limitation of being correlated with other unobservable variables that affect the firm level export destination diversification. This would therefore render estimates of its effect biased. Noteworthy to mention is the unobserved power of lobbying groups in the various industries. As an example, from the perspective of political economy literature, one could argue that when exporting is highly concentrated, large exporters may have disproportionate influence on the setting of tariffs on intermediate inputs (Grossman and Helpman, 1994). Consequently, this suggests that the input tariffs will not be independent of the exports[50]. Secondly, the use of input tariffs as an instrument for imported intermediate inputs may be hampered by the lack of variation in input tariffs over time.

This chapter addresses the endogeneity concern regarding the relationship between imports and exports using the case study of Botswana. The choice of Botswana is motivated by a number of reasons. Firstly, Botswana is a small country that is a member of a Customs Union in which South Africa dominates. Botswana thus adopts the common external tariff (CET) of the customs union. Historically, the CET has been determined by South Africa in accordance with its own industrial policy needs. Although the 2002 SACU agreement provides scope for joint decision making on tariffs, the tariff institutions within the other four member countries of SACU have not yet been established. This has resulted in a de facto continuation of the prior policy where South Africa administers and sets the tariffs.

Secondly, and most importantly, South Africa entered into a free trade agreement with the European Union in 2000, independent of the other SACU member states. The Agreement on Trade, Development and Cooperation between the European Union and the Republic of South Africa (TDCA) [51] allowed South Africa to reduce tariff barriers on imports from the EU, while Botswana and the other SACU members continued to impose the Most Favoured Nation rates on goods directly imported from the EU. Botswana firms will have benefitted in the form of

[50] Thus, depending on the power of the lobbying groups, the endogeneity bias could lead to an over- or under-estimation of the causal effect of imported intermediate inputs on the firm's export destination diversification.

[51] This agreement is particularly relevant for Botswana's manufacturers, given that the bulk of Botswana's imports (both intermediate and final goods) are sourced from South Africa.

cheaper imports from South Africa to the extent that EU competition drove down the price of South African produced import substitutes.

Thirdly, South Africa serves as the major trade hub for imports destined for the other SACU members. Many of the EU products are cleared at the South African borders and then flow freely within the customs union. Consequently, EU origin goods imported duty free under the TDCA were able to flow into Botswana and bypass the Most Favoured Nation (MFN) rates still imposed by Botswana. This study uses the exogeneity of the SACU tariff for firms in Botswana to identify the effect of imports on export destination diversification in Botswana.

Fourthly, Botswana's exporters are highly dependent on imported intermediate inputs and they largely export to a single destination (that is, South Africa). Thus, we would expect the trade shock from the EU-SA TDCA agreement to have a substantial impact on these exporters. This trade shock thus presents an opportunity to assess to what extent it has induced Botswana's firms to seek other export markets. Finally, the associated trade liberalization has accorded Botswana's firms better access to new source countries. This input complementarity advantage is expected to boost the overall firm productivity.

In light of the above, with this chapter, the focus of the importing-exporting nexus is on the input complementarity channel as well as the technology transfer channel. This is premised on the theoretical argument that technology embedded in imports increases the firms' productivity. An investigation of the impact of imported intermediate inputs on a firm's export destination diversification by product complexity is inspired by the fact that the differentiated (complex) intermediate inputs accounted for 73 percent of total intermediate inputs imported by Botswana's manufacturers over the period between 2003 and 2012 (Botswana Transaction Trade Dataset).

This chapter studies the relationship between importing and firm export destination diversification using firm-level data on export and import transactions obtained from Statistics Botswana for the period between 2003 and 2012. We also use tariff data from the WITS database as well as product complexity classification of Rauch (1999). The analysis of this study is restricted to firms that export manufactured goods as identified by ISIC Rev3 codes 15 up to 37. The EU-South Africa TDCA agreement serves as an instrument, thus enabling us to use the input tariffs applied on the European Union products by South Africa to obtain an exogenous variation for firms' intermediate imports.

The chapter is structured as follows. Section 4.2 reviews existing literature and related evidence on the relationship between firm's access of imported intermediate inputs and export performance in terms of export destination diversification. This is followed by the description of the data used in Section 4.3. Then the theoretical model of simultaneous firm exporting and importing including the empirical model as well as identification strategy are discussed in Section 4.4. Section 4.5 presents the empirical results while Section 4.6 concludes, drawing some policy implications.

4.2. Literature Review on Firm Importing and Export Destination Diversification

4.2.1. Theoretical Background

The discussion on the theoretical literature on the productivity-enhancing effects of imported intermediate inputs and their link to export destination diversification is four-fold; (i) models linking firm productivity to export destination diversification (ii) models favouring the existence of such productivity-enhancing effects through access to more varieties of inputs, higher quality inputs as well as learning effects (Amiti and Konings, 2007); (iii) models refuting the existence of such productivity-enhancing effects such as the effective protection literature; (iv) models linking productivity-enhancing effects of imported intermediate inputs to destination export diversification; as well as models linking the strength of the input complementarity channel to the complexity of imports. We start by discussing those models that link firm productivity to number of export destinations.

The primary question guiding this theoretical literature is what causes firm export destination diversification? Firstly, there exists models that link firm productivity to the number of destinations served by a firm, in the likes of Melitz (2003) model and the Chaney (2008) model. Specifically, the Melitz (2003) model argues that due to the presence of the export market entry costs associated with each specific export market, only the most productive firms will be able to enter the export markets and increase their export sales.

By extension, the Chaney (2008) model incorporates in the Melitz (2003) model a world with asymmetric countries differentiated by asymmetric trade barriers, making it an ideal model of firm selection into exporting. The model further distinguishes a theoretical channel through which firm productivity links with the number of export destinations served by each firm. This model predicts that the presence of fixed costs of exporting causes firms in the differentiated product sectors to operate under increasing returns to scale technology. This suggests that only

the most productive firms will be in such sectors and will thus be able to overcome the fixed costs associated with entering the different export markets. The Chaney (2008) model therefore explains variation in number of export destinations served by a firm by assuming that each export market has its own specific fixed cost of exporting. This suggests that only the most productive firms will be able to access many export destinations.

Having attributed the variation in firm export destination diversification to firm productivity, we next ask what causes firm productivity to vary? This question is prompted by the fact that according to the Melitz (2003) model, firm productivity does not vary over time (Impullitti et al., 2013). Literature on international technology diffusion posits imports as an important channel for knowledge and technology transfers (Keller, 2004; Rivera-Batiz and Romer, 1991). This literature is premised or derived from R&D-based models of growth and trade where technology and knowledge are embodied in differentiated intermediate capital goods (Eaton and Kortum, 1999). The models of international technology diffusion predict that a country that imports largely from high R&D source countries is likely to get much technology from the intermediate inputs, presented via higher productivity levels (Grossman and Helpman 1991). Although these models are able to predict the relationship between imported intermediate inputs and productivity, their drawback is their focus on sector/country-level rather than on firm-level, suggesting that firms in a country are considered as a homogenous group (Eaton and Kortum,1999; Rivera-Batiz and Romer, 1991; Grossman and Helpman, 1991). In addition, these models are more concerned with the prediction of the link between imported intermediate inputs and productivity and less explicit on the direct channel of imported intermediate inputs on firm export destination diversification.

Imported intermediate inputs have also been the subject of recent theoretical literature on incomplete contracts and intra-firm trade (Antras, 2003; Antras and Helpman, 2004; Muuls and Pisu, 2009). Premised on a world of incomplete contracts in which final-good producers have to obtain specialized intermediate inputs from their suppliers, this theory argues that the specialized intermediate inputs should be of high quality for production of the final goods to require no further costs (Antras, 2003). This is suggestive of the fact that imported intermediate inputs can deliver a cost-saving channel to manufacturing firms that import high-quality intermediate inputs. The model further predicts that high productivity firms will import the intermediate inputs whereas low productivity firms will source them domestically. However, the drawback of this model is that a distinction cannot be made beforehand by an outside party

whether the intermediate input is of low or high quality, this being attributable to the incomplete contracting nature of the model.

In contrast to the preceding models that favour the existence of the productivity-enhancing effects of imported intermediate inputs, there also exist models that refutes the existence of such productivity-enhancing effects. For example, models of effective protection literature (Amiti and Konings, 2007). In their model, Corden (1971) argues that access of imported intermediate inputs attributable to lower input tariffs may increase the effective rate of protection[52], leading to reduced import competition and subsequently to lower productivity as firms miss out on the advanced technology embedded in imported inputs.

The prior discussion of models that link access to imported intermediate inputs to firm productivity is followed by models linking the productivity-enhancing effects of imported intermediate inputs to firm export diversification. We start with the Melitz and Ottaviano (2008) who developed a trade model of heterogeneous firms to study how access to high-quality and cheaper foreign intermediate goods affects domestic firms' export performance within the same industry. This model is further extended by Bas (2009) by introducing two factors of production being domestic and imported intermediate goods[53]. In this framework, industry differentials are determined by differences in the imported input intensity or import duties administered on the intermediate inputs. The model predicts that the higher the industry's imported input intensity or the lower the import barriers administered on the intermediate inputs, the higher the domestic firms' competitiveness. A reduction in trade costs thus serves as a uniform increase in productivity for the firms in a particular sector (Maggioni and Turco, 2013). This assumption of uniformity is one particular limitation of the Melitz and Ottaviano (2008) as a reduction in trade costs or an increase in imported inputs intensity could not affect firms in the same industry the same, particularly if they differ in productivity levels.

Kasahara and Lapham (2013) model of simultaneous exporting and importing is based on the Melitz (2003) model which is extended to incorporate imported intermediate goods sector. In addition, sunk costs of trade, differences across firms in international transportation costs, firm-specific cost, and trade shocks have been incorporated in the model (Kasahara and Lapham, 2013). The model further assumes that the technology for a final good producer that is also

[52] Effective rate of protection gauges the protection subjected to domestic value added in comparison to international value added (Edwards, 2005).

[53] The two inputs (domestic and imported inputs) are combined using a CES technology. The final good's production does not require labour.

importing intermediate inputs is characterized by two inputs. This being labour input and the intermediate good input. The intermediate input is further divided into domestically-sourced input as well as an imported intermediate input. Due to increasing returns to variety in intermediate inputs as well as the high fixed costs associated with importing, the model predicts that firms that use a variety of imported intermediate inputs are likely to be the most productive. Hence, they will be able to export most of their products to many destinations. In this light, this model is favourable to our study. However, the limitation of the Kasahara and Lapham (2013) model is that it regards source countries as homogeneous and hence does not take into consideration heterogeneities between low-income and high-income source countries.

Premised on the Kasahara and Lapham (2013) model, the Turco and Maggioni (2013) model assumes firm production technology is also a function of labour and the intermediate goods sector. The intermediate inputs can be sourced domestically as well as imported. However, unlike the Kasahara and Lapham (2013) model, the imported input is not homogenous as these imports can be sourced from high and low-income countries. By implication, there are two different types of imported intermediate inputs. The model thus predicts that the inputs from high-income countries are of higher quality while the input coming from low-income countries, although are of low quality, presents a cost-saving channel. The model therefore assumes the three types of inputs (domestic; imported from low-income countries; and imported from high-income countries) are different varieties of the same homogenous intermediate goods sector. Because of the assumption of imperfect substitutability across varieties, the model further assumes that the three types of inputs can be used concurrently in production. Despite its limitation of not modelling import tariffs, the Turco and Maggioni (2013) model serves as the framework favourable to our study.

Another strand of theoretical literature argues that trade liberalization will affect the export performance of downstream firms differently, depending on the productivity level of each firm. This model is elaborated in Chevassus-Lozza et al. (2013). In this model, Chevassus-Lozza et al. (2013) argue that firms produce a differentiated good using labour and an intermediate input. The model further assumes that labour and the intermediate input are not perfectly substitutable and firms are heterogeneous in terms of labour productivity. This by implication suggests that the output price elasticity with respect to a change in input tariffs increases with the firms' labour productivity (Chevassus-Lozza et al., 2013). The resultant effect is the reallocation of export market shares from low-productivity to high-productivity firms. The model therefore predicts that a decrease in input tariffs will raise the probability of exporting when fixed export

costs are high. This further means that the most productive firms will gain more than the less-productive firms in the event of a reduction in input tariffs. When the fixed export costs are low, a reduction in input prices will force the least productive firms to exit the foreign markets. Hence, export sales of high-productivity firms will increase at the expense of low-productivity firms. The drawback of this model is that it assumes that the *n* foreign countries that the domestic firms source the intermediate inputs from are identical in size and therefore apply the same tariff to imported intermediate inputs. Hence, the drawback of the model lies in treating source countries as a homogenous group.

Last but not least, we conclude with models that indirectly link the advanced technology embodied in the imported intermediate inputs to differentiated intermediate inputs. On one hand, the Melitz (2003) model argues that the fixed entry costs associated with exporting are substantial for firms that are in the differentiated product industries. On the other hand, the Chaney (2008) model also distinguishes a theoretical channel through which differentiated products affect firm productivity. These models all point to the fact that differentiated inputs are a potential mechanism through which the strength of the input complementarity channel is enhanced. This works through the Nelson hypothesis that points to the multi-product firms' ability to be more innovative (Liu and Rosell, 2013).

In conclusion, we synthesize the preceding discussion on theoretical models of the link between a firm's use of imported intermediate inputs and firm's export performance by teasing out three important insights. Firstly, models on the productivity-enhancing effects of imported intermediate inputs are mixed, with some models pointing to the existence of such productivity-enhancing effects whilst others suggest the non-existence of such effects. Additionally, where such productivity-enhancing effects exist, literature points that they are stronger through differentiated inputs. Secondly, with the issue of homogeneous source countries, we argue that source countries can never be the same and therefore have to be differentiated according to their income levels. This is particularly relevant for countries whose firms rely heavily on a particular source country for their imports. The third insight relates to the modelling of input tariffs as a source of exogenous variation when analysing the link between access of imported intermediate inputs and firm export performance, to circumvent the endogeneity issue resulting from complementarity between importing and exporting[54].

[54] Naturally, we anticipate export growth to drive import growth. However, the reverse could also be true. Import growth could also lead to export growth. This is as a result of the complementarity between exports and imports. As firms get access to cheaper imported intermediate inputs, the anticipation is

4.2.2. Related Empirical Literature

The preceding discussion on theoretical literature has highlighted two channels through which a firm's access of intermediate inputs can influence its export performance – being the indirect and direct channels (Bas and Strauss-Kahn, 2014). However, much of the empirical literature on the importing-exporting nexus has largely focused on the indirect channel of access of imported inputs and firm productivity (Conti et al., 2014 for Italian manufacturing firms; Yu and Li, 2014 for Chinese manufacturing firms; Yasar and Paul, 2008 for Turkish manufacturing plants; Okafor et al., 2017 for Ghanaian manufacturing firms). Empirical research remains limited via the direct channel of access of imported intermediate inputs and exporting performance, in particular, firm export diversification (Turco and Maggioni, 2014 for Italian manufacturing firms; Muuls and Pisu, 2009 for the broad Belgian economy; Feng and Swenson, 2016 for Chinese manufacturing firms; Edwards et al., 2017). This section mainly discusses the link between imported intermediate inputs and firm export performance, which is the main aim of this chapter.

The empirical findings on the causal impact of access of imported intermediate inputs on export performance can be categorized into two groups. One group is the one that the intermediate goods sector is considered as composite and no attempt is made to make a distinction of the source country. The other group attempts to make a distinction between high income and low income countries. Firstly, the empirical stylised finding from the two groups is that there is considerable heterogeneity in the exporting behaviour of trading firms. The general conclusion is that two-way traders outperform "importers only" and "exporters only" traders in terms of trading and firm performance characteristics. The extent varies even amongst developed countries (Muuls et al., 2009 in Belgium; Castellani et al., 2010 in Italy; Vogel et al., 2010; and Bernard et al., 2009 in the US). Furthermore, if firms undertake international trade, they are more likely to engage in both exports and imports instead of either one activity (Muuls et al., 2009). Sufficient evidence has not yet been explored in developing countries to confirm these results. Recent studies for Sub-Saharan countries include Edwards et al. (2017) for South African manufacturing firms, who also confirmed this performance heterogeneity amongst "two-way traders", "importers only" and "exporters only".

---

that they will be incentivised to start exporting, even to long-distanced destination markets or even innovate new products. This "cross-firm synergy" is made possible by the existing network relationships that arise as firms make lasting connections with foreign suppliers in the importing markets.

There are some empirical studies that have considered the intermediate goods sector as homogenous, without distinguishing between the source countries. For example, Bas (2012) using firm-level data from Argentina found evidence pointing to the fact that input –trade liberalization increased export sales in Argentina between the period 1992 and 1996. Although this study is on the link between access of imported intermediate inputs and export performance (via export sales), the study is silent on export performance via firm-level export diversification.

Finally, empirical studies that have attempted to distinguish the intermediate goods sector into high and low income countries have presented mixed evidence regarding channels that are driving the imports-exports nexus. For instance, when exploring the effect of imports on the firm's export performance using Italy as a case study, Turco and Maggioni (2013) found strong evidence suggesting that only imports from low–income countries matter for exporting. In contrast, for France's case, Bas and Strauss-Kahn (2014) found evidence that both imports from high and low-income countries have a direct positive impact on the number of export varieties. In a similar vein, Edwards et al. (2017) consider a sample of South African manufacturing firms to analyse the complementarity relationship between direct access to imported intermediate inputs and firm exports. The study finds that the likelihood of exporting and greater scope, scale and value of exports increase with accessing imported intermediate inputs from advanced countries. Although the study distinguishes between intermediate inputs sourced from high and low-income countries, the major limitation of this study is that it controls for endogeneity of imports behaviour by using past import behaviour, due to a lack of a valid instrumental variable. This approach is unlikely to be appropriate as past import behaviour is likely to be endogenous as well[55]. Firms are likely to make their exporting decision based on their past import behaviour.

The literature on simultaneous firm importing and exporting notably, identifies endogeneity of imports as one potential problem that plagues research work on the link between access of imported intermediate inputs and firm export performance. This potential problem of endogeneity is attributable to the potential reverse causality between imported intermediate

[55] Using past import behavior as an instrument is unlikely to be valid because firms are likely to be persistent importers given fixed costs of entry into importing. Likewise, firms are also likely to be persistent exporters given the fixed cost of entry into exporting. Past import behavior is thus expected to be correlated with current export behavior, including the number of export destinations.

inputs and export scope. While some empirical studies have used lagged imports in their regressions to minimise this potential problem (Edwards et al., 2017), some studies explicitly utilized instrumental variable strategy to mitigate this issue. As a matter of fact, different variables have been used across studies to instrument for imported intermediate inputs. For instance, Bas and Strauss-Kahn (2014) relied on input tariffs as an instrumental variable, while other studies such as (Feng and Swenson, 2016) used input import tariffs, input import real exchange rates and fixed import costs as instrumental variables. In the bulk of these studies there still remains a lack of an exogenous shock that can increase the variety of imported intermediate inputs available to manufacturing firms.

Additionally, empirical literature linking the advanced technology embodied in imported intermediate inputs to differentiated inputs provides mixed evidence. This is due to the fact that increased import penetration ordinarily has two opposing effects on firm productivity depending on the product complexity of the intermediate inputs (Yu et al., 2013). Technology diffusion is expected to be weaker through access to homogenous inputs than through differentiated inputs. This is premised on the fact that under these circumstances, firm innovation becomes standard as multi-product firms narrow down their product scope[56] (Liu and Rosell, 2013). According to Caves (1974), some industries (firms) will have lower levels of average labour productivity because they trail in the diffusion of new technology. It is argued that differences in product-market competition can influence the speed of diffusion. To this end, using Swedish firm export data, Andersson (2007) finds that along the extensive margin, the effect of fixed costs of market entry (proxied by measures of familiarity with markets) is larger for differentiated goods than for homogenous goods when using the classification developed by Rauch (1999). This suggests that diffusion of technology is more likely to occur through access to differentiated products. Thus we would expect to see a stronger impact via the productivity diffusion channel of access to imports for exporters using differentiated inputs than homogenous inputs.

In sum, empirical literature provides a clear positive relationship of the direct channel of the role of access of imported intermediate inputs on firm export destination diversification. However, existing research is more focussed into categorizing source countries into developed and developing countries, without explicitly taking into cognizance the source of exogenous variation in imported intermediate inputs as well as the product complexity of the inputs.

[56] Theory links high firm productivity to multi-product firms.

Evidence from empirical literature therefore presupposes that source countries are always varied and as such exporting firms have a wide range of countries to choose from when sourcing the intermediate inputs. In this study, we argue that for unique countries such as Botswana whose manufacturing firms rely heavily in a specific source country, this can only be the case if there exists a source of exogenous variation in imported intermediate inputs that can increase the number of available imported varieties. This study therefore tests the hypothesis that input complementarity coupled with technology transfer will increase firm export destination diversification. In particular, the input complementarity of inputs is stronger through the differentiated inputs.

4.3. Data and Data Overview

4.3.1 Data Description

To investigate the impact of the complementarity of imported intermediate inputs on firm's export destination diversification, this study draws on a unique dataset consisting of annual firm exports and imports transactions as well as tariff data and product complexity classification. The trade transactions data are obtained from Statistics Botswana. Statistics Botswana records every import and export transactions that are undertaken by trading firms in Botswana each year. Each individual imports/exports record for a given commodity or service has information on the firm ID, the year the import and export transaction was undertaken, the 8-digit level of Harmonized System (HS-8) code of product traded, the destination and origin country, the export/import value in Pula currency and the volume in kilograms and quantity. These data capture all export/import transactions made by Botswana's trading firms between 2003 and 2012, adding up to total Botswana exports and imports as reported by Statistics Botswana. This classification of the data makes it possible to track the history of trading firms as well as their products and destinations (source countries) exported (imported) to over time.

Given the structure of the data, concordances such as identifying the income status of export destination/source countries are made possible. Concordances also allowed for the identification of firms according to whether they export manufactured goods, classification of imports according to the United Nations Classification by Broad Economic Classification (BEC) of final imports, intermediate inputs, capital goods, vehicle passages, etc as well as classification of the intermediate inputs according to their product complexity as explained in Rauch (1999).

For our instrumental variable, we select the tariffs applied by South Africa on the European Union products. The source of this data is from the WITS database from the period between 2003 and 2012. The tariff data is at the HS8 product level and is thus converted to HS6 2002 revision to conform to international practices. We follow Bas and Strauss-Kahn (2014) and compute input tariffs at the firm level, as a weighted average capturing the firm's relative use of a specific imported input (*j*) in total imported inputs of firm *i*, for each specific year (*t*)[57]. The beauty about this measure is that it isolates input tariffs that are actually imported by a firm (Bas and Strauss-Kahn, 2014).

It is important to highlight that the data used in this study is not without limitations. Since firms are classified according to whether they export manufactured goods, then trading firms may still be included in the sample. This means that our unit of analysis may not necessarily be a producing firm but for some units, no production activity may be taking place. Furthermore, the analysis of this chapter cannot control for firm productivity and also does not deal with selection into importing and exporting. The implication is that the relationship we are identifying between input complementarity and export destination diversification could be influenced by (i) the selection of more productive firms into importing and exporting, (ii) the combined effect of both the direct cost channel and the indirect productivity channel.

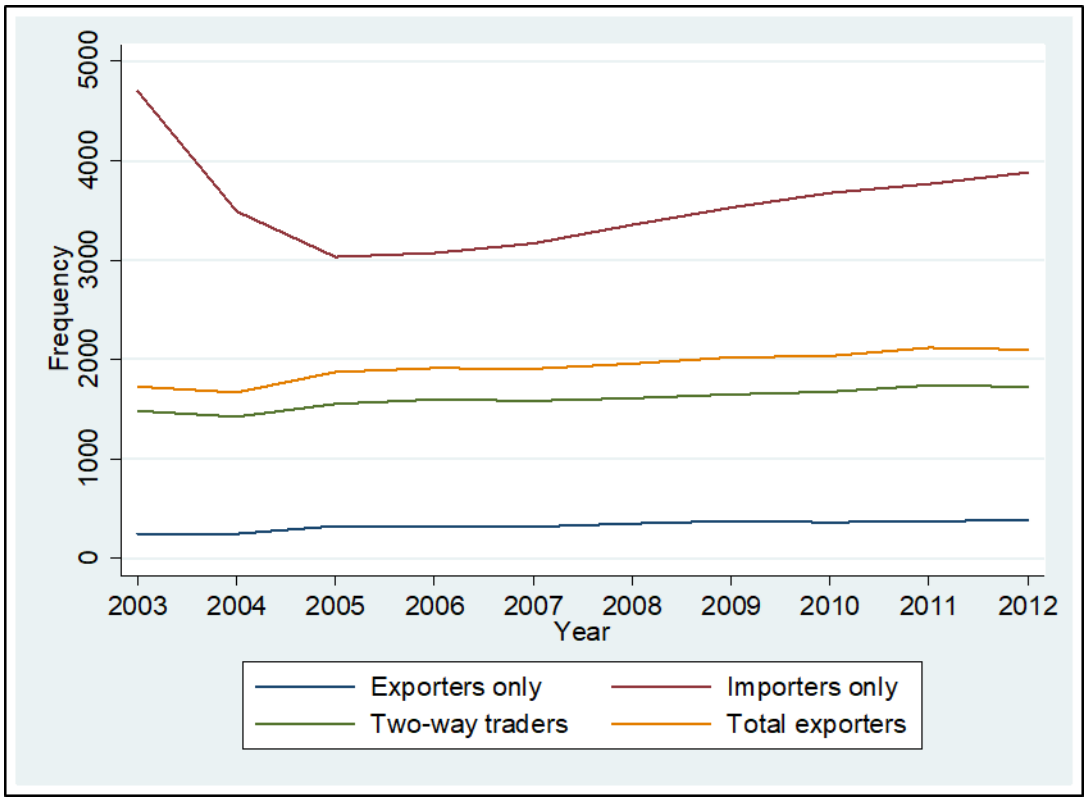
4.3.2. Merger of Export and Import Transactions

The Botswana Transaction Trade Dataset, which is a sample of firms that export manufactured goods (as identified according to ISIC rev3 sections 15 to 37) as well as import intermediate inputs as classified under the Broad Economic Category (BEC), resulted from the merging of the export and import transactions datasets at the level of the firm through the firm ID and year. Firm ID is a unique code identifying each firm. The merger resulted in firms being classified according to "exporters only", "importers only" and "two-way traders"- that is, those firms that both export and import. Our sample indicates 19 322 firm by year observations classified as exporters, of which 16 035 are "two-way traders" and 3 287 are "exporters only". While the focus of the chapter is not on "importers only", the merged sample of data reveals a substantial number of firm by year observations of "importers only" (35 673).

[57] The firm input tariff is computed as: $\tau_{it} = \sum_j \alpha_{ij}\tau_{jt}$ where α_{ij} is the weight of input *j* in the total imported inputs cost of firm *i* and τ_{jt} is the output tariff of good j in year *t*.

Figure 10 below depicts the evolution in the number of firms according to their trading status. There has been an upward trend in the number of firms in all the categories, including the number of total exporters[58] over time. Of particular importance is the high share of exporters that are also importers. We also observe a modest increase in the number of firms that both export and import. Together this suggests that export participation is closely associated with importing. Thus importing could be a potential channel to enhance firms' ability to export (Edwards et al., 2017).

Figure 10: Trends of Different Categories of Firms



Source: Botswana Transaction Trade Dataset

4.4. Methodological Framework

4.4.1. Modelling Simultaneous Firm Exporting and Importing

In estimating the productivity-enhancing effects of input complementarity on firm export destination diversification in Botswana, this study is inspired by the Kasahara and Lapham (2013) as well as the Turco and Maggioni (2013) models. These models are an extension of

[58] Total exporters include "exporters only" as well as firms that both export and import (two-way traders).

the heterogeneous firms Melitz (2003)-type model and incorporates exporting, importing and differences across plants with respect to productivity, exporting and importing costs and other characteristics (Kasahara and Lapham, 2013). These two models include an intermediate goods sector to explain both exporting of final goods and importing of intermediate inputs. In particular, firms produce final goods using labour and two types of intermediate inputs, sourced domestically or abroad.

The key assumption of these models is that there is increasing returns to variety in intermediate inputs such that firms that use a variety of imported intermediate inputs will have higher total factor productivity. The models differ in terms of the intermediate goods sector. On one hand, the Kasahara and Lapham (2013) model regards the intermediate good sector as homogenous while the Turco and Maggioni (2013)'s model distinguishes the intermediate good sector according to source country (Low-income and High-income source countries). In this regard, our proposed theoretical framework relies much on the Turco and Maggioni (2013) model which categorizes source countries into North (developed countries) and South (developing countries).

Following Bas and Strauss-Kahn (2014), we assume firms with different initial productivity levels (φ) produce final goods (y) using labour(L), capital goods (K) and two types of imported intermediate goods from the North (N_{jN}) and the South(N_{jS}). The total factor productivity (A) of each firm *i* is estimated as a Solow residual as follows:

$$A_{it} = \frac{y}{L^{\eta}K^{\beta}\prod_{j=1}^{I}\overline{M_{jF}^{\alpha j}}} = \varphi\prod_{j=1}^{I}\left(N_{jN}\chi_{jN}\right)^{\frac{\alpha j}{\sigma j-1}}\left(N_{jS}\right)^{\frac{\alpha j}{\sigma j-1}} \quad (1)$$

Equation (1) offers insights into the productivity-enhancing effects of imported intermediate inputs. Assuming an exogenous shock that serves to increase the number of available input varieties, the model predicts that firm's total factor productivity is increasing in the initial firm productivity draw, φ , the number of foreign input varieties[59] imported from the North, or the South. We further assume that the complementarity of inputs channel works stronger through differentiated products. Hence, the technology parameter(χ_{jN}), is amplified by the product

[59] This is because for each time period the firm decides to import, it must pay a fixed cost for each variety (Halpern et al., 2015).

complexity nature of inputs sourced from the North[60]. Hence, assuming that the contribution of product complexity to the productivity-enhancing effects of input complementarity is positive (as per theory predicts) suggests that product complexity and input complementarity are complements in the production of final goods. This model therefore predicts that by using more varieties of differentiated imported intermediate inputs, the firm attains greater complementarity of inputs and therefore increases its productivity (Bas and Strauss-Kahn, 2014). Hence, equation (1) allows us to unpack two channels through which imported intermediate goods affect firm's total factor productivity. These are the variety/complementarity channel as well as the technology transfer channel.

Literature on firm productivity-export destinations nexus (Chaney, 2008; Melitz, 2003) states that due to the presence of the fixed costs of exporting, firm productivity has externalities that increase the firm's export destination diversification. The fixed export costs (equation 2) therefore links firm productivity of equation (1) to the firm exporting behaviour (Turco and Maggioni, 2014).

$$f_x = e^{\delta_j + \rho_{ijt}} \tag{2}$$

where j captures industry, $\delta_j$and ρ_{ijt} captures a sector-specific component and a sector-firm idiosyncratic shock, respectively (Turco and Maggioni, 2013). To this end, Chaney (2008) and Melitz (2003) models predict that a firm will enter the export market if the tradeability condition for exporting (the zero-profit function condition that satisfies the minimum productivity threshold) is met. Equation (3) presents the export profit function:

$$\pi_x(A_{it}) = \frac{r_x(A_{it})}{\sigma_j} - F_x \tag{3}$$

where $F_x = g\left(F, \frac{f_x}{\chi_{jN}}\right)$and it includes the production fixed costs, inclusive of the import fixed cost for importing firms (F) as well as the export fixed costs (f_x) and the technology parameter $\left(\chi_{jN}\right)$. Equation (3) is a firm export profit function which depends on its productivity, elasticity of substitution (in our case proxied by product complexity) and the technology parameter. The

[60] If productivity gains from using a variety of imported intermediate inputs are due to technology embodied in the inputs, then we would expect that firms that use differentiated (complex) inputs would enjoy the largest productivity gains.

productivity-enhancing effects of imported intermediate inputs will ease the fixed costs of exporting, increasing the firm's variable profits $\frac{r_x(A_{it})}{\sigma_j}$.

Next we define a destination-specific fixed cost, which illustrates how rising firm productivity allows firms to enter new export markets (or induce exporting for non-exporting firms). This firm destination-specific fixed cost is introduced in the fixed cost of exporting. This reasoning is motivated by evidence from literature that suggest that not only do firms differ in productivity but they also differ in the ability to introduce a new variety in a destination at a low cost (Eckel and Neary, 2010); Eaton et al., 2011). For example, despite their large potential gains from export sales, some high productive firms do not export because they draw a very high fixed cost. Likewise, despite their low productivity, some small firms may export if they draw a small fixed cost[61] (Armenter and Koren, 2015).

To this end, as per Eaton et al. (2011), the destination-specific demand shock is defined such that a firm *i* enters destination *n* if:

$$\mu(i) \leq \bar{\mu}_{nB}\big(\eta_n(i)\big) = \left(\frac{\pi_{nB}X_n}{\kappa_1 \sigma \mathrm{E}_{nB}}\right)\eta_n(i)^{\tilde{\theta}} \qquad (4)$$

where $\tilde{\theta} = \frac{\theta}{\sigma-1} > 1$, $\mu(i)$ is the standardised unit cost that applies across all markets, $\bar{\mu}_{nB}\big(\eta_n(i)\big)$ is the standardised entry threshold that is only satisfied when it is lower than $\mu(i)$. Hence, if this entry threshold is satisfied, then a firm from Botswana will enter market *n*. Otherwise, the firm will be inactive in market *n*. Thus, firms will self-select into exporting and non-exporting groups depending on whether they satisfy this destination-specific productivity threshold for exporting[62]. Firms that were initially not exporting will start exporting and those that were already exporters will increase the number of destinations they serve (extensive margin), which subsequently stimulate the export value (intensive margin). This model predicts that the productivity-enhancing effects of input complementarity will increase the firm export destination diversification and that the impact is stronger through the product complexity of the intermediate input, that is, via the differentiated intermediate inputs.

[61] However, the exports of such firms will be marginal as these firms will not be competitive in the foreign markets.

[62] There exists a value of the fixed cost shock $\bar{\mu}_{nB}\big(\eta_n(i)\big)$ such that firm *i* with cost draw $\mu(i)$ makes zero profits by selling its core variety (Eaton et al., 2011). The more productive a firm is, the lower is its $\mu(i)$.

4.4.2. Econometric Model and Identification Strategy

To this end, in order to identify the causal effect of importing on firm export destination diversification, we estimate a reduced form variant of the model in equation (3). In line with answering the first research question of this study, we specify our baseline empirical model as shown in equation (5) below. A similar version of the model has also been used by Bas and Strauss-Kahn (2014)[63].

$$\#\_dest_{it} = \beta_0 + \beta_1 log(variety_{it}) + \alpha_i + \alpha_t + \varepsilon_{it} \quad (5)$$

The dependent variable, $\#\_dest_{it}$, is defined as either the total number of destinations per firm or the log of total number of destinations per product (export scope) as in accordance to the literature (Edwards et al., 2017). Likewise, the main variable of interest capturing the complementarity of imported inputs, $log(variety_{it})$ is defined as the log of the total number of product-source country pairs (Bas and Strauss-Kahn, 2014). We also identify other measures of the input complementarity to use in the estimations as identified in the literature such as total number of source countries and firm's import value[64] (Halpern et al., 2015). Halpern et al. (2015) argue that these two variables just like the number of product-source country pairs, are affected by the level of the fixed costs of importing, such that the higher they are the more productive the firms are. For example, they argue that higher initial import participation by a firm attributed to either low fixed costs or low tariffs suggest that the set of inputs affected by such is larger.

According to recent theories of firm heterogeneity (Chaney, 2008; Helpman, 2008; Melitz, 2008), fixed costs associated with each market opens up the possibility of an extensive margin adjustment and may explain the positive relationship between a country's export or import variety and total income. If the fixed costs are high, import liberalization is expected to lower the productivity hurdle of accessing imports from the various source countries. This has been confirmed by Frensch (2010) who found evidence supporting stronger import margin effects of unilateral institutional trade liberalization for intermediate inputs.

We also rely on firm fixed effects (α_i) and time fixed effects (α_t) to account for both observed and unobserved factors potentially correlated with firm imported intermediate inputs and

[63] A similar version of the model has also been used by Bas and Strauss-Kahn (2014), with the exception that in their model the dependent variable is the log number of exported varieties.
[64] However, Halpern et al. (2015) used firm initial import value instead.

export destination diversification. According to Di Giovanni et al. (2014), decomposition of firm sales growth in each destination market should include firm-specific, sector-level and macroeconomic components. Equation (5) allows us to identify β_1 using within-firm variation in usage of imported intermediate inputs after controlling for firm as well as time fixed effects.

As discussed earlier, identifying the link between a firm's use of imported intermediate inputs and its export destination diversification is plagued with the potential problem of endogeneity. If not addressed, this potential problem will make it hard to get unbiased estimates of the impact of imports on export destination diversification. Endogeneity is primarily caused by the reverse causality between importing and exporting. A case in point is the Grossman-Helpman (1994) model of endogenous protection. This model points out that certain interest groups, for example, industries that rely heavily on the use of imported intermediate inputs, may be more powerful such that they can lobby against import barriers from their governments by giving out political contributions[65]. This suggests that the use of intermediate inputs may not be exogenous.

We propose to address this potential concern through the instrumental variable approach. We rely on the European Union – South Africa TDCA agreement as an instrument to obtain exogenous variation for firms' intermediate imports and as such instrument firm intermediate imports by input tariffs levied on the European Union products by South Africa. The European Union-South Africa TDCA agreement, which aims to promote bilateral trade between South Africa and the European Union, was negotiated and signed by the two parties, independent of the Botswana government. As long as the Government of Botswana was not involved in any way in the negotiation of this agreement, we can treat this agreement as an exogenous factor with respect to Botswana manufacturing firms' importing decisions. We therefore argue that the EU-South Africa TDCA agreement has enabled the availability of intermediate inputs across all source countries. Finally, we argue that input tariffs are a good instrument for imported intermediate inputs because input tariffs are correlated with imported intermediate inputs but they are not linked to the conditional error (Yu and Li, 2014)[66]. Intuitively, by virtue

[65] These models thus relate the endogeneity concern to the fact that firms with higher productivity levels and higher import levels always survive in the export markets. Consequently, we cannot simply look at the correlation between imports and export destination diversification and argue that access to imports will drive export diversification.

[66] We argue that when firms' imported inputs are duty-free, as in the context of SACU member countries, the use of input tariffs as a source of exogenous variation may not be appropriate. However, for Botswana's case the use of input tariffs as a source of exogenous variation is valid in the sense that the bulk of Botswana's manufacturing firms source their imports from South Africa and the trade

of reducing the cost of foreign inputs, a tariff cut should raise both firm-level and aggregate productivity (Halpern et al., 2015).

In this light, from the perspective of the input complementarity hypothesis, the link between firm imports and firm export destination diversification is identified using a Two-stage residual inclusion approach (Stuart et al., 2009; Terza et al., 2008). Attempting to correct for endogeneity via the application of the conventional linear instrumental variable (IV) estimator, that is, the Two-stage least squares estimator, will be prone to bias, attributable to the nonlinearity associated with the two-part model (Stuart et al., 2009; Terza et al., 2008). With a dependent variable as a count variable, the appropriate approach to deal with endogeneity in nonlinear models is the Two-stage residual inclusion approach (2SRI) (Terza et al., 2008. The 2SRI estimator is a consistent nonlinear extension of the conventional IV method. In this approach, the endogenous variables are not replaced by first-stage predictors. Instead, first-stage residuals are included as additional regressors (Terza et al., 2008). In this approach, the residuals play two roles. Firstly, they control for potential endogeneity due to importing behaviour and other latent confounders; Secondly, their inclusion affords a simple diagnostic tool to statistically test for endogeneity of the input complementarity measures (Stuart et al., 2009).

This estimation approach thus takes into account the endogeneity bias and the count nature of the dependent variable as shown below:

$$log(variety_{it}) = \alpha_0 + \alpha_1 Z_{it} + \alpha_i + \alpha_t + \mu_{it} \quad (6)$$

$$\#\_dest_{it} = \beta_0 + \beta_1 log(variety_{it}) + \beta_2 lpuhat_{it} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (7)$$

where Z_{it} is the instrumental variable, $log(tariff_{it})$. As discussed earlier, α_i and α_t are firm fixed effects and time fixed effects, respectively included to account for both observed and unobserved factors potentially correlated with firm exporting and importing. $lpuhat_{it}$ captures the predicted residuals obtained from the first stage regression.

To test for the technology transfer hypothesis, and thus account for the differential effects of input complementarity based on product complexity of the intermediate inputs, we deviate from the logic of Liu and Rosell (2013) as well as Abel et al. (2012). They identify the joint impact of two variables by including interaction terms. We however estimate separate

agreement signed by South Africa and the European Union provide the needed exogenous variation for Botswana firms' intermediate imports.

regressions (for equations 6 and 7) for firms that use either differentiated intermediate inputs of homogenous intermediate inputs. This is because complexity variable cannot be included linearly in these regressions as it is constant over time.

4.5. Results and Discussion

4.5.1. Stylized Facts about Botswana's Importers and Exporters

4.5.1.1. Trends in Firms' Export Destination Diversification and Importing Decisions

Using a sample of firms that export manufactured goods, we identify the stylized facts that characterize firm exporting behaviour in terms of export destination diversification. The results are displayed in Table 28 below. Export destination diversification is defined in two ways – number of export destinations per firm as well as number of destinations per product per firm. The results as depicted in Table 28 show that just like in the existing empirical studies, trade concentration, in terms of export destinations, is a stylized fact in Botswana's international trading landscape. Modest increment in terms of export destinations has been witnessed over time. In 2003, on average the number of destinations per firm was 1.26 and it increased to a modest 1.45 in 2012. Export destination diversification in terms of average number of destinations per product was 1.10 in 2003 and it increased to a mere 1.14 in 2012. Although this suggests that on average firms do not export to many destinations, overall, a slight rise is witnessed. More importantly, these results are in sync with the limited variation of destinations served across firms over time, as measured by standard deviation[67].

Table 28: Descriptive statistics from Botswana's exports data

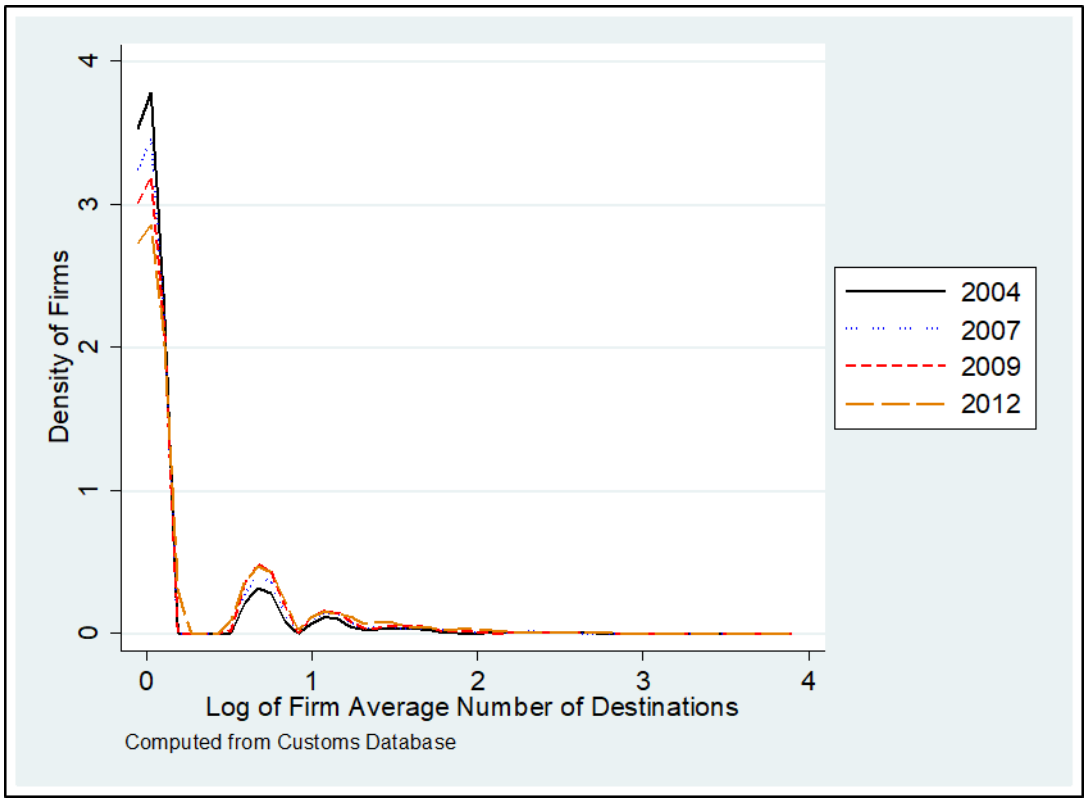
	No. of destinations/firm			No. of destinations/product		
	mean	median	sd	mean	median	sd
2003	1.26	1	1.57	1.10	1	0.82
2004	1.27	1	1.18	1.10	1	0.82
2005	1.28	1	1.07	1.09	1	0.69
2006	1.35	1	1.14	1.12	1	0.69
2007	1.32	1	1.02	1.10	1	0.56
2008	1.40	1	1.24	1.13	1	0.86
2009	1.37	1	1.15	1.12	1	0.74
2010	1.40	1	1.14	1.12	1	0.72
2011	1.46	1	1.24	1.14	1	0.76
2012	1.45	1	1.25	1.14	1	0.73

Source: Author's calculation based on customs data
Note: sd refers to standard deviation

[67] This limited variation across firms therefore suggest that our empirical analysis should explore variation within firms.

We complement the above trends by Figure 11 which displays the kernel distribution of the log of firm total number of destinations per firm. Figure 11 confirms that there is vast heterogeneity pertaining to the log average number of destinations per firm for the period under consideration. In particular, there is trade concentration evidenced by the fact that the majority of firms export on average to a few destinations while only a minority of the firms export to many destinations. These findings support the predictions of the theoretical models on firm heterogeneity such as the Melitz (2003) model as well as empirical evidence showing that only the largest and most productive firms will do exporting activity. Such trade concentration has also been cited in international literature such as in Bernard et al. (2007) in the US; Castellani et al. (2010) in Belgium and Muuls et al. (2009) in Italy[68]. Secondly, over time, no vast improvement in terms of average number of destinations per firm has been witnessed. A slight shift to the right for firms that export to few destinations as well as to those with many destinations is observed.

Figure 11: Distribution of log of Average Number of Destinations per Firm (2004-2012)



The period of analysis of this study spans 10 years from 2003 to 2012 and therefore coincides with the period associated with changes in tariffs applied by South Africa. It is thus imperative

[68] Trade concentration in these studies was focussed more on aggregate export and import concentration, but not on the number destinations per firm per se.

to unpack how the input complementarity measures have changed over time. We next categorize our input complementarity variable into the three firm-level measures identified earlier on – number of product-source country pairs, number of source countries as well as firm import value. This is with a view to establishing if, over time, Botswana's firms have witnessed increasing trends on these measures and whether the changing trends are coinciding with the period when South African tariffs were falling.

Table 29 below shows the results for these three measures over time using a sample of firms that import intermediate inputs. The results show that over the period between 2003 and 2012, these measures have all reasonably increased. However, on average, the firm import value has increased substantially, relative to the others[69]. In 2003, the average total import value stood at P792 560, which saw a marked increase to P6 031 445 in 2012. The average number of product-source country pairs per firm stood at 18.42 in 2003 and it increased to 23.98 in 2012. The average number of source countries per firm has generally also increased over time, registering 1.22 in 2003 and increasing to 1.42 in 2012. More importantly, these results suggest increased variation across firms over time, as measured by standard deviation. The results correspond with the increased trade liberalization in South Africa that followed the implementation of the SA-EU Trade, Development and Cooperation Agreement (TDCA) in 2000. As indicated by (Edwards, 2005) the decline in average protection in South African manufacturing from 20% in 1994 to less than 10% in 2000 was largely attributed to the implementation of the EU-SA TDCA post 2000.

[69] Higher import value reflects either low costs of importing or low tariffs, suggesting that the set of inputs affected by such is higher (Halpern et al., 2015).

Table 29: Descriptive statistics from Botswana's imports data

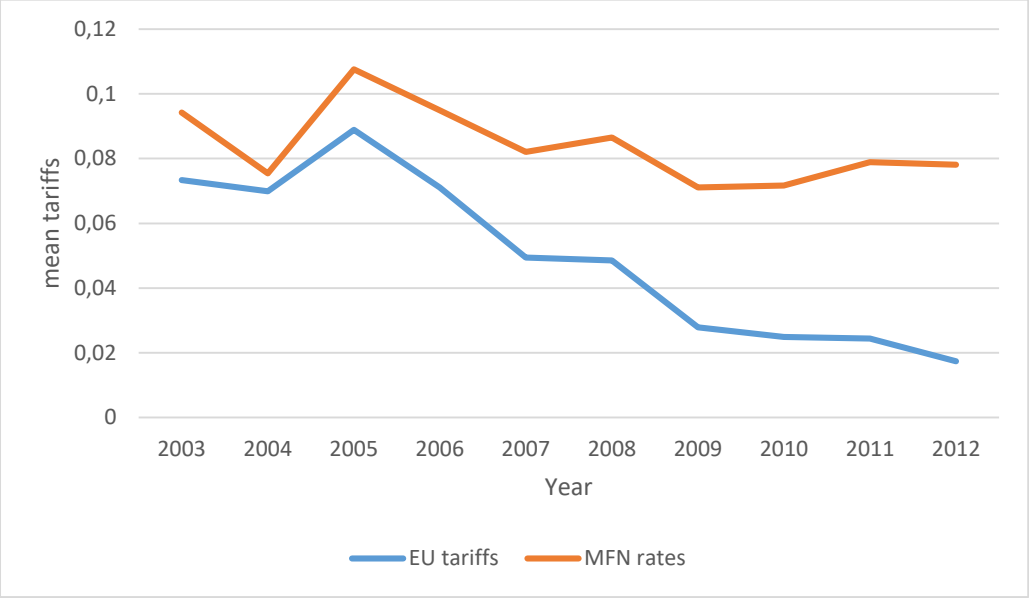
	No. of product-country pair/firm			No. of source countries/firm			Import value/firm		
	mean	median	sd	mean	median	sd	mean	Median	sd
2003	18.42	4	47.17	1.22	1	0.87	792559	21122	6132748
2004	24.35	6	55.50	1.31	1	1.02	1422819	35198	19800000
2005	24.72	6	53.22	1.34	1	1.07	1548992	46134	12100000
2006	24.43	6	52.80	1.33	1	1.09	1574204	38669	11700000
2007	24.64	6	53.40	1.36	1	1.08	2144054	51360	14300000
2008	24.84	6	52.78	1.37	1	1.09	3164428	69009	32000000
2009	23.89	6	50.97	1.37	1	1.11	2911193	68666	30500000
2010	23.77	6	50.36	1.40	1	1.14	3516504	71566	50700000
2011	24.39	7	52.07	1.41	1	1.17	4329907	69395	73400000
2012	23.98	6	52.77	1.42	1	1.18	6031445	72299	165000000

Source: Author's calculation based on customs data
Note: sd refers to standard deviation.

Whilst there has been a modest increase in export destination diversification (measured as number of destinations per firm and number of destinations per product per firm), as depicted earlier, it is not clear whether these trends are associated with the changes in tariffs applied by South Africa.

Figure 12 below contrasts trends in average tariff on inputs per firm categorized into the EU preferential tariffs as well as the most favoured nation rates. It is evident from Figure 12 that while the Agreement on Trade, Development and Cooperation (TDCA) between the European Union and South Africa has allowed South Africa to reduce tariff barriers on imports from the EU, the MFN rates imposed by Botswana on imports directly imported from the EU has remained high as compared to the EU preferential rates. Hence, the earlier observed trends in export destination diversification and input complementarity measures do not correspond with changes in the MFN rates that remained flat, but they correspond with declining EU preference rates.

Figure 12: Average Input Tariffs per Firm (2003-2012)



Note: This is the simple average of T_{it} where T_{it} is the firm level import weighted average MFN and EU preference tariff on intermediate inputs sourced by the firm, ($\sum_k w_{ikt} T_{kt}$) where k is product, w_{ikt} is import share of intermediate input k by firm i in period t (that is, the weight).

4.5.1.2. Firm Heterogeneity Across different trading status

Next we unpack the existing heterogeneity further by distinguishing firms by trading status. This is because empirical evidence has established heterogeneity within firms which explains exporter premia evidenced amongst trading firms. In this section, we utilize a dataset that comprises of a sample of firms that export manufactured goods. This sample comprise of exporters that import intermediate inputs (two-way traders) as well as those that do not (exporters only).

We construct the simple average of the firm by time observations over the period 2003 – 2012 for the various firm trading characteristics. The trading characteristics are divided into destination count (defined as the number of destinations per firm), scope of exports (defined as number of destinations per product per firm) and export value.

Table 30 below shows the trading characteristics of these two categories of firms, for the period between 2003 and 2012. It is clear from Table 30 that between 2003 and 2012 period, two-way traders outperformed "exporters only" firms in terms of all trading characteristics considered in this Table. Thus, on average over time, two-way traders export to more destinations (both at

destination count and export scope levels) and "fetch" high export values relative to "exporters only" firms.

This firm heterogeneity is in line with what has been predicted in the heterogeneous models of international trade (Bas, 2012; Kasahara and Lapham, 2013; Muuls and Pisu, 2009)[70]. Although we have not yet empirically tested this, these findings suggest that accessing more import varieties enables two-way traders to export, on average, to more destinations. This could thus be a potential channel that could be explored further to establish if it can be used to stimulate export growth and thus export destination diversification in the country.

Table 30: Trading Characteristics of Firms (2003-2012)

	Mean Destination count	Mean scope of exports	Mean total exports (Pula)
Exporters only	1.12	1.03	429 396
Two-way traders	1.41	1.08	5 345 086

Source: Author's calculation from Botswana Transaction Trade Dataset.
Note: Scope of exports refers to number of destinations per product per firm while variety of imports refers to number of product-source country pairs.
Note: These figures are calculated as the annual average of each firm trading characteristic over the period 2003 – 2012.

4.5.2. Empirical Results

4.5.2.1. Descriptive analysis

In order to analyse the causal impact of a firm's input complementarity on its export destination diversification, we strictly focus on firms that export manufactured goods. This sample comprise of exporters that import intermediate inputs (two-way traders) as well as those that do not (exporters only)[71]. The time period is between 2003 and 2012. Our empirical analysis starts off by undertaking a descriptive analysis that intends to investigate the import premia between the two categories of exporters – exporters sourcing their inputs from emerging

[70] Literature has established that firms that both export and import (two-way traders) have relatively large productivity premiums compared to those that solely do exporting, attributable to the high degree of international globalization that two-way traders find themselves engaged in (Kasahara and Lapham, 2013; Cadot et al., 2013).
[71] Hence, the dataset used in this section is strictly for exporters of manufactured goods and does not include non-exporting firms.

economies as well as those sourcing their inputs from advanced economies. Table 31 (columns 1-3) reports the results from the regression:

$$Ln\ X_{it} = \alpha_0 + \beta_1 DM_{it} + \lambda_i + \lambda_t + \varepsilon_{it} \quad (10)$$

where X_{it} refers to the trading characteristic (export value, destination count and export scope) of firm *i* at year *t*, DM_{it} is an importer dummy coded 1 if the firm imports intermediate inputs, zero otherwise while λ_i and λ_t refer to firm fixed effects as well as year fixed effects, respectively[72].

Columns 4 - 6 of Table 31 presents results of equation (10) with the importer dummy decomposed into firms that source their intermediate inputs from either advanced countries or emerging countries, as determined by the World Bank classification of countries by income. As there are some firms that import from both the income groups in a year, we deal with this by assigning a firm to the most dominant source country category in terms of import share for that year. We split import source by income category as international literature shows that the link between a firm's use of imported intermediate inputs and its export destination diversification varies by the source country (Turco and Maggioni, 2013; Bas and Strauss-Kahn, 2014).

The results presented in Table 31 corroborate evidence from international empirical literature. First, exporters that import intermediate inputs have higher export values (an astounding 351%), export to more destinations per firm (122%) as well as to more destinations per product (99%) relative to exporters that do not import.

The results also show that exporters sourcing their inputs from either emerging countries or advanced countries export on average to more destinations, thus "fetching" higher export values relative to non-importers. However, the premia are significantly higher for firms that source their inputs from advanced economies as compared to those that source them from emerging economies. The existence of such importer premia is in line with existing empirical literature on firm exporting and importing (Kasahara and Lapham, 2013).

[72] The standard errors are clustered at the firm-level.

Table 31: Importer Premia (2003-2012)

VARIABLES	(1) Export value	(2) Destination Count	(3) Export Scope	(4) Export Value	(5) Destination Count	(6) Export Scope
Importer	1.507***	0.799***	0.688***			
	(0.060)	(0.020)	(0.018)			
Importer Advanced Countries				2.469***	0.989***	0.763***
				(0.120)	(0.045)	(0.038)
Importer Emerging Countries				1.400***	0.778***	0.680***
				(0.061)	(0.020)	(0.018)
Constant	9.193***	0.386***	0.400***	10.265***	0.666***	0.592***
	(0.094)	(0.033)	(0.029)	(0.093)	(0.035)	(0.030)
Firm control	Yes	Yes	Yes	Yes	Yes	Yes
Year control	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,322	19,322	19,322	19,322	19,322	19,322
R-squared	0.032	0.047	0.046	0.038	0.049	0.046

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Export scope is defined as the log of total number of destinations per product per firm.

Note: The coefficients should be interpreted relative to non-importers.

Can these differences in magnitude emanating from advanced as well as emerging source countries be attributed to the technology embedded in the intermediate inputs? These results therefore call for the need to account for product complexity when we analyse the productivity-enhancing effects of the imported intermediate inputs on export destination diversification.

4.5.2.2. Empirical analysis

4.5.2.2.1. Baseline Results

In this section, we use a dataset of exporters of manufactured goods. We present regression results for equations (5) – (7), focussing on the relationship between firm's input complementarity (as measured by number of product-source country pairs per firm, number of source countries per firm and import value per firm) and its export destination diversification. In the baseline regressions, the export destination diversification measure is proxied by the number of destinations per firm. Results displayed in Table 32 are the ones for equation (5) for both pooled (columns 1-3) and firm fixed-effects (4-9) Poisson regression. We identify the relationship between a firm's use of imported intermediate inputs and its export destination diversification, after controlling for firm-specific as well as time-specific fixed effects. As per

theoretical predictions, the results from pooled poisson regressions (columns 1-3) show that there is a positive and significant relationship between input complementarity and export destination diversification. Specifically, a percentage increase in the number of imported intermediate varieties, source countries and import value increases the firm's export destination diversification by a percentage of 0.09, 0.69 and 0.07, respectively.

The above results are however likely to be biased as we did not account for unobserved time-invariant firm heterogeneity. We address this by estimating a firm fixed effects Poisson regressions in columns 4 - 9. The same results of a positive and significant effect of input complementarity on export destination diversification are obtained when we control for firm and year fixed effects, although the coefficients are now smaller.

When we take into account the fact that exporters may make their exporting decisions one year earlier and hence lag our input complementarity measures one period earlier, the coefficients still remain positive and significant at the 1 percent level. Thus, lagging the input complementarity measures does not alter their level of significance. Overall, these results are in line with the predictions of models of simultaneous importing and exporting that the productivity-enhancing effects of input complementarity enhance the firms' export destination diversification[73]. However, we note that in line with the arguments made by Wagner (2012), that much of the evidence of the relationship between importing and productivity suggests that more productive firms self-select into importing, our results may be limited in the sense that due to data limitations, we did not control for firm productivity and firm self-selection into importing. We have however, included firm fixed effects in this estimation to control for some of the unobserved time invariant effects that could bias the estimates.

[73] Using export scope as a proxy for export destination diversification yields relatively the same conclusions. The results are shown in Table ch4A in appendix ch4.

Table 32: Pooled Poisson and Fixed Effects Regression: The Relationship between Import Variables and Number of destinations per firm (2003-2012)

_	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled Poisson			Fixed effects Poisson					
VARIABLES	Destination count	Destinations count	Destination count	Destination count	Destination count	Destination count	Destination count	Destination count	Destination count
$\ln(product\_source)_t$	0.094***			0.078***					
	(0.012)			(0.011)					
$\ln(sourcecount)_t$		0.693***			0.229***				
		(0.038)			(0.034)				
$\ln(totalimports)_t$			0.067***			0.029***			
			(0.007)			(0.005)			
$\ln(product\_source)_{t-1}$							0.001***		
							(0.000)		
$\ln(sourcecount)_{t-1}$								0.171***	
								(0.038)	
$\ln(totalimports)_{t-1}$									0.035***
									(0.008)
Constant	0.042	-0.348***	-0.525***						
	(0.036)	(0.033)	(0.084)						
Year control				Yes	Yes	Yes	Yes	Yes	Yes
Firm control				Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,035	16,035	16,035	14,157	14,157	14,157	8,709	8,709	8,709
Number of trader_id				2,968	2,968	2,968	1,789	1,789	1,789

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: Input complementarity measure includes the following variables: import variety (number of product-source country combinations imported by a firm), number of source countries and total imports value. Each of these variables is recorded as natural log of (1 + input complementarity measure) as well as lag of (1 + input complementarity measure).

4.5.2.2.2. Robustness Checks using Instrumental Variables Estimation

The fixed effects poisson regression results in the preceding section are as per theoretical predictions. We however extend our empirical analysis by establishing if the input complementarity measures are endogenous as per theoretical predictions by appealing to the use of an instrumental variables strategy. As the dependent variable is the number of destinations per firm (a count variable) our empirical strategy follows the control function approach of the Two-stage Residual Inclusion estimation (2SRI) as suggested from Terza et al. (2008). This approach is described in equations 6-7. Noteworthy is to mention that we do not include firm fixed effects in this approach.

The estimates of the two stages of the 2SRI are presented separately in Tables 33 and 34. The first stage results of the relationship between the import variables and firm-level input tariffs, as defined in terms of the tariff preference margin (MFN rates less EU preferential tariffs), are displayed in Table 33 below. As per theoretical expectations of a positive and significant relationship between the input complementarity measures and the tariff preference margin, we found such a relationship in our results (columns 1-3). The coefficients are positive and significant at the 1 percent level of significance for all the three measures of input complementarity. These results therefore establish that the requirement that the instrument be highly correlated with the explanatory variable is satisfied.

Table 33: First-stage Regression: The Relationship between the Import Variables and the Tariff Preference Margin (2003-2012)

	(1)	(2)	(3)
	Baseline Model: Dependent variables		
VARIABLES	Log product_source country pairs	Log source count	Log total imports
$\ln(\text{tariffdiff})_t$	0.080***	0.027***	0.377***
	(0.008)	(0.003)	(0.017)
Constant	3.186***	0.919***	12.638***
	(0.014)	(0.004)	(0.028)
Observations	14,737	14,737	14,737

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: $\ln(\text{tariffdiff})_t$ refers to the tariff preference margin.

Note: The two-stage regressions have been estimated using the control function approach.

The problem with endogeneity is that it biases the coefficients (Table 32). Hence, the instrumental variable regression is expected to give more appropriate results. The baseline second-stage results of the instrumental variable regression are presented in Table 34 (columns 1-3). The predicted residuals are included in this table to establish if endogeneity bias is a concern. The results show that the coefficients of the residuals on ln (product-source) and ln (source count) are significant. This confirms the endogeneity of the input complementarity measures, in particular, the ln (product-source country pair) as well as ln (source count). Hence, it is appropriate to instrument.

We further observe that the coefficients on all the three import variables are positive and significant at the 1 percent level just like what we observed in the regression without instrumentation in Table 32. However, the coefficients of the instrumental variable regression in Table 34 are larger than those in the non-instrumental variable regression. Failure to account for the endogeneity of importing, thus biases the estimated coefficients on the import variable downwards.

We thus found evidence confirming that complementarity of a firm's use of imported intermediate inputs enhances its export destination diversification. As per theoretical predictions, the findings confirm the input complementarity hypothesis for Botswana's firms and hence suggest that these firms stand to benefit from the productivity-enhancing effects of imported intermediate inputs which boost their export destination diversification prospects.

Table 34: Second-stage Regression Estimates of the Relationship between the Import Variables and Export Destination Diversification (2003-2012)

	(1)	(2)	(3)
	Baseline Poisson IV		
VARIABLES	Destination count	Destination count	Destination count
ln(product_source)$_t$	0.367***		
	(0.081)		
ln(sourcecount)$_t$		1.146***	
		(0.191)	
ln(totalimports)$_t$			0.073***
			(0.016)
Residuals	-0.274***	-0.472**	-0.014
	(0.080)	(0.191)	(0.015)
Constant	-0.853***	-0.779***	-0.618***
	(0.264)	(0.181)	(0.210)
Observations	14,737	14,737	14,737

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We provided alternative robustness checks on the 2SRI using the Poisson IV regression estimates (a 2SLS approach for non-linear models) as proposed by Cameron and Trivedi (2009). In this model, we included firm fixed effects. The results of the estimates which include predicted residuals are shown in appendix ch4; Table ch4B and Table ch4C. The results indicate a weak correlation between the instrumental variable and import variables in the first stage, with the exception of total imports. Looking at the second stage, there is no significant association between import value and number of export destinations[74].

Hence, this result suggests that much of the effect is driven by cross-firm differences in the relationship between importing and number of export destinations. Firms that import more tend to export to more destinations and this relationship is robust to instrumentation. However, when looking within firms over time (results with firm fixed effects), we do not see a strong association between changes in the import status and export destinations in the instrumented regression.

In line with answering the second research question of this study, we unpack our intermediate input product type by coding firms as to whether they primarily use differentiated or homogenous inputs. A firm is coded one if it uses a differentiated input or zero if it uses a homogenous input. This is with a view to establish if the complementarity effect works stronger through differentiated or homogenous products[75].

We ran separately regressions on a sample of firms that import differentiated intermediate inputs and those that import homogenous intermediate inputs[76]. The results are displayed in columns 1-3 of Table 35, where panel (a) is for a sample of firms that import differentiated intermediate inputs and panel (b) is for firms that import homogenous intermediate inputs. Unlike in the earlier analysis where we separated the first stage regression and second stage regression of the 2SRI, in this table we combine them together. These regressions do not include firm fixed effects, just like regressions in Tables 33 and 34.

---

[74] These results suggest that the input complementarity measures are exogenous, as shown by the insignificant coefficients of the predicted residuals (lpuhat – lpuhat2), leading to the non-rejection of the null hypothesis of exogeneity (Cameron and Trivedi, 2009)

[75] Like previous authors such as Yu and Li (2014) and Yu et al. (2013) we use the conservative method of the Rauch classification as a measure of our product complexity.

[76] As there are some firms that import both differentiated and homogenous intermediate inputs, each firm was assigned the most dominant type of intermediate input in terms of import share. After that a dummy variable, called product complexity, was constructed where it was coded one if a firm imports differentiated intermediate inputs, zero if it imports homogenous intermediate inputs.

Comparing the results in both panels, in terms of magnitude and level of significance, we conclude that the coefficients in both regressions are significantly different from another. In particular, the coefficients in the regression for a sample of firms that use differentiated inputs are all significant at 1 percent level as compared to the ones in the sample of firms that use homogenous inputs whose significance levels range between 1 percent and 10 percent. The coefficients are also relatively larger in the regression for a sample of firms that use differentiated inputs as compared to the one whose firms use homogenous inputs.

Hence, these results suggest that input complementarity is stronger through the differentiated intermediate inputs. Our results are in line with those found by Yu et al. (2013), who established that differentiated products enhance the productivity-enhancing effects of imported intermediate inputs. However, they contradict the results of Yu and Li (2014).

We however caution that since the advanced technology embodied in differentiated intermediate inputs is largely product-specific, it may not easily be absorbed by an average firm (Yu and Li, 2014). This may suggest that firms with high absorptive capacities will be the only ones able to realize improved productivity gains associated with export destination diversification. Hence, pointing to the need to explore other potential channels of transmitting technology such as through FDI so as to boost the productivity-enhancing effects of imported intermediate inputs. Literature has found out that foreign-invested firms enjoy higher productivity levels largely attributable to either their ability to benefit from international technology spillovers or their financial soundness (Keller and Yeaple, 2009).

Table 35: Two-stage Residual Inclusion Regression Estimates for Differentiated Inputs versus Homogenous Inputs (2003-2012)

(a) DIFFERENTIATED INTERMEDIATE INPUTS

VARIABLES	(1) Destination count	(2) Destination count	(3) Destination count
Second-stage Results			
ln(product_source)$_t$	0.458***		
	(0.106)		
ln(sourcecount)$_t$		1.364***	
		(0.255)	
ln(totalimports)$_t$			0.085***
			(0.018)
Residuals	-0.372***	-0.722***	-0.030*
	(0.106)	(0.254)	(0.017)
Constant	-1.197***	-0.990***	-0.787***
	(0.351)	(0.239)	(0.240)
Observations	12,283	12,283	12,283
First-stage Results			
in(tariffdiff)$_t$	0.069***	0.023***	0.353***
	(0.009)	(0.004)	(0.018)
Observations	12,283	12,283	12,283

(b) HOMOGENOUS INTERMEDIATE INPUTS

	Destination count	**Destination count**	**Destination count**
Second-stage Results			
in(product_source)$_t$	0.158*		
	(0.086)		
ln(sourcecount)$_t$		0.704***	
		(0.219)	
ln(totalimports)$_t$			0.038*
			(0.021)
Residuals	-0.026	0.042	0.029
	(0.088)	(0.224)	(0.022)
Constant	-0.077	-0.336	-0.103
	(0.260)	(0.214)	(0.279)
Observations	4,874	4,874	4,874
First-stage Results			
in(tariffdiff)$_t$	0.119***	0.037***	0.467***
	(0.014)	(0.005)	(0.034)
Observations	4,874	4,874	4,874

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.6. Conclusion

Access of affordable and high quality imported intermediate inputs is key to the realization of the firms' export destination diversification which builds up to the subsequent aggregate export diversification at country level. This study has investigated the role of input complementarity on a firm's export destination diversification in Botswana, taking into account product complexity of the imported intermediate inputs. Results confirm the input complementarity hypothesis for Botswana's firms and therefore suggest that firms stand to benefit from using imported intermediate inputs as they generally enhance their export destination diversification prospects. In addition, the impact of input complementarity on a firm's export destination diversification is stronger when the firm uses complex imported intermediate inputs. These results are robust to controlling for the endogeneity bias induced by imported intermediate inputs by instrumenting with the EU-South Africa TDCA agreement. The results are therefore broadly in sync with the predictions of the literature on importing-productivity-exporting nexus that imported intermediate inputs can serve as a channel that could indirectly foster firms' productivity as well as their competitiveness.

We however conclude that technological spillovers associated with imported complex intermediate inputs and which subsequently lead to firm productivity gains will be hampered if firms have limited absorptive capacities. This is because the advanced technology embodied in the complex intermediate inputs is largely product-specific and hence is not easily absorbed by an average firm. This is one key facet attributable to the productivity slowdown that has been associated with Botswana's manufacturing firms. We therefore conclude that although the productivity-enhancing effects of imported intermediate inputs are confirmed in Botswana, imports are no panacea to providing productivity externalities to firms.

This study has some policy implications. Industrial and trade policies within the SACU region should be harmonized, with a view to enhancing access of affordable and high quality intermediate inputs, particularly from South Africa[77]. This move will be favourable to Botswana's manufacturing firms that aspire to export out of the SACU region. More importantly, if imported intermediate inputs boost firms' export destination diversification through high productivity gains, it is a welcome development strategy for Botswana's

[77] Access of affordable raw materials is mostly cited as one of the bottlenecks to doing business by most African countries (Brenton et al., 2012).

manufacturing firms to import more from the rest of the world. However, to fully reap the benefits accruing from imported intermediate inputs, Botswana's firms' absorptive capacities should be boosted through formation of joint ventures between multinational corporations (MNCs) and small to medium-sized citizen-owned firms.

Our study has limitations, which are important to highlight to stimulate future research. We suggest that, once all specific tariffs are converted into advalorem rates, there is need to investigate in-depth the factors that inform a firm's decision to import complex intermediate inputs in favour of homogenous intermediate inputs in Botswana. Secondly, as the availability of FDI-invested data at the firm level improves, future research work be geared towards understanding the productivity-enhancing effects of FDI as an alternative channel of technology spillovers.

Chapter 5

5. General Conclusion and Policy Implications

5.1. Summary of findings

This thesis has explored both the extensive and the intensive margins of international trade in Botswana by looking at the export value, productivity and imported intermediate inputs effects of firm export diversification. This has been addressed in three empirical studies. The first study (Chapter 2) has explored stylized facts of firm export diversification, both product diversification and destination diversification, coupled with investigating how the evolution of growth in value of firm exports is related to changes in firm export diversification characteristics. The second study (Chapter 3) has dealt with the productivity impact of destination export diversification while the last study (Chapter 4) has considered the productivity-enhancing effects of input complementarity on export destination diversification.

This thesis is inspired by the Melitz (2003) and Chaney (2008) theoretical models which pin down reallocations on firm entry into export markets, number of products and destinations served by exporting firms as well as the export value "fetched" by the exporters to firm heterogeneity in productivity and the fixed costs of exporting. It thus contributes to the debate on the importing-productivity-exporting nexus in three ways. Firstly, in defining firm export diversification, it considers both product diversification and destination diversification to build a case to identify the types of exporters that contribute more to the export value, coupled with the non-linearities associated with the link between export value and firm export diversification characteristic. Secondly, by taking into account the existence of trade preferences and an empirical methodology that accounts for firm's selection into the export markets and excess zeros emanating from the fact that not all firms export to all destinations in the world, the productive impact of firm export destination diversification is investigated. Lastly, attributed to the lack of a valid instrument that serves to exogenously increase the availability of imported intermediate inputs, a direct link of the productivity-enhancing effects of imported intermediate inputs to firm export destination diversification is currently sparsely researched. Exploring this link has enabled us to theoretically combine together the firm productivity-enhancing effects of input complementarity, technology transfer and firm export destination diversification.

Using export transactions dataset of all Botswana's traders for the period 2003 to 2012, Chapter 2 provides descriptive evidence of how diversified Botswana's exports are as well as what is driving changes in the observed export diversification trends. Additionally, particular emphasis was placed in investigating the association between firm size as measured by export value and its export diversification characteristic, defined in terms of product-destination category. The results provide stylized facts about Botswana's firm exporting behaviour which are in line with evidence from existing empirical literature and to theories of firm heterogeneity of international trade.

Specifically, Botswana's exporters have increasingly become diversified in terms of products and destinations, for the period 2003 to 2012. However, product diversification as measured by the average number of products per firm has increased more than destination diversification (average number of destinations per firm). In 2003, the average number of products per firm stood at 5.8 and had since increased to 9.2 products per firm in 2012. In contrast, in 2003, the average number of destinations per firm was 1.3 while it increased to a modest 1.5 in 2012. These results further show that while the average number of products (destinations) has changed over time, the median number of products (destinations) has remained the same. In comparison to other exporters elsewhere such as in Mali, Tanzania and Senegal (Cadot et al., 2013), there is evidence that exporters in those countries are more diversified in terms of destinations. This points to the need to decompose Botswana's export growth into the extensive and intensive margins of international trade, with a view to establishing what factors drive these.

Combining information about the number of products and destinations, with a view to depict the significance of multi-product multi-destination exporters in generating higher export values, there is clear evidence that international trade is highly concentrated across firms. Over 70 percent of Botswana's exports are from the mining sector such as diamonds, copper nickel and gold while the United Kingdom has remained the leading export destination for Botswana, followed by South Africa. In specific terms, in 2003, 87.71 percent of Botswana's exporting firms exported to a single destination and these exports accounted for 78 percent of the aggregate export value during that year. On the other hand, while multi-destination exporters accounted for about 12 percent of exporters in 2003, their exports accounted for 22 percent of the export value. This is a striking feature of the exporting behaviour registered in 2003, where single destination exporters accounted for the bulk of the export value. However, for 2012, the distribution of exporters and their export values reflected patterns found in empirical studies

done elsewhere such as in the US and Denmark (Bernard et al., 2007; Eriksson et al., 2009). Here, multi-product multi-destination exporters, although were few, contributed the bulk of the export value. These results may signal the potential of firm productivity differentials in influencing firm export diversification status.

Generally, the descriptive evidence in this chapter highlights the existing trade concentration, especially in terms of destinations and dominance of diamonds, coupled with the potential importance of the multi-product multi-destination exporters in generating higher export values. The dominance of the single product single destination exporters in the country serves as a testament that entry into the export markets is an unpopular activity, as evidenced by the drop in the number of new exporting firms over time. While 712 new exporters entered the export markets in 2004, only 471 entered the export markets in 2012.

Chapter 2 then turns to a more formal empirical analysis of the association between firm export diversification status and its export value. This is explored using a regression methodology that enables the categorization of the firm export diversification status into four entry modes, namely single product single destination (SPSD); single product multi-destination (SPMD); multi-product single destination (MPSD); and multi-product multi-destination (MPMD) exporters. The estimation results indicate that the export value is significantly and positively related to choosing all the three entry mode choices relative to single product single destination exporters. Furthermore, the estimated returns to exports are highest for the multi-product multi-destination exporters, followed by single product multi-destination exporters and then lastly multi-product single destination exporters. These results are consistent for both between and within firms.

Interestingly, plotting the predicted probabilities of the four entry choices confirms that the association between firm's export value and its entry mode choice is a non-linear one. This finding cautions against basing the estimation results solely on coefficient interpretation (Wulff, 2015). The results show that there has not been much dynamism in changing export diversification in Botswana, with very few firms exporting to multi-destinations. Specifically, firms are entirely single product single destination exporters at low export values. They then expand the number of products to the destination but not the destinations of that product as they continue to grow. At higher level of export values, firms transition into exporting to multi-destinations. Hence, these results highlight that to grow exports, firms need to break into new markets. However, the existing low concentration of exports in multi-destination exporters,

suggests a constraint relating to this particular type of diversification that undermines its potential to boost the country's exports. These results therefore underscore the importance of grouping exporters into their different export diversification categories in order to get more informed evidence of the dynamics of firm exporting behaviour.

Given the potential of multi-product multi-destination exporters in boosting firm exports coupled with the existing trade concentration in terms of number of destinations per firm, it is imperative to investigate the characteristics of multi-product multi-destination exporters. Chapter 3 has dealt with providing insights into firm characteristics determining selection into export destinations. In more specific terms, it has investigated the link between firm productivity and its export destination diversification. The chapter thus investigates the factors that determine firm selection into export markets as well as the firm characteristics that influence export destination diversification. This study has been motivated by theoretical predictions in the productivity-exporting nexus that attempts to link firm productivity, trade preferences and export destination diversification. In doing so, it tests two hypotheses. One being destination count is positively related to firm productivity and the other one being productivity differentials matter more for exporting out of the SACU region.

Using firm-level data capturing export transactions as well as firm characteristics of manufacturing firms, the chapter provides evidence that the more productive firms are most likely to enter the export markets. Once firms have self-selected themselves into the export markets, only the most productive firms will be multi-destination exporters. These results suggest that firm productivity is important for the realization of firm export destination diversification. Related to other firm characteristics, the chapter provides evidence that foreign-owned, large and older firms are those that are most likely to enter the export markets. Once self-selected into the export markets, only firm size and exporting experience matter for firm export destination diversification. Our results also confirm that there exists productivity premium associated with exporting out of the SACU region. However, for less competitive firms, exporting out of SACU region will compromise the firm's destination diversification efforts. An additional channel influencing firm export destination diversification through productivity was identified to be exporting non-primary products that exclude beef and diamonds exports.

Finally, chapter four has addressed the empirical question of the role of the productivity-enhancing effects of input complementarity on firm export destination diversification. Inspired

by the input complementarity and technology transfer hypotheses, the chapter is premised on a theoretical framework that links together productivity-enhancing effects of imported intermediate inputs and firm export destination diversification (Melitz, 2003; Chaney, 2008). The SA-EU TDCA agreement presents an opportunity of the existence of a valid instrument that can be used to offer an exogenous variation in the availability of imported intermediate inputs. This is further substantiated by the fact that Botswana's firms are heavily reliant on imports from South Africa. We address the empirical question of this chapter using the export and import transactions datasets, product complexity classification as well as tariff data used to compute firm-level input tariffs. This study relies on a sample of exporters of manufactured goods that imported intermediate inputs as well as those that did not import at all during 2003 – 2012 period.

In answering this empirical question, the chapter relies on the three measures that proxy for input complementarity as identified in the literature being, number of product-source country pairs, number of source countries and total import value. The results, which are robust to the use of the three measures of input complementarity, showed remarkably consistent finding confirming the productivity-enhancing effects of the input complementarity hypothesis on firm export destination diversification in Botswana. Specifically, a firm's use of imported intermediate inputs stimulates its export destination diversification. The results indicate that Botswana's manufacturing firms stand to benefit from imported intermediate inputs and suggest that trade policy should not discourage imports, particularly of intermediate inputs.

In addition, the impact of input complementarity on a firm's export destination diversification is stronger when the firm uses differentiated imported intermediate inputs. We however caution that since the advanced technology embodied in differentiated intermediate inputs is largely product-specific, it may not easily be absorbed by an average firm (Yu and Li, 2014). This may suggest that firms with high absorptive capacities will be the only ones able to realize improved productivity gains associated with export destination diversification. Therefore, despite that the productivity-enhancing effects of imported intermediate inputs are confirmed for Botswana, imports are no panacea to providing productivity externalities to firms in the country.

5.2. Implications of findings for policy

This thesis contributes to the understanding of the debate on the importing-productivity-exporting nexus in developing countries, particularly for developing countries that rely heavily on trade preferences. The period of analysis of the thesis, from 2003 – 2012, coincided with the implementation of the SA-EU TDCA agreement in 2000 earmarked towards tariff liberalization. Thus, growth in the margins of international trade (both intensive margin and extensive margin) attributed to firm productivity growth, was expected during this time period.

However, the evidence presented in the thesis that of prevailing trade concentration, especially in terms of destinations, suggests a constraint to realizing this particular type of diversification. This can be addressed by amongst others, policies geared towards stimulating firm productivity. Secondly, the finding of the existence of the non-linear association between firm export diversification status (defined in terms of product-destination category) and export value, calls for the need for focussed industrial/trade policies that are tailor-made for the needs of each category of firm. This therefore calls for the government to refrain from implementing the conventional "one-size fits all" kinds of industrial/trade policies. Furthermore, the finding that multi-product multi-destination exporters has the potential to boost firm exports, including their high likelihood of being large exporters, suggests that focussed industrial/trade policies should endeavour to promote joint ventures between foreign-owned firms with small to medium –sized citizen firms. This is expected to stimulate firm productivity.

Chapter three also has key policy implications. The findings that the more productive firms are most likely to enter the export markets and that there is a productivity premium associated with exporting out of the SACU region, suggest that policy should be geared towards enhancing the firms' competitiveness in the export markets. This is more relevant given that exporting out of the SACU region will dampen the export destination diversification efforts of the less competitive firms. Because of trade preferences, majority of firms export to the neighbouring South Africa, which has a lower productivity threshold as compared to destinations out of the SACU region. This therefore calls for market access strategies that are geared towards addressing firms' inefficiencies and their absorptive capacities. This is even more so given that chapter three proceeds to establish that only the most productive firms that export out of the SACU region will be the ones that are able to export to many destinations.

Lastly, evidence confirming the productivity-enhancing effects of the input complementarity hypothesis on export destination diversification suggests that industrial and trade policies within the SACU region should be harmonized. This step will encourage importing of affordable and high quality intermediate inputs, particularly from South Africa. This goes to show that South Africa remains an important trading partner for Botswana, both for imports and exports. More importantly, the non-tariff barriers aimed at discouraging imports should gradually be removed. However, effort also needs to be put in strengthening the absorptive capacities of the firms, so that they are able to benefit fully from the advanced technology embodied in imported intermediate inputs.

5.3. Suggestions for future research

This thesis suggests a number of research ideas to be considered for future research. In chapter two, the empirical analysis was based on the relationship between a firm export diversification status (defined in terms of both products and destinations) and its export value. It would be useful in future to extend the research to the analysis of the link between firm export diversification status and its initial entry into the export market in order to understand firm entry dynamics and export diversification, with a view to establish if the link is also non-linear.

With respect to the study on how firm productivity influences export destination diversification, the caveat of the study is a lack of a proper measure of firm productivity due to data limitations. It is therefore proposed that in the future, when data availability allows for the estimation of a firm total factor productivity, this kind of research be extended to cover such.

Finally, given that effort still needs to be put in converting tariffs that are specific tariffs into advalorem rates, it is suggested that an in-depth study on the productivity-enhancing effects of input complementarity and technology transfer hypotheses be undertaken going forward. This will be with a view to fully appreciate what informs a firm's decision to import complex (differentiated) versus homogeneous intermediate inputs. In addition, empirical literature has identified that foreign direct investment outperforms importing as a source of technology (Keller, 2004). It is thus proposed that in future, this study be extended to look at the productivity-enhancing effects of FDI on a firm's export destination diversification.

References

Abel, J.R., Dey, I. and Gabe, T.M. 2012. "Productivity and the Density of Human Capital". *Journal of Regional Science,* 52(4): 562-586.

Acemoglu, D. and Zilibotti, F. 1997. "Was Prometheus Unbound by Chance? Risk, Diversification, and Growth". *Journal of Political Economy,* 105(4): 709-751.

Acemoglu, D., Johnson, S. and Robinson, J.A. 2001. "An African Success Story: Botswana" Massachusetts Institute of Technology, Working Paper 01 – 37.

Aghion, P., Blundell, R., Griffith, R., Howitt, P. and Prantl, S. 2004. "Entry and Productivity Growth: Evidence from Microlevel Panel Data". *Journal of the European Economic Association, 2(2/3): 265-276.*

Alvarez, R. and Lopez, R. 2005. "Exporting and Performance: Evidence from Chilean Plants". *Canadian Journal of Economics,* 38(4): 1384-1400.

Ama, N.O, Mangadi, K.T., Okurut, F.N. and Ama, H.A. 2013. "Profitability of the Informal Cross-Border Trade: A Case Study of Four Selected Borders of Botswana". *African Journal of Business Management,* 7(40): 4221-4232.

Amador, J. and Opromolla, L.D. 2013. "Product and Destination Mix in Export Markets". *Rev World Econ,* 149: 23-53.

Amiti, M. and Konings, J. 2007. "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia". *The American Economic Review,* 97(5): 1611-1638.

Amiti, M. and Freund, C. 2008. "The Anatomy of China's Export Growth". Policy Research Working Paper No.4628. World Bank Group: Washington, DC.

Andersson, M. 2007. "Entry Costs and Adjustment on the Extensive Margin: An Analysis of How Familiarity Breeds Exports", CESIS Working Paper NO. 81, Royal Institute of Technology, Stockholm.

Andersson, M, Johansoon, S. and Loof, H. 2008. "Productivity and International Trade: Firm Level Evidence from a Small Open Economy". *Review of World Economics (Welt-wirtschaftliches Archiv),* 144(4): 774-801.

Antras, P. 2003. "Firms, Contacts and Trade Structure", *Quarterly Journal of Economics,* 118(4): 1375-1418.

Antras, P. and Helpman, E. 2004. "Global Sourcing", *Journal of Political Economy,* 112(3): 552-580.

Arezki, Rabah, Gylfason, Thorvaldur and Sy Amadou. 2011. "Beyond the Curse: Policies to Harness the Power of Natural Resources. International Monetary Fund.

Arkolakis, A., Muendler, A. and Ganapati, S. “The Extensive Margin of Exporting Products: A Firm-level analysis”. *Previously NBER working paper 16641*.

Armenter, R. and Koren, M. 2015. “Economies of Scale and the Size of Exporters”, *Journal of the European Economic Association,* 13(3): 482 – 511.

Bas, M. 2012. “Input-trade Liberalization and Firm Export Decisions: Evidence from Argentina”. *Journal of Development Economics,* 97(2): 481-93.

Bas (2009). “Trade, Foreign Inputs and Firms; Decisions: Theory and Evidence”, CEPII Working Paper, 2009-2035.

Bas, M. and Strauss-Kahn, V. 2014. “Does importing more Inputs raise Exports? Firm-level Evidence from France”. *Review of World Economics,* 150: 241-275.

Bernard, Andrew B. and Bradford J. Jensen and Robert, Lawrence, Z. 1995. “Exporters, Jobs and Wages in U.S Manufacturing: 1976-1987” *Brookings Papers on Economic Activity. Microeconomics”,* 1995 (1995): 67-119.

Bernard, A.B., and Jensen, J.B. 1999. “Exceptional Export Performance: Cause, Effect or Both?” *Journal of International Economics,* 47(1): 1-25.

Bernard, A.B., and Jensen, J.B. 2004. “Why Some Firms Export”. *Review of Economics and Statistics,* 86(1): 413 – 417.

Bernard, A.B., Eaton, J., Jensen, J.B. and Kortum, S. 2003. “Plants and Productivity in International Trade”. *American Economic Review,* 93: 1268-1290.

Bernard, Andrew B., Jensen, Bernard, J., Redding, S. and Schott, Peter K. 2007. “Firms in International Trade” The *Journal of Economic Perspectives,* 21 (3): 105-130.

Bernard, Andrew B, Jensen, Bradford, J., Redding, S.J. and Peter K. Schott. 2009. “The Margins of US Trade”. *The American Economic Review,* 99(2): 487-493.

Bernard, Andrew B, Bradford J. Jensen and Peter K. Schott. 2009. “Importers, Exporters and Multinationals: A Portrait of Firms in the U.S that trade Goods”. In *Producer Dynamics: New Evidence from Micro Data,* ed. T. Dunne, J.B. Jensen, and M.J. Roberts. University of Chicago Press 513-552.

Bernard, Andrew B., Redding, S.J. and Peter K. Schott. 2011. “Multi-Product Firms and Trade Liberalization”. *Quarterly Journal of Economics,* 126: 1271-318.

Bernard, Andrew B, Jensen, Bradford, J., Redding, S.J. and Peter K. Schott. 2012. “The Empirics of Firm Heterogeneity and International Trade”. *Annu. Rev. Econ,* 4: 283-313.

Bernard, A.B., Beveren, I.V. and Vandenbussches, H. 2014. “Multi-Product Exporters and the Margins of Trade”. *The Japanese Economic Review,* 65(2): 142-167.

Bertinelli, L., Heinen, A., and Strobl, E. 2009. “Export Diversification and Price Uncertainty in Developing Countries: A Portfolio Theory Approach”. Universidad Carlos III de Madrid

Besedes, Tibor and Prusa, Thomas J. 2011. “The Role of Extensive and Intensive Margins and Export Growth”. *Journal of Development Economics,* 96: 371-379.

Besedes, Tibor and Prusa, Thomas J. 2006. “Ins, Outs, and the Duration of Trade”. *The Canadian Journal of Economics,* 39(1): 266-295.

Boehe, D.M., & Jimenez, A. 2016. “How Does the Geographic Export Diversification-Performance relationship vary at Different levels of Export Intensity:” *International Business Review,* 25: 1262-1272.

Brenton, Paul, Cadot, Olivier and Pierola, Martha. 2012. “Pathways to African Export Sustainability”. The World Bank.

Bustos, P. 2011. “Trade Liberalization, Exports and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinian Firms”. *American Economic Review,* 101: 304-340.

Cadot, O., Carrere, C., and Strauss-Kahn, V. 2011. “Export Diversification: What’s Behind the Hump?” *The Review of Economics and Statistics,* 93(2): 590-605.

Cadot, O., Carrere, C., and Strauss-Kahn, V. 2013. “Trade Diversification, Income and Growth: What Do We Know?”. *Journal of Economic Surveys,* 27(4): 790-812.

Cadot, O., Iacovone, L., Pierola, M.D., and Rauch, F. 2013. “Success and Failure of African Exporters”. *Journal of Development Economics,* 101: 284-296.

Cameron, A.C. and Trivedi, P.K. 2009. “Microeconometrics Using Stata”. College Station, Texas: Stata Press Publication.

Can, M. and Gozgor, G. 2018. “Effects of Export Product Diversification on Quality Upgrading: An Empirical Study”. *The Journal of International Trade & Economic Development,* 27(3): 293-313.

Canales-Kriljenko, Gwenhamo, F. and Thomas, S. 2013. “Inward and Outward Spillovers in the SACU area”. IMF Working Paper.

Castellani, Davide, Serti, Francesco and Tomasi, Chiara. 2010. *“*Firms in International Trade: Importers’ and Exporters’ Heterogeneity in Italian Manufacturing Industry*”*. *The World Economy.*

Caves, R.E. 1974. “Multinational Firms, Competition, and Productivity in Host- Country Markets”. *Economica, New Series,* 41(162): 176-193.

Cebeci, T., Fernandes, A.M., Freund, C. and Pierola, M.D. 2012. “Exporter Dynamics Database”. Policy Research Working Paper Series 6229, World Bank.

Chacha, P.W. 2017. “Firm Level Export Dynamics and Market Access Costs: Evidence from Kenya”. Thesis Presented for the Degree of Doctor of Philosophy. University of Cape Town.

Chaney, T. 2008. “Distorted Gravity: The Intensive and Extensive Margins of International Trade”. *The American Economic Review,* 98(4): 1707 – 1721.

Chevassus-Lozza, E., Gaigne,C.. and Mener, L.L. 2013. “Does Input Trade Liberalization Boost Downstream Firms’ Exports? Theory and Form-level Evidence”. *Journal of International Economics,* 90: 391-402.

Chikabwi, D., Chidoko, C. and Mudzingiri, C. 2017. “Manufacturing Sector Productivity Growth Drivers: Evidence from SADC Member States”. *African Journal of Science, Technology, Innovation and Development,* 9(2): 163-171.

Colantone, I., Coucke, K. and Sleuwaegen L. 2014. “Low-cost import competition and firm exit: evidence from the EU”. *Industrial and Corporate Change,*

Conti, G., Turco, A.L. and Maggioni, D. 2014. “Rethinking the Import-Productivity Nexus for Italian Manufacturing”. *Empirica,* 41: 589-617.

Contractor, F.J., Kumar, V., & Kundu, S.K. 2007. “Nature of the Relationship between International Expansion and Performance: The Case of Emerging Market Firms”. *Journal of World Business,* 42: 401-417.

Corden, M.W. 1971. “The Theory of Protection”. Oxford: Oxford University Press.

D’Angelo, A., Majocchi, A., and Zucchella, A. and Buck, T. 2013. “Geographical Pathways for SME Internalization: Insights from an Italian sample”. *International Marketing Review,* 30: 80-105.

Damijan, J.P., Polanec, S. and Prasnikar, J. 2007. “Outward FDI and Productivity: Micro-evidence from Slovenia”. *The World Economy,* 30(1): 135-155.

De Benedictis, L. and Salvatici, L. (eds). “The Trade Impact of European Union Preferential Policies”, DOI 10.1007/978-3-642-16564-1_4, © Springer-Verlag Berlin Heidelberg 2011.

De Loecker, J. 2007. “Do Exports Generate Higher Productivity? Evidence from Slovenia”. *Journal of International Economics,* 73(1): 69 - 98.

Di Giovanni, J., Levchenko, A.A., and Mejean, I. 2014. “Firms, Destinations and Aggregate Fluctuations”. *Econometrica,* 82(4): 1303-1340.

Dixit, A. and Stiglitz, J. 1977. "Monopolistic Competition and Optimum Product Diversity". *American Economic Review,* 67 (3): 297-308.

Dornbusch, Rudiger (1992). "The Case for Trade Liberalization in Developing Countries". *The Journal of Economic Perspectives.* Vol 6(1): pp. 69 – 85.

Eaton, J. and Kortum, S. 1999. "International Technology Diffusion: Theory and Measurement", *International Economic Review,* 40(3): 537-570.

Eaton, J., Kortum, S., and Kramarz, F. 2004. "Dissecting Trade: Firms, Industries and Export Destinations". *American Economic Review,* 94(2): 150-154.

Eaton, J., Eslava, M., Kugler, M., & Tybout, J. 2008. "Export Dynamics in Colombia: Firm-level evidence". In E. Helpman, D, Marin, & T. Verdier (Eds), *The organization of firms in a global economy.* Cambridge, MA: Harvard U. Press.

Eaton, J., Kortum, S., and Kramarz, F. 2011. "An Anatomy of International Trade: Evidence from French Firms". *Econometrica,* 79(5): 1453 – 1498.

Eckel, C. and Neary, J.P. 2010. "Multi-Product Firms and Flexible Manufacturing in the Global Economy". *The Review of Economic Studies,* 77: 188 – 217.

Edwards, L. 2004. "A Firm Level Analysis of Trade, Technology and Employment in South Africa". *Journal of International Development,* 16: 45-61.

Edwards, L. 2005. "Has South Africa Liberalised its Trade?". *South African Journal of Economics,* 73(4): 754-775.

Edwards, Lawrence and Alves, Phil. 2006. "South Africa's Export Performance: Determinants of Export Supply". *South African Journal of Economics,* 74(3).

Edwards, L., Sanfilipo, M. and Sundaram, A. 2017. "Importing and Firm Export Performance: New Evidence from South Africa". *South African Journal of Economics.*

Egger, H. and Kreickmeier, U. 2009. "Firm Heterogeneity and the Labour Market Effects of Trade Liberalization". *International Economic Review,* 50(1): 187-216.

Eriksson, Tor, Smeets, Valerie and Warzynski, Frederic. 2009. "Small Open Economy Firms in International Trade: Evidence from Danish Transactions-Level Data". Working Paper 09-7.

Ethier, W.J. 1982. "National and International Returns to Scale in the Modern Theory of International Trade". *American Economic Review,* 72(3): 389-405.

Evenett, S. and Venables, A. 2002. "Export Growth in Developing Countries: Market Entry and Bilateral Trade Flows". Working Paper, < http://www.evenett.com/working/setvend.pdf>.

Falk, M., and Hagsten, E. 2015. "Export Behaviour of Micro Firms in the Swedish Computer and Business Service Industries". *The Open-Access, Open-Assessment E-Journal,* 9: 1-24.

Feenstra, R. and Kee, H.L. 2004. "On the Measurement of Product Variety in Trade". *American Economic Review,* 94(2): 145-149.

Feng, L. Li, Z. and Swenson, D.L. 2016. "The Connection between Imported Intermediate Inputs and Exports: Evidence from Chinese Firms". *Journal of International Economics,* 101: 86-101.

Fernandes, A.M., Freund, C. and Pierola, M.D. 2016. "Exporter Behaviour, Country Size and Stage of Development: Evidence from the Exporter Dynamics Database". *Journal of Development Economics*, 119(1): 121-137.

Foster-McGregor, N., Isaksson, A., and Kaulich, F. 2014. "Importing, Exporting and Performance in Sub-Saharan manufacturing firms". *Rev World Econ,* 150? 309-336.

Frensch, R. 2010. "Trade Liberalization and Import Margins". *Emerging Markets and Finance & Trade,* 46(3): 4-22.

Gebreeyesus, M. 2015. "Firm Adoption of International Standards: Evidence from the Ethiopian Floriculture Sector". *Agricultural Economics,* 46: 139-155.

Goldberg, Pinelopi K., Khandelwal, Amit K., Pavcnik, N. and Topalova, P. 2010. "Multiproduct Firms and Product Turnover in the Developing World: Evidence from India". *The Review of Economics and Statistics*, 92(4): 1042-1049.

Goldberg, Pinelopi K., Khandelwal, Amit K., Pavcnik, N. and Topalova, P. 2010. "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India". *The Quarterly Journal of Economics.*

Government of Botswana. 2008. "Industrial Development Policy". Ministry of Trade and Industry. Gaborone, Botswana.

Grossman, G.E. and Helpman, E. 1991. "Innovation and Growth in the World Economy, Cambridge, MA: MIT Press.

Grossman, G.M. and Helpman, E. 1993. "Endogenous Innovation in the Theory of Growth". National Bureau of Economic Research, Working Paper No. 4527.

Grossman, G. E. and Helpman, E. 1994. "Protection for Sale". *American Economic Review,* 84(4): 833 – 50.

Habiyaremye, A. 2013. "Imported Capital Goods and Manufacturing Productivity: Evidence from Botswana's Manufacturing Sector". *South African Journal of Economics,* 81(4):

Halpern, L. and Murakozy, B. 2011. "Firm Size and Extensive Margin: Hungarian Exports". *Economic and Business Review,* 13(1-2): 27-50.

Halpern, L., Koren, M. and Szeidl, A. 2015. "Imported Inputs and Productivity". *American Economic Review,* 105(12): 3660-3703.

Hausmann, R., and Rodrik, D. 2003. "Economic Development as self-discovery". *Journal of Development Economics. 72: 603-633.*

Hausmann R., and Klinger, B. 2006. "Structural Transformation and Patterns of Comparative Advantage in the Product Space". Harvard University, Cambridge, MA.

Hausmann, R., Hwang, J. and Rodrik, D. 2007. "What You Export Matters". *Journal of Economic Growth,* 12(1): 1-25.

Helpman, E., Melitz, M.J. and Yeaple, S.R. 2004. "Export versus FDI with Heterogeneous Firms". *American Economic Review,* 94(1): 300-316.

Helpman, E., Melitz, M. and Rubinstein, Y. 2008. "Estimating Trade Flows: Trading Partners and Trading Volumes". *The Quarterly Journal of Economics,* 123(2): 441-487.

Hottman, C.J., Redding, S.J. and Weinstein, D.E. 2016. "Quantifying the Sources of Firm Heterogeneity". *The Quarterly Journal of Economics,* 2016: 1-74.

Hwang, J. 2006. "Introduction of New Goods, Convergence and Growth". Job Market Paper. Cambridge, MA: Harvard University.

Iacovone, L. and Javorcik, B.S. 2010. "Multi-Product Exporter: Product Churning, Uncertainty and Export Discoveries". *The Economic Journal,* 120(544): 481-499.

Imbs, J. and Wacziarg, R. 2003. "Stages of Diversification". *American Economic Review,* 93(1): 63-86.

Impullitti, G., Irarrazabal, A.A. and Opromolla, L.D. 2013. "A Theory of Entry into and Exit from Export Markets", *Journal of International Economics,* 90: 75 – 90.

International Monetary Fund. 2017. Botswana Article IV Consultation, Country Report No. 17/249.

Jordaan, Andre C. and Eita, Joel H. 2009. "Testing the Export-Led Growth Hypothesis for Botswana: A Causality Analysis". *Botswana Journal of Economics.*

Jorge, Canales K., Farayi Gwenhamo, and Thomas Saji. 2013. "Inward and Outward Spillovers in the SACU Area". IMF Working Paper No. 13/31.

Kamal, F. and Sundaram, A. 2016. "Buyer-Seller Relationships in International Trade: Do your Neighbours Matter". *Journal of International Economics,* 102: 128-140.

Kasahara, H. and Lapham, B. 2013. "Productivity and the decision to import and export: Theory and Evidence". *Journal of International Economics,* 89(2), 297-316.

Keller, W. and Yeaple, S.R. 2009. "Multinational Enterprises, International Trade and Productivity Growth: Firm-level Evidence from the United States". *The Review of Economics and Statistics,* 91(4): 821-831.

Keller, W. 2004. "International Technology Diffusion", *Journal of Economic Literature,* 42(3), 752-782.

Kojo, N.C. 2010. "Diamonds Are Not Forever: Botswana Medium-Term Fiscal Sustainability". Policy Research Working Paper No. 5480. Washington: The World Bank.

Koren, M. and Tenreyro, S. 2007. "Volatility and Development", *The Quarterly Journal of Economics*, 122(1): 243 – 287.

Lawless, M. 2009. "Firm Export Dynamics and the Geography of Trade". *Journal of International Economics,* 77: 245-254.

Lawless, M. 2010. "Geography and Firm Exports: New Evidence on the Nature of Sunk Costs". *Review of World Economics/ Weltwirtschaftliches Archiv,* 146(4): 691-707.

Lee, L.F. 1983. "Generalized Econometric Models with Selectivity". *Econometrica,* 51(2): 507-512.

Lesser, C. and Moise-Leeman, E. 2009. "Informal Cross-Border Trade and Trade Facilitation Reform in Sub-Saharan Africa". OECD Trade Policy Working Papers, No. 86, OECD Publishing, Available at http://dx.doi.org/10.1787/225770164564, accessed on 26-03-2016.

Link, A.N. and Long, J.E. 1981. "The Simple Economics of Basic Scientific Research: A Test of Nelson's Diversification Hypothesis". *The Journal of Industrial Economics,* 30(1): 105-109.

Liu, R. and Rosell, C. 2013. "Import Competition, multi-product firms, and Basic Innovation". *Journal of International Economics*, 91: 220-234.

Long, J.S. and Freese, J. 2006. "Regression models for categorical dependent variables using stata (2nd edition). College Station, TX: Stata Press.

Lopez-Calix, J., Walkenhorst, P. and Diop, N. 2010. "Trade Competitiveness of the Middle East and North Africa: Policies for Export Diversification" The World Bank Group.

Love, J. 1979. "A Model of Trade Diversification Based on the Markowitz Model of Portfolio Analysis". *Journal of Development Studies,* 15(2): 233-241.

Love, J. H., Roper, S. and Zhou, Y. 2016. "Experience, Age and Exporting Performance in UK SMEs". *International Business Review,* 25: 806-819.

Maier, J. and Wood, A. 1998. "Africa's Export Structure in a Comparative Perspective". Study No.4. United Nations Conference on Trade and Development.

Matthee, Marianne, Farole, Thomas, Naughtin, Tasha and Rankin, Neil. 2015. "South African Exporters and the Global Crisis: Intensive Margin Shock, Extensive Margin Hangover". *South African Journal of Economics.*

Mayer, T., and Ottaviano, G.I. 2008. "The Happy Few: The Internationalization of European Firms". *Intereconomics,* 43(3): 135-148.

Mclntyre, A., Xin Li, M., Wang, K. and Yun, H. 2018. “Economic Benefits of Export Diversification in Small States”, IMF Working Paper.

Melitz, M. and Ottaviano, G.I.P. 2008. “Market Size, Trade and Productivity”. *Review of Economic Studies,* 75(1): 295-316.

Melitz, M. J. 2003. “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity”. *Econometrica,* 71 (6): 1695-1725.

Morris, M., Kaplinsky, R. and Kaplan, D. 2012. : One Thing Leads To Another: Promoting Industrialization by Making the Most of the Commodity Boom in Sub-Saharan Africa”. ISBN 978-1-4717-8188-9.

Mundlak, Y. 1978. “On the Pooling of Time Series and Cross Section Data”. *Econometrica,* 46(1): 69-85.

Muuls, Mirabelle and Pisu, Mauro. 2009. “Imports and Exports at the Level of the Firm: Evidence from Belgium”. *The World Economy,* 32(5).

OECD and WTO. 2013. “Aid for Trade at a Glance 2013: Connecting to Value Chains. Paris: Organization for Economic Co-operation and Development.

Okafor, L.E., Bhattacharya, M. and Bloch, H. 2017. “Imported Intermediates, Absorptive Capacity and Productivity: Evidence from Ghanaian Manufacturing Firms”, *The World Economy,*

Papke, L.E. and Wooldridge, J.M. 2008. “Panel Data Methods for Fractional Response Variables with an Application to test Pass Rates”. *Journal of Econometrics,* 145: 121-133.

Parteka, A., and Tamberi, M. 2013. “What Determines Export Diversification in the Development Process? Empirical Assessment”. *The World Economy,* 36(6): 807-826.

Pforr, K. 2014. “femlogit – Implementation of the Multinomial Logit Model with Fixed Effects”, *The Stata Journal,* 14(4): 847-862.

Rauch, E.J. 1999. “Networks versus markets in international trade”. *Journal of International Economics,*48: 7-35.

Republic of Botswana. 2009. “National Trade Policy: Industrialization, Diversification and Export Development for Global Competitiveness”. Ministry of Trade and Industry, Gaborone, Botswana, July 2009.

Republic of Botswana. 2016. “Vision 2036: Achieving Prosperity for All”. Prepared by the Vision 2036 Presidential Task Team. Gaborone, Botswana.

Rivera-Batiz, L.A. and Romer, P.M. 1991. “Economic Integration and Endogenous Growth”, *The Quarterly Journal of Economics,* 106(2): 521-555.

Roberts, M.J. and Tybout, J.R. 1997. “The Decision to Export in Colombia: An Empirical model of Entry and Exit with Sunk Costs”, *The American Economic Review,* 87(4): 545-564.

Rodríguez-Pose, A., Tselios, V., Winkler, D., & Farole, T. 2013. “Geography and the determinants of firm exports in Indonesia”. *World Development, 44*: 225-240.

Schott, P.K. 2004. “Across-Product Versus Within-Product Specialization in International Trade”. *The Quarterly Journal of Economics,* 119(2): 647-678.

Seyoum, B. 2014. “Export-import theory, Practices and Procedures”. Taylor & Francis.

Shaver, J.M. 1998. “Accounting for Endogeneity when assessing strategy performance: Does entry mode choice affect FDI survival?”. *Management Science,* 44: 571-585.

Shepherd, B. 2010. “Geographical Diversification of Developing Country Exports”. *World Development,* 38(9): 1217-1228.

Stirbat, Liviu, Record, Richard and Nghardsaysone, Konesawang. 2011. “Exporting from a Small Landlocked Economy: An Assessment of Firm-Product-Destination Survival Rates in the Lao PDR”, Policy Research Working Paper 5695, The World Bank.

Stuart, B.C., Doshi, J.A. and Terza, J.V. 2009. “Assessing the Impact of Drug Use on Hospital Costs”. *HSR: Health Services Research,* 44(1): 128-144.

Terza, J.V, Basu, A., & Rathouz, P.J. 2008. “Two-stage Residual Inclusion Estimation: Addressing Endogeneity in Health Econometric Modeling”. *Journal of Health Economics,* 27: 531-543.

Terza, J., Bradford, W.D. and Dismuke, C.E. 2008. “The Use of Linear Instrumental Variables Methods in Health Services Research and Health Economics: A Cautionary Note”. *Health Services Research,* 43: 1102 - 1120.

Turco, A.L. and Maggioni, D. 2013. “On the Role of Imports in Enhancing Manufacturing Exports”. *The World Economy,*

Verbeke, A., & Brugman, P. 2009. “Triple-testing the quality of multinationality-performance research: An Internationalization theory Perspective”. *International Business Review,* 19: 265-275.

Vernon, R. 1966. “International Investment and International Trade in the Product Cycle”. *The Quarterly Journal of Economics,* 80: 190-207.

Vogel, A and Wagner, J. 2010. “Higher Productivity in Importing German Manufacturing Firms: Self-Selection, Learning From Importing, Or Both?”. *Review of World Economics/Weltwirtschaftliches Archiv,* 145(4): 641-665.

Wagner, J. 2007. “Exports and Productivity: A Survey of the evidence from firm-level data”. *The World Economy,* 30: 60-82.

Wagner, J. 2012. “International Trade and Firm Performance: A Survey of Empirical Studies since 2006”. *Rev. World Econ,*148: 235 – 267.

Wooldridge, J.M. 2010. “Correlated Random Effects Models with Unbalanced Panels”. *Manuscript* (version May 2010), Michigan State University.

Wulff, J.N. 2015. “Interpreting Results From the Multinomial Logit Model: Demonstrated by Foreign Market Entry”. *Organizational Research Methods,* 18(2):300-325

Xuefeng, Q., & Ya§ar, M. 2016. “Export Market Diversification and Firm Productivity: Evidence from a Large Developing Country”. *World Development,* 82: 28-47.

Yasar, M. and Paul, C.J.M. 2008. “Foreign Technology Transfer and Productivity: Evidence from a Matched Sample”. *Journal of Business & Economic Statistics,* 26(1): 105-112.

Yu, M., Ye, G. and Qu, B. 2013. “Trade Liberalization, Product Complexity and Productivity Improvement: Evidence from Chinese Firms”. *The World Economy,* 36(7): 912-934.

Yu, M. and Li, J. 2014. “Imported Intermediate Inputs, Firm Productivity and Product Complexity”. *The Japanese Economic Review,* 65(2): 178-192.

Appendix ch2

Table ch2A: Top HS-8 Products, Average 2003-2012

	HS-8 Product Code	Total (Pula)
1	Non-industrial diamonds unworked or simply sawn,	790 000 000
2	Nickel mattes	690 000 000
3	Copper mattes	200 000 000
4	Unwrought gold	140 000 000
5	Helicopters of an unladen weight	94 000 000
6	Non-industrial diamonds, not mounted or set, nes	86 000 000
7	Unsorted diamonds	84 000 000
8	Copper ores and concentrates	83 000 000
9	Disodium carbonates	30 000 000
10	Nickel ores and concentrates	29 000 000
11	Industrial diamonds unworked or simply sawn	28 000 000
12	Fresh or chilled boneless bovine meat	26 000 000
13	Semi-manufactured gold	24 000 000
14	Aeroplanes and other aircraft	24 000 000
15	Industrial diamonds, not mounted or set, nes	20 000 000
16	Frozen boneless bovine meat	18 000 000
17	Breeches and shorts	16 000 000
18	Jerseys, pullovers, slipovers, cardigans, twinsets, bed-jackets and jumpers	16 000 000

Table ch2B: Predicted Values at 5th Percentile

Category	Probability	95% Confidence Interval
Pr (y=SPMD | x)	0.0029	(0.0019, 0.0039)
Pr (y=MPSD | x)	0.2109	(0.1983, 0.2235)
Pr (y=MPMD | x)	0.0099	(0.0082, 0.0116)
Pr (y=SPSD | x)	0.7763	(0.7631, 0.7895)

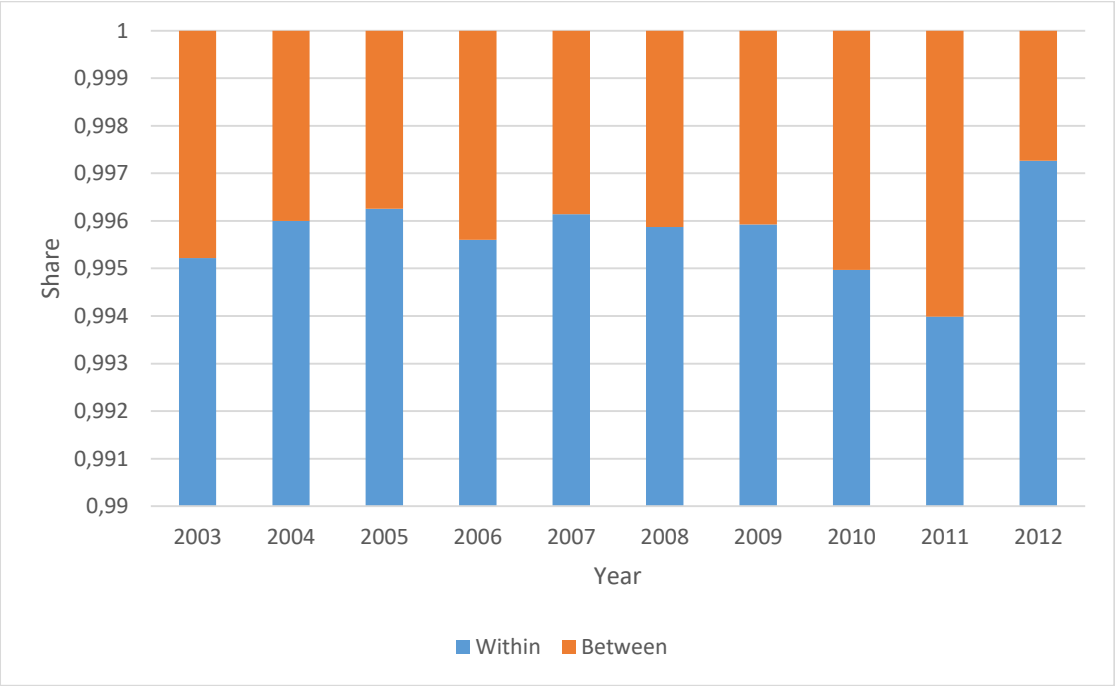
Table ch2C: Predicted Values at 95th Percentile

Category	Probability	95% Confidence Interval
Pr (y=SPMD | x)	0.0443	(0.0341, 0.0546)
Pr (y=MPSD | x)	0.3663	(0.3392, 0.3934)
Pr (y=MPMD | x)	0.5389	(0.5092, 0.5687)
Pr (y=SPSD | x)	0.0505	(0.0441, 0.0569)

Table ch2D: Transition matrix for the category of exports to which a firm belongs

	Product_Destination_Status Year (t)				
Product_Destination_Status Year (t-1)	SPSD	SPMD	MPSD	MPMD	Total
SPSD	45.16	1.54	41.95	11.36	100.00
SPMD	16.18	16.18	14.71	52.94	100.00
MPSD	22.13	0.76	62.10	15.01	100.00
MPMD	8.81	4.45	22.58	64.16	100.00
Total	24.27	2.28	45.56	27.90	100.00

Figure ch2A: Shares of Within and Between Components in Overall Theil Index



Appendix ch3

A. MERGING PROCESS STEPS

The identifier in the export transaction dataset is VAT number while in the other dataset it is the license number. Therefore, we could only merge the two datasets using firm name. The challenge is that firm names are written differently with some written as (Pty) Ltd while others are (PTY) Limited. So the first step we undertook was to generate a new identifier from the original firm names by extracting unwanted characters such as (Pty) Ltd, brackets, spaces, etc. This step was replicated in both datasets. We renamed the new identifier "idmap". Below is an outline of the steps followed to merge the datasets:

- When the two datasets were merged using idmap, 646 firm names were matched.
- We then considered only firm names that didn't merge, to ascertain if they are written differently in both datasets. After synchronizing the names, we repeated the first step and this round two of merging resulted in 665 firm names being merged. A concordance file was then developed using this subset of firm names as these are names that appear in both datasets.
- The concordance file is mapped onto the original datasets to develop an exporter_map and a manufacturing_map. Since the using dataset is the one containing the concordance file, then _merge==2 is zero.
- Finally, we extracted _merge==3 in the exporter_map and merged it into the manufacturing_map to have a complete dataset (including trade data and firm characteristics) of manufacturing firms which comprise of domestic manufacturers and exporting manufacturers.
- Before this final merging is undertaken, the two datasets are collapsed into firm-year observations. In the extracted exporter_map variables such as export scope, export variety, multi-destination dummy, etc are created before this dataset is merged into the manufacturing_map.

B. CHALLENGES ENCOUNTERED DURING THE MERGING PROCESS

1. Three cases of duplicates were identified in the firm characteristics dataset:
   Case 1: In a particular year, a firm with the same license number and same entries of the variables appeared twice. Since these were clear duplicates, the duplicates were dropped by idmap and license number.
   Case 2: This one involves a scenario whereby firm names are the same but license numbers are different with same entries of the variables. In this case duplicates were dropped by investment, employment and idmap.
   Case 3: This case involves a scenario whereby the firm names are the same but different license numbers and different entries on the same variable. In this case firm names with the same idmap were collapsed and duplicates were dropped based on the newly created identifier, idMAN.
2. For the export transactions dataset, we only considered case 3.
3. The firm age variable was created from the variable called "the first year the firm was established", by defining firm age= (year – first year the firm was established) + 1.

Where missing observations in the firm age variable exist and a firm is allocated different years on when it was first established, then a mode was taken.

C. MERGING RESULTS

Table ch3A: Final Merged Dataset

Result	Number of observations
Not merged	2471
From master	1079 (_merge==1)
From using	1392 (_merge==2)
Merged	1578 (_merge==3)

Note: Here the manufacturing_map dataset and exporter_map dataset were merged. The merged dataset is collapsed into firm-year observations.

D. Representativeness of the Dataset

Table ch3B: Coverage of the Dataset, Manufacturing: Number of Firms, Exporters and Export Value (2003-2012)

	Export Value		
Year	BURS dataset (billion)	Our dataset (billion)	Coverage (%)
2003	2.82	1.56	53.32
2004	3.72	2.32	62.37
2005	5.50	2.14	38.91
2006	6.58	5.03	76.44
2007	10.2	6.91	67.75
2008	11.3	4.70	41.59
2009	9.14	3.82	41.79
2010	11.7	3.76	32.14
2011	13.1	4.65	35.50
2012	13.1	12.0	91.60
Total	87.16		54.14

Source: Author's elaboration from the merged dataset.

Notes: 1) The years 2010 and 2011 were outliers in terms of overall export value, which was attributable to one firm whose total export value for these years exceeded the annual average export value. Therefore, we excluded this firm in the years in question when we generated the annual export value.

2) In the export transactions dataset, the exporting manufacturing firms were identified via the ISIC revision 3, capturing divisions 15 up to 37.

Table ch3C: Potential Data Recording Issues (2003-2012)

	(1)	(2)	(3)
Year	**Merged Manufacturing Exporters (BURS)**	**Merged Manufacturing Exporters (our dataset)**	**Discrepancy**
2003	251	167	84
2004	250	165	85
2005	258	171	87
2006	281	187	94
2007	285	202	83
2008	279	186	93
2009	275	133	142
2010	272	91	181
2011	264	159	105
2012	242	117	125
Total	2657	1578	1079

Source: Author's elaboration from the merged dataset.

Table ch3D: Distribution of Firms Across markets and Entry and Exit Dynamics

Country Destination	Rank	Total Exports	Share (%)	Exporters (average)	Entry	Exit	Net Number of Exporters
South Africa	1	27 400 000 000	61.26	438	299	166	133
China	2	3 890 000 000	8.70	14	12	7	5
Bangladesh	3	3 590 000 000	8.03	1	1	1	0
Lesotho	4	1 310 000 000	2.93	6	6	1	5
Namibia	5	1 230 000 000	2.75	55	21	13	8
Belgium	6	938 000 000	2.10	3	3	0	3
Germany	7	885 000 000	1.98	13	12	4	8
Austria	8	858 000 000	1.92	3	5	0	5
Democratic Republic of Congo	9	852 000 000	1.90	3	9	0	9
India	10	663 000 000	1.48	18	13	8	5
Angola	11	536 000 000	1.20	10	8	5	3
France	12	395 000 000	0.88	8	8	2	6
Malawi	13	336 000 000	0.75	15	17	8	9
Czech Republic	14	266 000 000	0.59	1	1	1	0
Denmark	15	215 000 000	0.48	2	3	3	0
Andorra	16	205 000 000	0.46	14	15	15	0
Kenya	17	197 000 000	0.44	5	4	4	0
Mozambique	18	183 000 000	0.41	11	5	3	2
Azerbaijan	19	112 000 000	0.25	1	1	1	0
Norway	20	100 000 000	0.22	2	4	4	0
Hong Kong	21	92 800 000	0.21	4	4	4	0
Egypt	22	73 400 000	0.16	1	1	0	1
Moldova	23	67 500 000	0.15	1	1	1	0
Antarctica	24	62 100 000	0.14	1	1	1	0
Iran	25	51 100 000	0.11	1	2	2	0
Gambia	26	30 500 000	0.07	1	2	2	0
Canada	27	26 400 000	0.06	8	5	5	0
Zimbabwe	28	24 800 000	0.06	37	28	16	12

Country Destination	Rank	Total Exports	Share (%)	Exporters (average)	Entry	Exit	Net Number of Exporters
Australia	29	23 300 000	0.05	5	5	5	0
New Zealand	30	21 200 000	0.05	1	2	2	0
Korea	31	18 800 000	0.04	2	2	2	0
Saudi Arabia	32	13 000 000	0.03	1	1	0	1
United Kingdom	33	11 800 000	0.03	3	2	2	0
Italy	34	11 100 200	0.02	2	2	0	2
Zambia	35	9 175 181	0.02	15	13	4	9
Republic of Yemen	36	4 864 188	0.01	1	1	1	0
Finland	37	4 382 047	0.01	2	2	2	0
Madagascar	38	4 372 908	0.01	1	1	1	0
Mauritius	39	3 577 768	0.01	2	3	3	0
United States of America	40	3 422 058	0.01	6	5	5	0
Ghana	41	3 147 654	0.01	4	6	6	0
Mongolia	42	2 835 960	0.01	1	1	1	0
Bosnia and Herzegovina	43	2 083 046	0.00	2	2	2	0
Netherlands	44	813 726	0.00	3	2	2	0
Gabon	45	721 842	0.00	1	1	1	0
Peru	46	609 021	0.00	1	1	1	0
Tanzania	47	381 200	0.00	3	3	3	0
Oman	48	248 300	0.00	1	2	2	0
Antigua and Barbuda	49	159 952	0.00	1	1	1	0
Israel	50	132 337	0.00	1	2	2	0
Nigeria	51	97 895	0.00	2	2	2	0
Malaysia	52	49 127	0.00	1	1	1	0
Mali	53	17 987	0.00	1	1	1	0
Uganda	54	9585	0.00	1	1	1	0
Senegal	55	8683	0.00	1	1	1	0
Thailand	56	5604	0.00	1	1	1	0
Total		**44 729 916 269**	**100.00**				

Table ch3E: Exporter Premia (2007 – 2012)

VARIABLES	(1) Investment	(2) Turnover	(3) Employment	(4) Age	(5) Turnover/Worker
Exporter	0.975***	1.034***	0.660***	0.210***	0.367***
	(0.077)	(0.089)	(0.052)	(0.051)	(0.071)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Ownership fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	14.108***	15.208***	3.345***	2.265***	11.810***
	(0.221)	(0.251)	(0.150)	(0.140)	(0.200)
Observations	1,640	1,563	1,641	1,497	1,558
R-squared	0.183	0.181	0.139	0.031	0.093

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: 1) Values are given in natural logarithms.

2) Robust standard errors clustered at the firm level.

3) Data pooled over the period 2007 – 2012.

Source: Author's calculation using the merged dataset.

Table ch3F: Over-dispersion test

ystar	Coefficient	Standard error	t	P>|t|	95% confidence interval	
muhat	0.2444241	0.0542711	4.50	0.000	0.1378866	0.3509615

Appendix ch4

Table ch4A: Pooled OLS and Fixed Effects Regression: The Relationship between Import Variables and Number of destinations per product per firm (2003-2012)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS			Fixed effects OLS					
VARIABLES	Scope exports/firm	Scope exports/firm	Scope exports/firm	Scope exports/firm	Scope exports/firm	Scope exports/firm	Scope exports/firm	Scope exports/firm	Scope exports/firm
$\ln(product\_source)_t$	0.002***			0.003**					
	(0.001)			(0.001)					
$\ln(sourcecount)_t$		0.080***			0.015***				
		(0.004)			(0.006)				
$\ln(totalimports)_t$			0.004***			0.001			
			(0.000)			(0.001)			
$\ln(product\_source)_{t-1}$							0.000		
							(0.000)		
$\ln(sourcecount)_{t-1}$								0.014**	
								(0.007)	
$\ln(totalimports)_{t-1}$									0.003**
									(0.001)
Constant	0.713***	0.646***	0.665***	0.703***	0.698***	0.697***	0.723***	0.712***	0.683***
	(0.003)	(0.004)	(0.006)	(0.005)	(0.006)	(0.011)	(0.004)	(0.008)	(0.017)
Year control				Yes	Yes	Yes	Yes	Yes	Yes
Firm control				Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,035	16,035	16,035	16,035	16,035	16,035	9,567	9,567	9,567
R-squared	0.001	0.065	0.009	0.006	0.007	0.006	0.004	0.005	0.005
Number of trader_id				4,846	4,846	4,846	2,647	2,647	2,647

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table ch4B: First-stage Fixed Effects Regression: Relationship between Import Variables and Tariff Preference Margin (2003-2012)

	(1)	(2)	(3)
	Baseline Model		
VARIABLES	Log product-source	Log source count	Log total imports
ln(tariffdiff)$_t$	-0.000	0.003	0.063***
	(0.009)	(0.004)	(0.017)
Constant	3.268***	0.921***	12.578***
	(0.020)	(0.008)	(0.040)
Firm control	Yes	Yes	Yes
Year control	Yes	Yes	Yes
Observations	14,737	14,737	14,737
R-squared	0.008	0.012	0.065
Number of trader_id	4,413	4,413	4,413

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Tables ch4B and ch4C are estimated using the Poisson IV regression (a 2SLS approach for non-linear models proposed by Cameron and Trivedi (2009).

Table ch4C: Fixed Effects IV-Poisson Second-stage Regression Estimates on Relationship between Import Variables and Export Destination Diversification (2003-2012)

	(1)	(2)	(3)
	Baseline Poisson IV		
VARIABLES	Destination count	Destination count	Destination count
ln(product_source)$_t$	-4.827		
	(24.389)		
lpuhat	4.915		
	(24.390)		
ln(sourcecount)$_t$		0.474	
		(2.462)	
lpuhat1		-0.240	
		(2.457)	
ln(totalimports)$_t$			0.028
			(0.118)
lpuhat2			0.008
			(0.118)
Firm control	Yes	Yes	Yes
Year control	Yes	Yes	Yes
Observations	13,063	13,063	13,063
Number of trader_id	2,739	2,739	2,739

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1