School of Economics and Finance

Curtin Business School

Aid for Trade, Trade Costs and Export Diversification with Reference to Sub-Saharan Africa

Rajiv Kumar Nathoo

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Declaration

This dissertation was written while I was studying in the School of Economics, Finance and Property, Curtin Business School at Curtin University. To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: …………………………………………….

Date: April 26, 2019.

Dedicated to

my wife Tina Nathoo

and

our loving son Aarav.

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ABSTRACT

The thesis develops a conceptual model to investigate the effectiveness of Aid for Trade (AfT) in reducing trade costs and for promoting export diversification in sub-Saharan Africa (SSA). Trade costs, which are significantly higher in SSA than in other regions of the world, constitute a potent explanation for the region's marginalisation in global trade and for its vulnerability to external shocks because it relies heavily on a few export commodities. A central hypothesis is that, if AfT can reduce trade costs and spur export diversification, it can help SSA leverage its growth potential through trade.

The thesis makes a contribution to the AfT effectiveness literature by developing a conceptual model to explore causality links between AfT and export diversification measured at two margins: the export share of existing products (*intensive margin*), and the export share of new products (*extensive margin*). The study uses a novel, and more robust, empirical approach, namely the Flex estimator of Santos Silva, Tenreyro, and Wei (2014), to investigate the link between AfT and export diversification in a gravity trade setting. Previous studies have investigated the relationship between AfT and export values. This thesis extends the research to the links between AfT and export diversification – which is a key priority of the AfT initiative (OECD/WTO 2011).

This research is useful and timely because of the heightened awareness among African policymakers of the urgent need for structural transformation and export diversification into high value-added products to sustain economic growth (AfDB 2017). Donor countries have also become more concerned about the effectiveness of aid since the Paris declaration of 2006 and face increasing pressure to reduce aid as they refocus on domestic priorities (Hallaert 2013). Investigating whether AfT, and which category of AfT, is effective in reducing trade costs and in encouraging export diversification in SSA is a promising avenue of research since it could provide important policy insights for both African governments and the donor community. The thesis fills this gap in knowledge by conducting three inter-related empirical studies.

Firstly, the thesis examines the sources of trade costs in 20 SSA countries using data for the period 2004 to 2012. It employs a bilateral trade cost model, controlling for time-varying partner country and time fixed effects, for the empirical analysis. The results reveal that, alongside tariff barriers, and non-policy factors related to geography, policy-induced factors such as weak transport-related infrastructure, poorly connected networks, and inefficient customs and border procedures contribute to the region's high trade costs.

Secondly, the thesis analyses the impact of AfT on trade costs in 47 SSA countries using data for the period 1995 to 2014. It employs a bilateral trade cost model, similar to the previous study but the analysis controls for country-pair and time-varying factors. The findings suggest that AfT flows have helped reduce trade costs in SSA, with the smallest category of AfT, *aid for trade facilitation,* being more effective than *aid for economic infrastructure* and *aid for building productive capacity.* The results are robust to the inclusion of different sources of trade costs as control variables in the model.

Thirdly, the thesis investigates the link between AfT and export diversification along the intensive and extensive margins in 42 SSA countries for the period 1995 to 2014. It applies the Flex technique to estimate an augmented gravity trade model. The findings of this study suggest that *total AfT* is conducive to export diversification along both margins. When analysed by AfT category, the results reveal that *aid for trade facilitation* is more effective at the extensive export margin while *aid for productive capacity* has a bigger impact along the intensive export margin. *Aid for economic infrastructure* seems to promote exports only at the intensive margin.

The empirical findings confirm the importance of trade facilitation in reducing trade costs and stimulating export diversification in SSA, with *aid for trade facilitation* contributing to the most desirable outcome despite its relatively small share in total AfT. Hence, a key policy implication for African governments and the donor community is that providing new and additional resources to trade facilitation could deliver the highest returns in terms of aid effectiveness.

Key words: *Aid for Trade, Trade Costs, Trade Facilitation, Export Diversification, Intensive Margin, Extensive Margin, Gravity Trade Model.*

JEL Classification: *C23, F12, F14, F35, O19.*

ACRONYMS

ACI	Air Connectivity Index
AfDB	African Development Bank
AfT	Aid for Trade
AMG	Augmented Mean Group
BACI	Base de Données de Commerce International
CCEMG	Common Correlated Effects Mean Group
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CES	Constant Elasticity of Substitution
CFTA	Continental Free Trade Area
CIF	Cost, Insurance and Freight
CRS	Creditor Reporting System
CSD	Cross-Sectional Dependence
DAC	Development Assistance Committee
DDA	Doha Development Agenda
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
EU	European Union
EU	European Union
FDI	Foreign Direct Investment
FEM	Fixed Effects Model
FOB	Free On Board
GDP	Gross National Product
GMM	Generalised Method of Moments
GNI	Gross National Income
GPML	Gamma Pseudo-Maximum Likelihood
GSP	Generalised System of Preferences
GVC	Global Value Chain
HDI	Human Development Index
HHI	Herfindahl-Hirschman Index
HK	Hummels and Klenow (2005) trade decomposition

HS	Harmonised System
HS	Harmonised Commodity Description and Coding Systems
ICT	Information and Communication Technologies
IDS	International Development Statistics
IMF	International Monetary Fund
LDC	Least Developed Country
LDCs	Least Developed Countries
LM	Lagrange Multiplier
LPI	Logistics Performance Index
LSCI	Liner Shipping Connectivity Index
MFN	Most Favoured Nation
MFN	Most Favoured Nation
MR	Multilateral Resistance
NTB	Non-Tariff Barriers
ODA	Official Development Assistance
ODCs	Other Developing Countries
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPML	Poisson Pseudo-Maximum Likelihood
REM	Random Effects Model
RTA	Regional Trade Agreement
SSA	Sub-Saharan Africa
TBT	Technical Barriers to Trade
TFA	Trade Facilitation Agreement
TFI	Trade Facilitation Index
TRAINS	Trade Analysis Information System
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
US	United States
USD	United States Dollar
WB	World Bank

WCO	World Customs Organization
WDI	World Development Indicators
WEF	World Economic Forum
WITS	World Integrated Trade Solution
WTO	World Trade Organization
ZIPPML	Zero-inflated Poisson Pseudo-Maximum Likelihood

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CHAPTER 1

INTRODUCTION

1.1 Context of the Study

The Aid for Trade (AfT) initiative, formalised at the Hong Kong WTO Ministerial Conference in December 2005, is based on the premise that trade and development policies are complementary in nature, and that developing countries will not be able to exploit the expanded trading opportunities offered by greater market access to the developed markets under the Doha Round unless they address their supply-side constraints. The restraints can take the form of inadequate or defective infrastructure, weak institutional structures, cumbersome and time-consuming customs procedures, among others (Ferro, Portugal-Perez, and Wilson 2014; Razzaque and te Velde 2013). The AfT initiative was, therefore, introduced to provide financial and technical assistance to developing countries, particularly the least developed countries (LDCs), to address their trade-related infrastructure weaknesses, build their productive capacity, and to formulate and implement appropriate trade policies and regulations (OECD/WTO 2015).

There is a consensus in the trade literature that sub-Saharan Africa[1] suffers from these supply-side deficiencies relatively more than do other developing regions, which in turn contribute to significantly higher trade costs. Africa's infrastructure deficit increases both inland transport costs and shipping costs caused by poor road conditions and an inefficient port system, respectively (Limão and Venables 2001; Njinkeu, Wilson, and Fosso 2008). Moreover, information and communication costs between traders are higher because of poor telecommunication networks (Portugal-Perez and Wilson 2009). Weak institutional structures allow the proliferation of several corrupt practices throughout the supply chain, and this has resulted in additional transaction costs (Francois and Manchin 2013). The slow and sometimes complicated bureaucratic customs procedures in some countries

[1] Hereafter, Africa or SSA.

cause significant delays in the shipping process (Freund and Rocha 2011; Jordaan 2014). Landlocked countries face a higher burden because of the need to transit through their neighbouring countries, such that transit delays and trade costs are higher (Christ and Ferrantino 2011; Elbadawi, Mengistae, and Zeufack 2006).

High trade costs constitute a potent explanation for SSA's marginalisation in world trade and its relatively low regional trade. The continent's share of world merchandise exports stands at around 1.7% while regional trade represents only about 14.8% of its total merchandise exports (UNCTAD 2018). Moreover, SSA's exports are concentrated on a few unprocessed primary commodities (Gupta and Yang 2006; Mosley 2018; Nicita and Rollo 2015). Thirty nine of the 47 SSA countries depend on two primary commodities for over 50% of their export earnings (Morrissey and Filatotchev 2000), and manufacturing exports represent only around 19% of the region's total exports in goods (UNCTAD 2018). The concentrated export structure and the implied absence of diversification enhance SSA's vulnerability to commodity price fluctuations, make them less resilient to economic shocks, and prevent the transfer of resources to higher-productivity sectors like agro-processing and manufacturing.

Export diversification into high value-added primary goods and manufacturing would reduce SSA's vulnerability to shocks that could result in highly unstable export earnings (Cadot, Carrère, and Strauss-Kahn 2013; Haddad et al. 2013; Samen 2010). In addition, diversifying exports from primary commodities into high-skilled, high-technology goods would generate positive spillovers on the rest of the economy through the learning-by-doing and learning-by-exporting effects. Export diversification can, in turn, stimulate economic growth (Fu, Wu, and Zhang 2017; Hausmann, Hwang, and Rodrik 2007; Herzer and Nowak-Lehnmann D. 2006; Lin, Weldemicael, and Wang 2016; Mau 2016).

Export diversification can be achieved if SSA addresses its infrastructure deficit, further liberalises and facilitates trade between borders, and invest in human capital formation. Studies investigating the determinants of export diversification confirm this view (e.g., Agosin, Alvarez and Bravo-Ortega 2012; Anwar 2008; Fonchamnyo and Akame 2017;

Jetter and Hassan 2015; Nicita and Rollo 2015; Parteka and Tamberi 2013; Regolo 2013). However, addressing the supply-side constraints requires significant financing, which poor developing countries may be unable to meet on their own.

Since 2005, the size of AfT flows disbursed to SSA tripled, making it the second largest AfT recipient after Asia. The bulk of the AfT funds obtained from donors have been channelled into the transport and storage, energy, and agricultural sectors in the form of *aid for economic infrastructure* and *aid for productive capacity building*. The amount of AfT disbursed to assist SSA countries in the formulation and implementation of trade policies and trade-related agreements, including trade facilitation initiatives is comparatively low. The share of *aid for trade policy and regulations* is around 2.9%, while its sub-category, *aid for trade facilitation*, is only around 1.2% of the total AfT (OECD 2018).

This study develops a conceptual model that establishes causality links between different categories of AfT, trade costs and export diversification. It also conducts an empirical assessment of the effectiveness of AfT in reducing trade costs and in stimulating export diversification in SSA. This research is useful and timely because of the heightened awareness among African policymakers of the urgent need for structural transformation and export diversification into high value-added products to sustain growth (AfDB 2017; IMF 2017; UNECA 2015). Also, donor countries have expressed scepticism over the effectiveness of aid since the Paris declaration of 2006 and are facing increasing pressure to reduce financial assistance to developing countries as they refocus on domestic priorities (Hallaert 2013). Investigating whether AfT, and which category of AfT, is effective in reducing trade costs and in encouraging export diversification is a promising avenue of research since it could provide important policy insights for both African governments and the donor community.

1.2 Research Objectives

This study has the following objectives:

1. To empirically examine the sources of policy-induced and non-policy barriers to trade in SSA and to assess their relative contribution to the continent's high trade costs.
2. To conduct an empirical assessment of the effectiveness of AfT in reducing the costs of trading within SSA and with the rest of the world.
3. To develop a conceptual model that establishes causality links between different categories of AfT and export diversification at the intensive and extensive margins, and to empirically investigate the effectiveness of AfT in stimulating export diversification along both margins in SSA.

1.3 Research Hypotheses, Methodology and Data

This study employs relevant panel data econometric analyses to achieve the research objectives stated above. Firstly, a bilateral trade cost equation similar to Arvis et al. (2013), and Chen and Novy (2011) is estimated using a panel dataset consisting of 20 SSA countries studied over the period 2004 to 2012. Potential sources of trade costs cited in the literature are included as regressors in the estimating equation. These include factors such as *distance* (e.g., Disdier and Head 2008), *language dissimilarity* (e.g., Egger and Lassmann 2012), *high communication costs* (e.g., Lin 2015), *poor physical infrastructure* (e.g., Limão and Venables 2001), *weak institutions* (e.g., Anderson and Marcouiller 2002; Dutt and Traca 2010), and *trading time delays* (e.g. Djankov, Freund, and Pham 2010; Shepherd 2013). The first comprehensive estimates of bilateral trade costs computed using Novy's (2013) methodology is used as the dependent variable. Standard panel data estimation techniques, namely the Pooled OLS, Random Effects Model (REM), and the Fixed Effects Model (FEM), are employed for the regression. However, the FEM, which controls for time-varying partner country and time fixed effects is favoured by the Hausman test.

The second research objective is to investigate the impact of AfT flows received by SSA countries on bilateral trade costs. The main hypotheses tested in this empirical work relate to the conceptual framework developed by Calì and te Velde (2011), and Cadot and de Melo (2014) to identify causality relationships between AfT and trade costs. In particular, it is hypothesised that *aid for trade facilitation* reduces the time and costs of processing trade, while *aid for economic infrastructure* serves to reduce logistics and communications costs of trade. *Aid for productive capacity*, in turn, helps to reduce behind-the-border costs by creating a more favourable business environment and by dealing with institutional failures. An estimating equation similar to Ali and Milner (2016), and Miroudot and Shepherd (2014) is specified with lagged AfT flows as the independent variable and bilateral trade costs as the dependent variable. Dyadic and time fixed effects serve as control variables in this estimation. A panel dataset consisting of 47 SSA countries examined over the period 1995 to 2014 is employed for the regression. An alternative model specification is also applied as a robustness check. This involves including potential sources of trade costs investigated in the previous empirical analysis as additional control variables in the estimating equation. This analysis, however, restricts the sample to only 20 SSA countries over the period 2004 to 2012 after a consideration of the available data.

Thirdly, a conceptual model is developed to establish causality relationships between AfT, trade costs, and export diversification at the intensive and extensive margins. This model is adapted from the framework developed by Calì and te Velde (2011), and Cadot and de Melo (2014) to analyse the link between AfT, trade costs, and export performance, but is extended to consider the impact on export diversification at the two margins using the 'new-new' trade theory of Chaney (2008), Helpman, Melitz, and Rubinstein (2008), and Melitz (2003). The primary hypothesis derived from the model is that AfT serves to reduce both fixed and variable trade costs, which then increases exports at the intensive and extensive margins. Specifically, AfT reduces variable trade costs such as transportation costs, which in turn encourages an increase in the share of exports of each existing exporter (intensive margin). This also allows some new firms, attracted by the higher profit opportunities in export markets, to enter (extensive margin) in response to a fall in the productivity threshold. AfT also serves to reduce the fixed costs of trade such as those incurred behind-the-border and at-the-border each time goods are to be exported, e.g. costs of handling customs procedures, which do not depend on the size of the shipment. A fall in fixed trade costs, in turn, also reduces the productivity threshold and allows less productive firms to start exporting. With more active firms in export markets, exports may grow at the extensive margin, but the fall in fixed costs does not affect the intensive margin of trade since these are considered as sunk costs for existing firms.

Direct causality links between AfT and export diversification can also be hypothesised; particularly at the extensive margin. *Aid for economic infrastructure* serves to improve international competitiveness enabling more local producers to become exporters and thereby diversify the country's export product basket. *Aid for trade policy and regulations* helps countries to liberalise their trade regimes and to implement trade facilitation reforms successfully. This is important because an increase in producers' access to foreign markets, and a more diverse demand from trading partners, would encourage the diversification of export-oriented goods. Also, *aid for productive capacity building* through educational reforms that serve to improve the quality of human capital would enable innovation and discoveries, thereby promoting export diversification. It is also possible, however, that AfT reduces export diversification via the Dutch Disease effect, or if it goes towards sectors that already enjoy a comparative advantage it will promote export concentration.

The hypotheses drawn from the conceptual model are then tested using a novel empirical approach. Specifically, the use of a gravity trade model augmented with AfT flows received by 42 SSA countries over the period 1995 to 2014 is estimated using the Flex estimator proposed by Santos Silva, Tenreyro, and Wei (2014). Their estimation technique accounts for the presence of zero trade flows, heteroscedasticity and, more importantly, the doubly-bounded nature of the dependent variable, export diversification decomposed at the intensive and extensive margins using Hummels and Klenow (2005)'s methodology from HS 6-digit product disaggregated trade data. Also, since the variable of interest, AfT received by SSA countries is country specific, multicollinearity prevents accounting for Multilateral Resistance (MR) effects using country fixed effects. Baier and Bergstrand (2010)'s methodology is thus employed for this purpose. Robustness checks are also conducted using alternative gravity estimation approaches; namely, the Poisson Pseudo-Maximum Likelihood (PPML), and its variants, the Gamma Pseudo-Maximum Likelihood (GPML) and the zero-inflated PPML (ZIPPML).

1.4 Contributions of the Study

The three inter-related empirical studies make several contributions to the literature on trade costs and AfT effectiveness. The first empirical study investigates the sources of trade costs in SSA and assesses their relative contribution to the high trade costs faced by the region. The findings of previous related studies (Arvis et al. 2013; Duval and Utoktham 2011; Chen and Novy 2011; Jacks, Meissner, and Novy 2010, 2011) are based on a general sample of developed or developing countries and may not be applicable in the SSA context. They also use cross-sectional analysis while this present study employs panel estimation techniques to control for cross-country heterogeneity. In addition, the present study controls for four additional explanatory variables, namely the quality of physical infrastructure, communication infrastructure, border and transport efficiency, and the business regulatory environment, computed using the methodology of Portugal-Perez and Wilson (2012), to allow for a finer disaggregation of the sources of trade costs. The findings of this empirical work can help African governments prioritise their policy actions to reduce trade costs in an attempt to expand both regional and international trade.

In the second empirical study, the causality links between AfT and trade costs are established and tested. This research develops on the few existing studies (Busse, Hoekstra, and Königer 2012; Calì and te Velde 2011) by employing the first comprehensive micro-founded estimates of bilateral trade costs, and a more refined AfT data computed using the methodology of Hühne, Meyer, and Nunnemkamp (2014b) to conduct the empirical analysis. Besides its robustness, the dataset covers a longer time period, which improves the precision of estimates obtained. Furthermore, to minimise the risk of omitted variable bias this study controls for a larger number of trade cost determinants in the regression equation. This study is also unique in that unlike previous empirical investigations that have focused on a sample of developing countries across the world, it provides a lens to analyse the impact of AfT on trade costs faced by SSA when trading regionally and across the globe.

The third empirical study develops a conceptual model exploring transmission mechanisms between AfT, trade costs, and export diversification decomposed into the intensive and extensive margins. An empirical analysis of the effectiveness of AfT in promoting export diversification along the two margins is also conducted using a gravity trade model. Previous studies have focused on aggregate and bilateral export values (see Cadot et al. 2014 for a review of literature) or on export diversification without any distinction between the intensive and extensive margins (see Gnangnon and Roberts 2015; Gnangnon 2018c; Hühne, Meyer, and Nunnenkamp 2014c; Kim 2017). Export diversification at the intensive margin occurs from a rise in the export share of existing product lines, while an increase in exports of new product lines is considered as export diversification at the extensive margin (Amurgo-Pacheco and Pierola 2008; Shepherd 2010).

This decomposition is useful in assessing the effectiveness of the AfT initiative on export diversification in SSA given the continent's over-reliance on a few unprocessed primary commodities. On the one hand, a more equal distribution of the share of exports among existing primary products is desirable to reduce SSA's vulnerability to commodity price fluctuations; while on the other hand, developing comparative advantages in new, higher value-added export sectors contributes to economic growth as supported by the findings of this strand of the literature. This study extends the research to the links between AfT and export diversification along these two margins. It also uses a novel empirical gravity approach, the Flex estimator of Santos Silva, Tenreyro, and Wei (2014), to investigate the effectiveness of AfT in stimulating export diversification in SSA. Previous studies investigating the impact of AfT on export performance through a gravity trade model have employed standard estimation approaches such as the OLS technique with fixed effects, and the dynamic panel Generalised Method of Moments (GMM) for the empirical analysis. Such estimating techniques may not, however, produce reliable estimates (Gómez-Herrera 2013; Santos Silva and Tenreyro 2006).

1.5 Structure of the Thesis

The thesis is divided into six chapters, including this introductory chapter. The rest of the thesis is organised as follows:

Chapter 2 provides a foundation to subsequent empirical chapters on the determinants of trade costs, the effectiveness of AfT in reducing trade costs, and in stimulating export diversification in SSA. It reviews the economic performance of SSA and analyses the factors that have contributed to its relatively poor economic performance from the 1970s until the mid-1990s, the factors behind the rise in economic performance after that, and the lingering problems the continent faces. Trends in SSA's exports in goods are also analysed and a synthesis of the reasons behind the region's relatively poor export performance, with a particular focus on its high trade costs, is made. Subsequently, the meaning and objectives of the AfT initiative are discussed, and trends in AfT disbursements to SSA over time, across sectors, and categories are studied. The literature on the determinants of AfT allocation is also reviewed.

Chapter 3 reviews the literature on the meaning, measures, and sources of trade costs, and discusses the theoretical link between trade costs and trade flows using the Anderson and van Wincoop (2004) model. The micro-founded comprehensive measure of trade costs developed by Novy (2013) is also presented as it forms the basis of subsequent estimations in this study. The computation of proxy indicators of the quality of physical infrastructure, ICT, border and transport efficiency, and business and regulatory environments following the factor analysis approach of Portugal-Perez and Wilson (2012) is discussed. This chapter then describes the empirical investigation of the sources of trade costs within SSA and between SSA and the rest of the world using pooled OLS, fixed panel, and random panel estimation techniques.

Chapter 4 considers the theoretical model developed by Calì and te Velde (2011) to establish causality links between AfT and trade costs. The few empirical studies on the effectiveness of AfT in reducing trade costs are also reviewed. The methodology of Hühne, Meyer, and Nunnemkamp (2014b) in computing a refined AfT data for a longer period is presented. The chapter then reports the baseline findings after assessing the effectiveness of AfT on bilateral intra-African and extra-African trade costs from a fixed effects regression framework, while controlling for dyadic and time fixed effects. It also presents the results from robustness checks performed by using more extended AfT lagged values and an alternative specification model with additional control variables.

Chapter 5 provides a brief literature review of foreign aid and trade before discussing previous studies on AfT and export performance. The literature on export diversification and economic growth, aid and export diversification, and trade costs and export diversification relevant to the study is also reviewed. The chapter then presents a conceptual model to establish causality links between AfT, trade costs, and export diversification at the intensive and extensive margins. The empirical literature on the gravity model of trade is discussed to highlight estimation issues and Hummels and Klenow's (2005) methodology used to compute the intensive and extensive margins of exports is explained. Finally, an AfT-augmented gravity equation is estimated using the Flex technique of Santos Silva, Tenreyro, and Wei (2014) to investigate the effectiveness of AfT along the two margins of exports in SSA. Alternative exports margins measure, AfT data, and gravity estimators are employed as robustness checks of the baseline results.

Finally, Chapter 6 concludes the thesis by discussing the major findings of the empirical chapters. It also discusses the policy implications of the study for SSA policymakers and the donor community. The chapter discusses some limitations of the study and some directions for future research.

CHAPTER 2

AN ANALYSIS OF ECONOMIC PERFORMANCE, EXPORT PERFORMANCE, TRADE COSTS AND AID FOR TRADE IN SUB-SAHARAN AFRICA

2.1 Introduction

The African continent consists of 54 countries, of which 7 countries – Algeria, Egypt, Libya, Mauritania, Morocco, Sudan, and Tunisia – form part of a different regional economy, the Middle East, with its distinctive economic features. The remaining 47 countries represent the sub-Saharan African region (hereafter, Africa or SSA), which is the focus of the present study.

The heterogeneous nature of the region calls for some classification[2]. Collier and O'Connell (2008) classify SSA countries into coastal (43%), landlocked (26%), and resource rich countries (31%). According to the World Bank classification, SSA consists of 27 low income countries, 13 middle income countries, six upper middle income countries, and only one high income country. On human development dimensions, 31 countries are at the bottom level, 11 countries have achieved the medium human development status, and only four countries experience high human development standards according to the United Nations. In this backdrop, SSA is home to the world's poorest countries, and it has the highest number of countries experiencing low human development.

Sub-Saharan Africa is also marginalised in world trade, with the continent's share of world merchandise exports standing at 1.7% in 2017 (UNCTAD 2018). Moreover, SSA's exports are concentrated on a few unprocessed primary commodities (Gupta and Yang 2006; Mosley 2018; Nicita and Rollo 2015). Thirty nine of the 47 SSA countries depend

[2] See Table A2.1 of the Appendix.

on two primary commodities for over 50% of their export earnings (Morrissey and Filatotchev 2000), and, on average, manufacturing exports represent only around 19% of the region's total exports in goods (UNCTAD 2018). This relatively poor export performance can be largely explained by the presence of high trade costs in the region because of its structural deficiencies such as weak transport infrastructure, poor telecommunication networks, bureaucratic customs procedures and corruption. The Aid for Trade (AfT) initiative, formalised at the Hong Kong WTO Ministerial Conference in December 2005, aims at providing financial and technical assistance to developing countries, particularly LDCs, to address these structural deficiencies. Since 2005, the amount of AfT flows disbursed to SSA tripled, making it the second largest AfT recipient after Asia.

This chapter provides a foundation to subsequent chapters on the determinants of trade costs, the effectiveness of AfT in reducing trade costs in SSA, and in improving the continent's export performance at the intensive and extensive margins. It is organised as follows. Section 2.2 reviews the economic performance of sub-Saharan Africa from the first half of the twentieth century to date and analyses the factors that have contributed to its poor performance in the 1970s until the mid-1990s, the factors behind the rise in economic performance thereafter, and the lingering problems the continent faces. Section 2.3 analyses its merchandise export performance, examines trade cost patterns and makes a synthesis of the reasons behind the region's poor export performance. Section 2.4 discusses the meaning and objectives of the AfT initiative, analyses trends in AfT disbursements to SSA and reviews the literature on the determinants of AfT. Section 2.5 is a preliminary analysis of the hypothesised relationships of AfT with trade costs, and export growth at the intensive and extensive margins, which are the key variables of interest in this study. Section 2.6 concludes the chapter.

2.2 Economic Performance in Sub-Saharan Africa

In the first half of the twentieth century, SSA was all set to grow and economic prospects were more promising than in South Asia. With SSA countries free from colonialism in the

1960s, the region demonstrated higher growth than in South Asia before slowing down in the 1970s (Collier and Gunning 1999a, 1999b). However, the period 1975 to 1995 has been one of economic decline for most SSA countries. The average growth rate was around 1.6% when the world was growing by 3.1% over the same period (see Table 2.1). Several reasons have been put forward to explain SSA's poor economic performance; some are destiny-related while others are policy-induced (Collier and Gunning 1999b).

Table 2.1: Average Growth Rate of Real GDP by Region

Region	1966-1975	1976-1985	1986-1995	1996-2005	2006-2015
East Asia & Pacific	6.70	4.81	4.85	3.71	4.63
Europe & Central Asia	3.28	2.48	1.81	2.63	1.41
Latin America & Caribbean	6.18	3.20	2.72	2.81	2.97
Middle East & North Africa	11.14	1.27	3.70	4.15	3.68
North America	3.48	3.50	2.89	3.41	1.50
South Asia	3.59	4.48	5.35	5.96	7.07
Sub-Saharan Africa	4.54	1.87	1.35	4.69	4.92
World	4.69	3.23	2.91	3.25	2.69

Data from World Bank, World Development Indicators.

Among the destiny-related factors, SSA is disadvantaged because of its geography. Its tropical climate is conducive to the spread of diseases such as malaria, which results in poor health and low life expectancy. Also, it leads to poor soil quality and unpredictable rainfall, which affects agricultural productivity by reducing its growth performance (Barrios, Bertinelli, and Strobl 2010; Sachs and Warner 1997; Tang and Woods 2008). Moreover, around one quarter of the region is landlocked, compared to 11% in the rest of the developing countries and 40% of the SSA's population live in the landlocked countries (Venables 2010). This limits access to foreign markets because of cross-border barriers. Overcoming the barriers imposes significant trade costs on traders and penalises foreign trade. This eventually impedes growth because of the small size of markets (Bosker and Garretsen 2012). The region's low population density and its fragmentation intensify the small market size problem (Collier and Gunning 1999b). Another feature of SSA's geography relates to its high level of ethnic diversity compared to other regions of the world. Ethnic divisions result in social and political tensions, which divert resources from productive activities such as sound policy-making, and hinders growth (Easterlin and

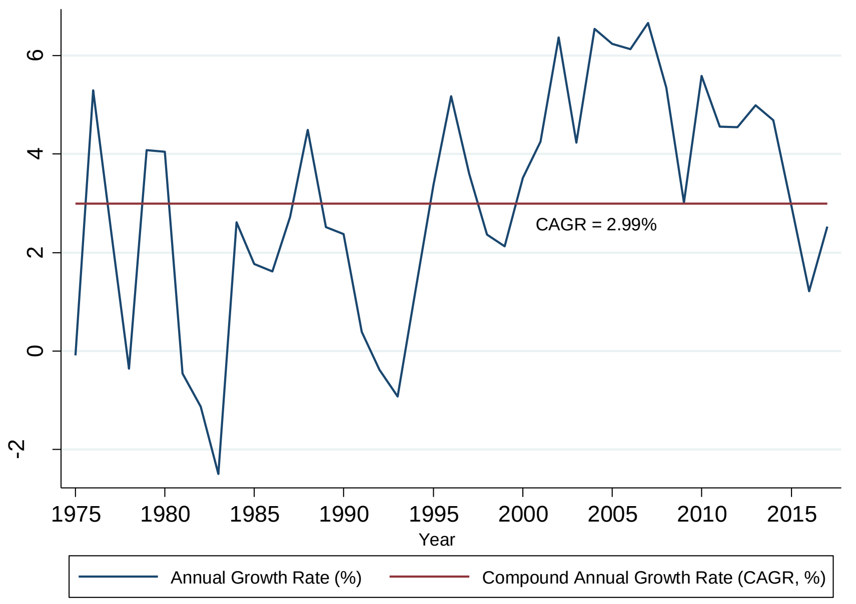
Levine 1997). The abundance of SSA's natural resources can also explain its low growth rates (Janda and Quarshie 2017; Sachs and Warner 1997). One of the reasons to explain this phenomenon, coined the 'resource curse', relates to the upward pressure a commodity price boom can put on the real exchange rate, and which undermine export competitiveness in other economic sectors. This is referred to as the Dutch disease hypothesis. Other explanations include volatilities in commodity prices, the greater incentive to engage in rent-seeking activities, corruption, and mismanagement of the economy through overconfidence caused by ready access to resource rents; all of which harm growth[3].

Africa's relatively poor growth performance during the second half of the twentieth century can also be explained by inappropriate policies adopted by undemocratic governments in the post-colonial period. Dictatorship and the political self-interest motive resulted in wasteful spending in many economies and poor public service delivery (Collier and Gunning 1999b). The failure to invest in productive infrastructure, education, and health can also explain much of SSA's lost ground in the pursuit of economic growth (Artadi and Sala-i-Martin 2003; Calderón and Servén 2010). Sub-Saharan Africa could not industrialise on the same scale as the South and East Asian economies because weak infrastructure and low human capital prevents the movement of resources from the low-productivity agricultural sector to the higher-productivity manufacturing sector. This was partially triggered by the natural resources abundance as well. The restrictive trade policies adopted by several African governments also played a significant role in impeding industrialisation. The presence of high trade barriers made it difficult for producers to import capital equipment needed to undertake manufacturing processes. The policy barriers to trade also exacerbated the small market size problem caused by geography (Sachs and Warner 1997). The result was, and still is, a heavy concentration of Africa's production and exports on a narrow range of primary commodities, leaving many economies in the region vulnerable to terms of trade shocks and the resource curse.

[3] See Badeeb, Lean, and Clark (2017) for a recent and extensive review of the literature on the causes of the natural resource curse.

In the mid-1990s, however, a trend break from this declining economic performance was noted. Growth accelerated in Africa and remained positive throughout the period 1996 to 2015 despite the episodic swings shown in Figure 2.1. The continent became the world's second fastest growing economy after South Asia during the period 1996 to 2015 (see Table 2.1).

Figure 2.1: Growth Rate in Real GDP (%) in SSA, 1975-2017



Data from World Bank, World Development Indicators.

This turnaround in economic performance was due in part to good policies adopted by African governments as they learnt from past mistakes (AfDB 2016; Arbache, Go, and Page 2008; Rodrik 2016). Greater political stability and public sector reforms resulted in a more favourable business climate, which attracted inflows of FDI (see Table 2.2[4]) and contributed to the growth of the private sector (Mullings and Mahabir 2018). Increased public spending on infrastructure and better use of aid money also helped to improve competitiveness. Sound fiscal management also contributed to a decrease in the debt burden of the governments over the period 1996 to 2015 (see Table 2.2). The region is

[4] Table 2.2 summarises the economic performance of SSA countries on the basis of various key indicators.

also facing the lowest inflation in over 20 years, with average inflation rate systematically declining over the period analysed.

The adoption of more-open policies has increased trade as a proportion of GDP between Africa and the rest of the world. This is also partly because of the commodity price boom triggered by rapid increases in demand, especially from China, which helped improve Africa's terms of trade during that period (Arbache and Page 2010). A small decline in economic performance was noted during the global financial crisis 2008-10 and as a consequence of falling external demand for Africa's goods and services. However, on account of its relatively low financial and trade integration with the outer world it was not a hard hit (AfDB 2012; IMF 2010).

Despite the recent positive growth, the poor performance of SSA in the 1970s has left many economies far behind on the development path. Many would argue that the pace of reforms has been too slow to unlock the continent's economic potential. Economic indicators (see Table 2.2) suggest that the high growth experienced by Africa in recent years is unlikely to be sustainable because long run growth fundamentals did not improve alongside (Arbache and Page 2010).

Table 2.2: Key Indicators of SSA's Economic Performance

	1966-1975	**1976-1985**	**1986-1995**	**1996-2005**	**2006-2015**
GNI per capita, Atlas method (current US$)	218.04	589.40	620.86	612.52	1462.54
GDP per capita growth (annual %)	1.84	-1.27	-1.05	1.70	2.03
GNI per capita growth (annual %)	n/a	-3.04	-0.84	1.63	2.20
Population growth (annual %)	2.65	2.88	2.82	2.69	2.76
Unemployment, total (% of total labor force)	n/a	n/a	7.62	8.20	7.08
Poverty headcount ratio at $1.90 a day (2011 PPP)	n/a	n/a	26.35	25.15	17.50
Foreign direct investment, net inflows (% of GDP)	1.03	0.39	0.67	2.38	2.62
Inflation, consumer prices (annual %)	18.31	12.16	10.53	5.69	5.95
Literacy rate, adult total (%)	n/a	49.23	52.33	57.40	60.37
Budget Deficit (% of GDP)	n/a	n/a	n/a	-0.56	-1.58
General government gross debt (% of GDP)	n/a	n/a	n/a	55.34	29.49
External debt, total (% of GDP)	n/a	n/a	n/a	44.68	23.95
Trade (% of GDP)	44.36	48.48	43.62	56.36	61.54
Exports of goods and services (% of GDP)	21.18	23.71	22.36	28.32	30.49
Exports of goods and services (annual % growth)	n/a	2.63	2.96	5.61	4.73
Imports of goods and services (% of GDP)	23.17	24.77	21.27	28.04	31.05
Imports of goods and services (annual % growth)	n/a	-12.06	2.20	8.47	4.58
External balance on goods and services (% of GDP)	-1.99	-1.06	1.09	0.27	-0.55

Data from World Bank, World Development Indicators; IMF, World Economic Outlook Database 2018.

Although GDP per capita and GNI per capita growth were positive and rose during the past two decades, there has been no marked reduction in the unemployment rate. Unemployment remains persistently high at around 7.6%, suggesting that SSA has been experiencing jobless growth during the past two decades (Ancharaz 2011).

One possible explanation for this phenomenon is that the recent growth in SSA has been driven by the export of natural resources that is due to the commodity price boom. However, such export activities are not labour-intensive and offer limited job prospects to the unemployed workforce (Ancharaz 2011). With high unemployment prevailing in many of the economies, poverty is high in the region. During the period 2006-2015, 17.5% of the population was still below the poverty line. With estimates pointing out that SSA will have the world's highest number of people entering the working age population in the next few decades, the problem of unemployment and poverty will worsen unless appropriate measures are taken to benefit from the so called 'demographic dividend' (see AfDB 2018).

For Africa to achieve sustained growth and overcome its deep-rooted problems, it must undergo a structural transformation. This objective ranks high on African governments' policy agendas (AfDB 2017; IMF 2017). Currently, the share of the agricultural sector in GDP remains high and it employs the highest proportion of labour (see Table 2.3). For productivity to rise, labour must move from the low-productivity agricultural sector to the higher-productivity manufacturing sector. Unlike in South Asia, this move did not take place in Africa and much of the labour movement has been from agriculture to informal, low-productivity services. The continent has a relatively large informal sector, which contributes to about 25% to 65% of GDP and accounts for 30% to 90% of non-agricultural employment (WEF 2014).

Table 2.3: Sectoral Analysis of SSA

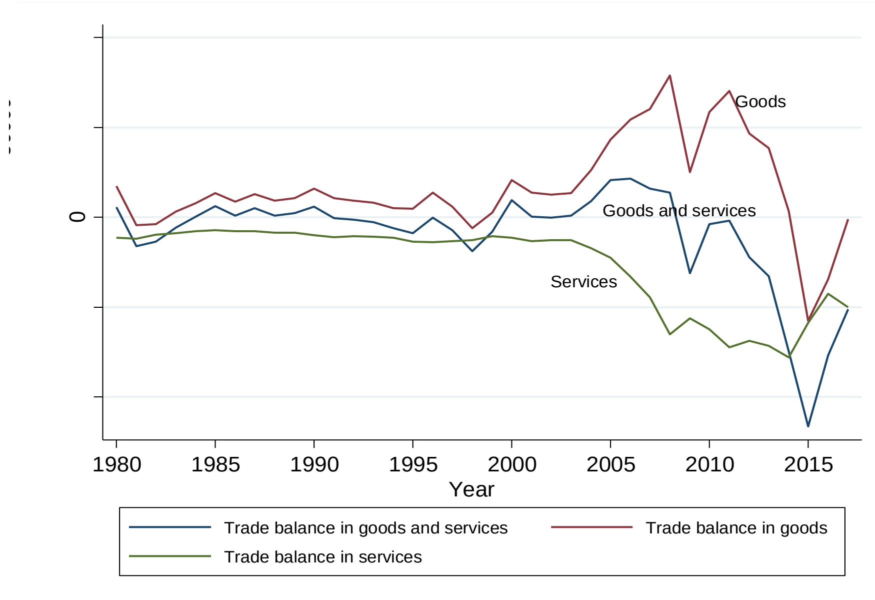
	% of GDP (2017)	**% average growth (1995-2017)**	**% of total employment (2017)**
Agriculture, forestry, and fishing	16.23	4.60	57.36
Industry	23.29	2.95	11.19
Services	53.17	n.a.	31.45

Data from World Bank, World Development Indicators.

The failure to industrialise can be attributed to the poor policies adopted by African governments in the mid-1970s and the destiny factors related to geography and natural resources abundance. However, by the time good governance started prevailing in the region, SSA had already acquired a large infrastructure deficit. It is estimated that Africa's infrastructure requirements range from US$130 billion to US$170 billion a year (AfDB 2018), and with the existing large public debt, financing productive infrastructure projects is challenging. The infrastructure gap needs to be addressed to enable new higher-productivity and job-promising sectors such as agro-processing, manufacturing, and modern services to emerge and expand. Concurrently, African governments should invest significantly in upgrading their human capital to meet the needs of twenty first century industrialisation and to prepare for the fourth industrial revolution (AfDB 2017). The literacy rate in the region remains low at around 60% on average (see Table 2.2) compared to East Asia or Latin America that have had literacy rates above 90% for the last two decades (World Bank 2017).

Africa's lost ground on the industrialisation path partly explains its relatively poor trade performance. Its trade balance in goods and services has been mostly negative and the deficit has widened significantly during the past five years (see Figure 2.2). This can be attributed to its over-concentration on the export of a narrow range of unprocessed primary commodities, whose revenues are insufficient to cater for the higher value import of manufactures and services. The next section offers an in-depth analysis of the merchandise export performance of SSA countries.

Figure 2.2: SSA's Trade Balance, 1980-2017



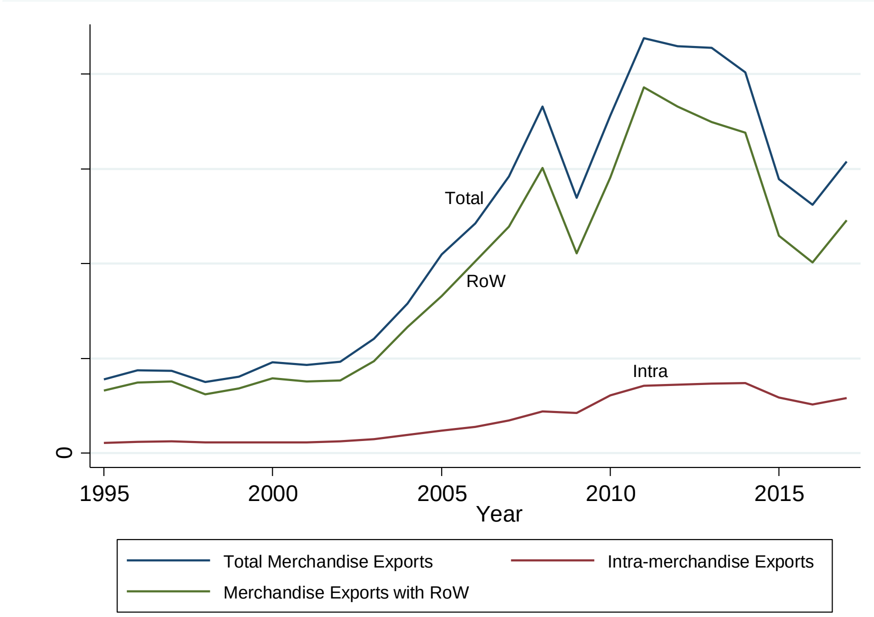
Data from UNCTADstat.

2.3 Analysis of Export Performance and Pattern of Trade Cost

In the post-independence era, African governments imposed high levels of trade restrictions to support their inward-looking industrialisation strategies. However, not only did Africa fail to industrialise, the protectionist regime resulted in an anti-export bias (Page 2012; Rodrik 1998). It was, therefore, expected that the unilateral and regional trade liberalisation efforts that began in the 1980s would improve the export performance of SSA (Ackay and Morrissey 2005; Hammouda and Jallab 2004; Iwanow and Kirkpatrick 2009; Kassim 2015).

Indeed, the data does reveal some signs of improvement. The value of merchandise exports has increased nearly fourfold between 1980 and 2017, rising from US$78,845 million to US$307,560 million in 2017. The bulk of SSA's merchandise exports occur with the rest of the world, and intra-African exports represent only a small proportion of the region's total exports – around 14.8% on average. However, intra-African exports have been rising faster over the past decade than previously (see Figure 2.3).

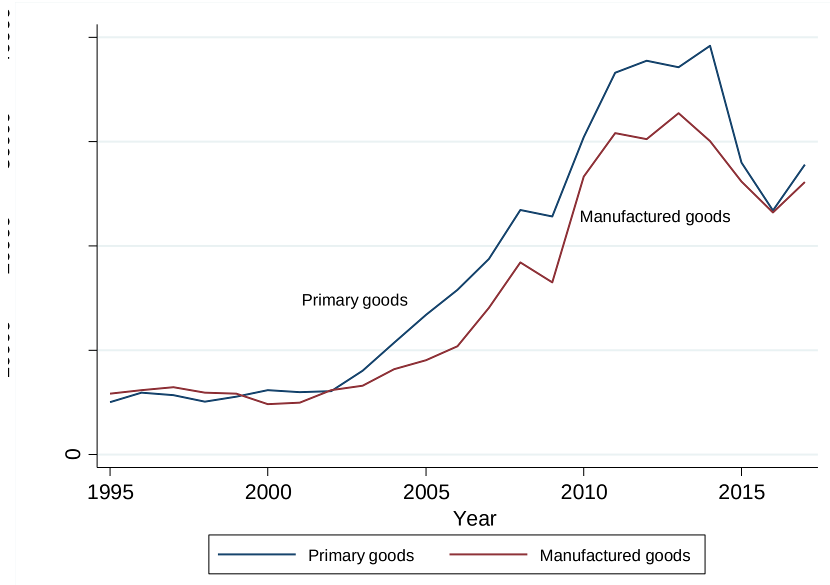
Figure 2.3: SSA's Merchandise Exports Value, 1995-2017



Data from UNCTADstat.

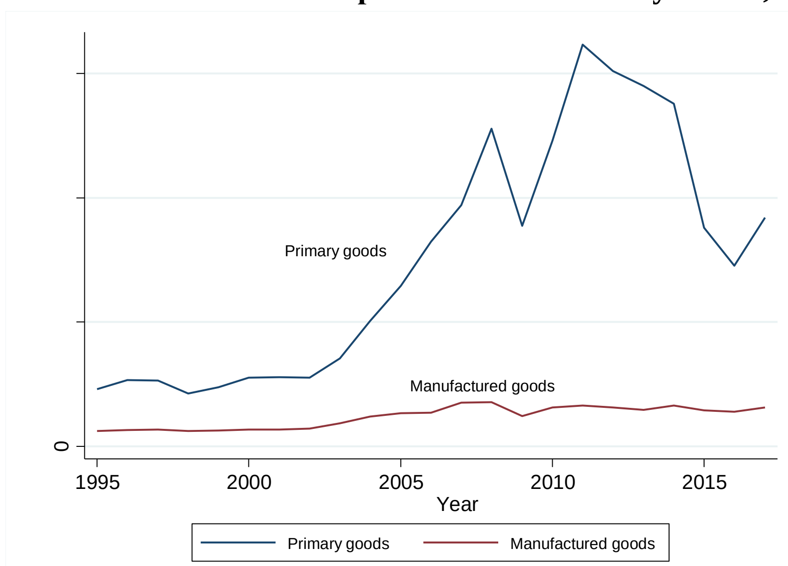
A breakdown of exports by sector shows that primary commodity exports have dominated manufacturing exports even though the latter have tripled in value since 1995. However, some differences can be noted between Africa's exports to the rest of the world and within the region. Intra-African manufacturing exports stand at about 47% of the total while African manufacturing exports to the rest of the world represent only about 16% of the total during the period 1995-2017. Moreover, intra-manufacturing exports have moved in tandem with intra-primary commodity exports. Manufactured exports to the rest of the world have remained almost flat throughout the period of analysis (see Figure 2.4 and Figure 2.5).

Figure 2.4: SSA's Intra-Merchandise Exports by Sector, 1995-2017



Data from UNCTADstat.

Figure 2.5: SSA's Merchandise Exports with the RoW by Sector, 1995-2017



Data from UNCTADstat.

Despite the rise in the value of exports, Freund and Rocha (2011) noted that export volumes in Africa was 16% lower than what was expected after controlling for other determinants of trade. This is also evidenced by the region's marginalisation in world trade. Africa's share of world merchandise exports is not only relatively low but has been falling over the past few decades (see Table 2.4). As of 2017, SSA's share of world merchandise exports was 1.73%.

Table 2.4: Regional Shares of World Merchandise Exports (%)

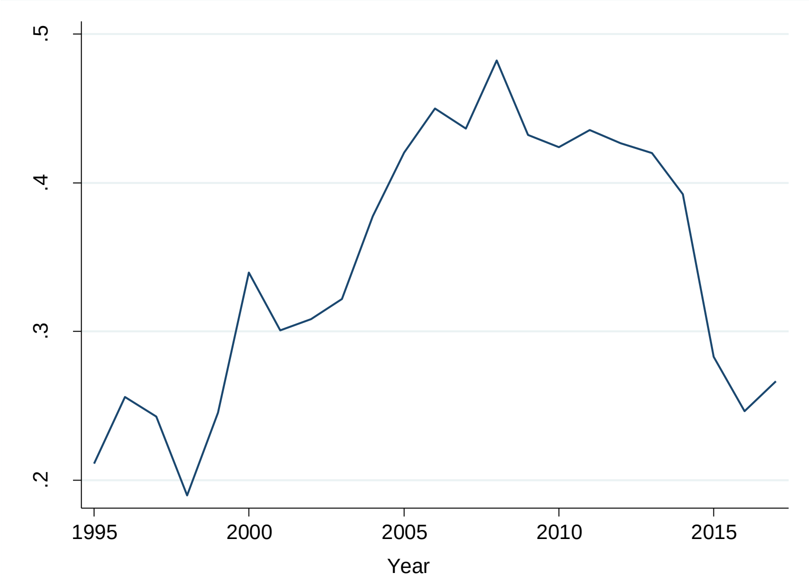
Region	**1987**	**1997**	**2007**	**2017**
East Asia & Pacific	22.15	26.49	27.99	33.66
Europe & Central Asia	51.56	45.22	44.84	39.43
Latin America & Caribbean	4.56	5.57	6.08	6.07
Middle East & North Africa	4.62	4.07	6.57	6.06
North America	14.33	16.03	11.11	11.04
South Asia	0.76	0.96	1.35	2.07
Sub-Saharan Africa	2.21	1.59	2.03	1.73

Data from World Bank, World Development Indicators.

Failure to channel resources into export-oriented, higher-value manufacturing largely explains this relatively poor performance. Manufactured exports represent only around 19% of SSA's total merchandise exports (on average) over the period 1995 to 2017 (UNCTAD 2018). Moreover, 39 out of the 47 SSA countries depend on two primary commodities for over 50% of export earnings (Morrissey and Filatotchev 2000).

Figure 2.6 illustrates the export concentration index, also known as the Herfindahl-Hirschman index (HHI), of SSA during the period 1995 to 2017. The index varies between 0 and 1, and the closer the index value is to 1, the more concentrated Africa's exports are on a few products. In other words, a higher HHI indicates a lower degree of export diversification. Between 1995 and 2008, an upward trend is noted, implying a higher degree of export concentration. Lack of product diversity and differentiation across the region can also explain why intra-African trade is still low compared to other regions in the world (Ancharaz, Mbekeani, and Brixiova 2011). During the past five years, however, a decline in the export concentration index can be noted, suggesting that SSA's exports have become more diversified. This increase in export diversification could be due to a rise in the share of exports in existing products (intensive margin) or an increase in the share of exports in new products (extensive margin).

Figure 2.6: SSA's Concentration Index, 1995-2017



Data from UNCTADstat.

Although destiny factors related to geography and the region's comparative advantage in low value-added primary commodities play an important role in explaining why SSA remain marginalised in world markets, policy-related factors are to blame as well. The restrictive trade policies embraced by many African governments in the 1960s and 1970s penalised exports in the past (Ng and Yeats 1997; Rodrik 1998). The reasoning is that import substitution entails an anti-export bias that prevents resources from being channelled to more productive export production activities, and tariffs on inputs and intermediates hurt export-oriented producers. Nonetheless, despite the significant reductions in average tariffs applied by African governments since the 1980s, and in other parts of the world (see Table 2.5), exports did not grow as much as expected (Ackay and Morrissey 2005; Mullings and Mahabir 2018; Subramanian and Tamirisa 2001).

Table 2.5: Applied Average Tariff Rates by Region

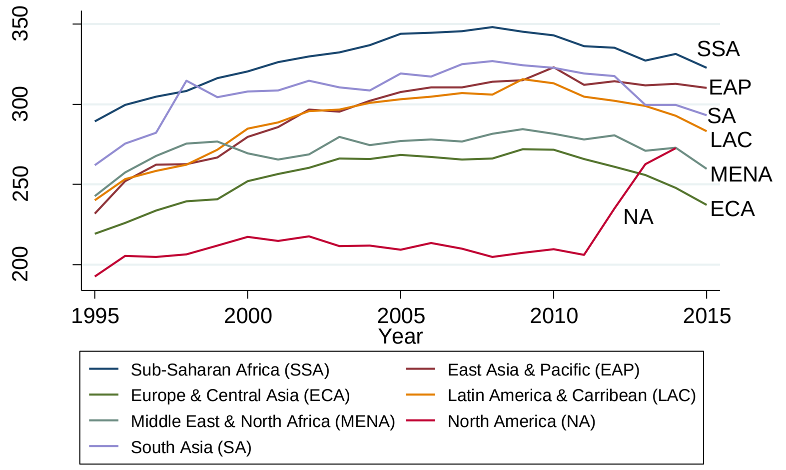
Reporter	Partner	Weighted Average (%), All Products					
		1997	2001	2005	2009	2013	2017
SSA	World	10.20	9.71	7.66	7.70	7.05	5.67
World	SSA	5.58	6.38	4.86	3.11	2.60	2.63
East Asia & Pacific	SSA	7.25	6.79	5.73	6.01	6.06	6.10
Europe & Central Asia	SSA	9.69	9.74	9.01	6.33	5.63	4.70
Latin America & Caribbean	SSA	11.76	12.59	11.46	10.03	9.05	8.73
Middle East & North Africa	SSA	12.72	14.79	9.69	8.94	6.56	7.92
North America	SSA	3.48	3.53	2.94	2.77	1.81	2.08
South Asia	SSA	22.75	23.15	15.49	12.39	11.53	10.35
SSA	SSA	15.64	7.42	5.51	4.43	2.11	0.74

Data from WITS - UNCTAD TRAINS.

While there are still gains to be had from further trade liberalisation, either at the unilateral, regional, or multilateral level to improve market access opportunities (Hoekman and Nicita 2010; Nicita and Rollo 2015), SSA would benefit only if it addresses its supply-side constraints. The poor export performance observed in SSA can, therefore, be attributed to policy-induced, supply-side deficiencies in the region (Harrison, Lin, and Xu 2014; Ng and Yeats 1997). These, in turn, translate into making the cost of trading with SSA significantly higher than elsewhere (Bouet, Mishra, and Devesh 2008; Djankov, Freund, and Pham 2010; Freund and Rocha 2011; Portugal-Perez and Wilson 2009). Broadly defined, trade costs embrace "all costs involved in getting a good to a final user other than the marginal cost of producing the good itself" (Anderson and van Wincoop 2004, p. 691).

Novy (2013) developed a micro-founded measure of bilateral trade costs based on the gravity theory of trade, which can include "transportation costs and tariffs but also other components that can be difficult to observe such as language barriers, informational costs, and bureaucratic red tape" (Novy 2013, 101). This comprehensive measure of trade costs has been employed by Arvis et al. (2013) to compute bilateral trade costs between trading partners in the world. Figure 2.7 illustrates the trade costs faced by each region as they trade with the rest of the world in ad valorem terms.

Figure 2.7: Trade Costs (ad valorem, %) by Region, 1995-2015

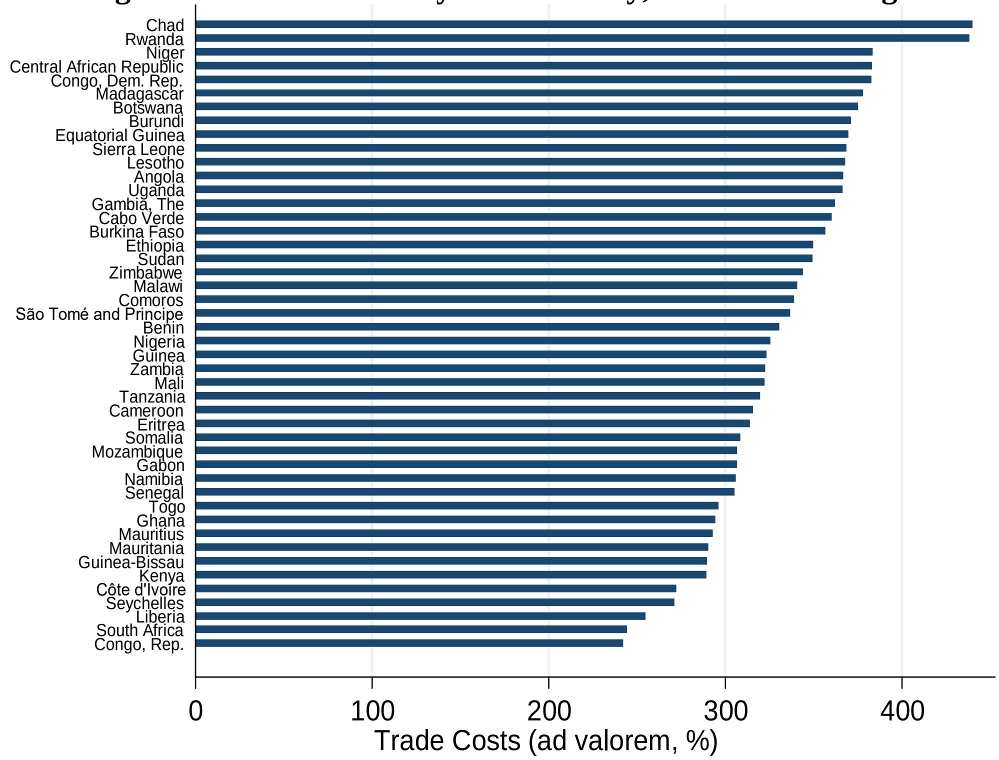


Data from ESCAP-WB Trade Cost Database.

Trade costs in SSA were much higher than elsewhere, and trading with SSA still entails the highest trade costs compared to other regions in the world, although some tendency for trade costs to decline has been noted during the past decade. However, there is heterogeneity across SSA as indicated in Figure 2.8. The five worst performers in Africa in terms of trade costs are Chad, Rwanda, Niger, Central African Republic, and Congo Democratic Republic (all landlocked countries), while the five best performers are Congo Republic, South Africa, Liberia, Seychelles, and Côte d'Ivoire.

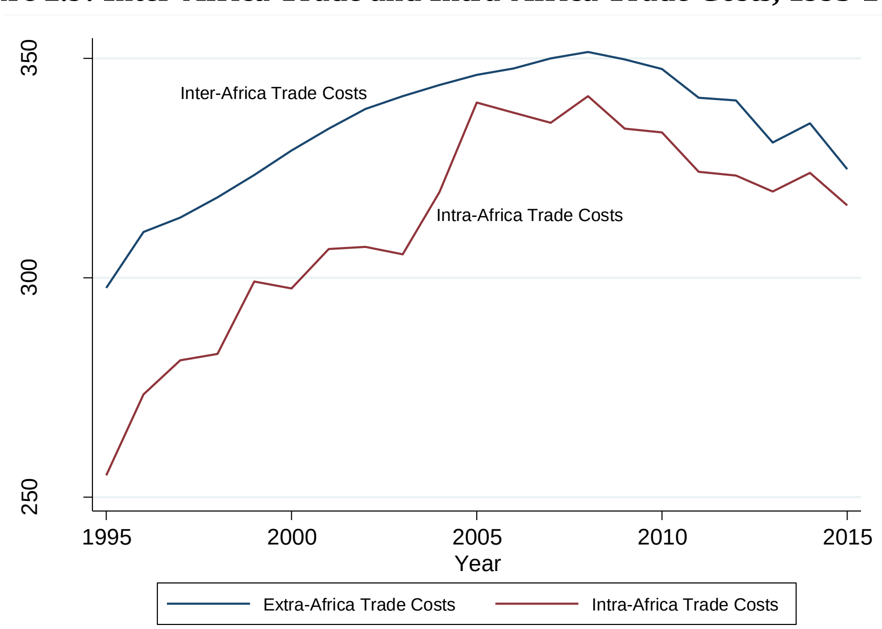
Valensisi, Lisinge, and Karingi (2016) argue that the relatively high trade costs faced by Africa not only reduces its trade integration with the rest of the world but also within the region. Figure 2.9 shows that intra-Africa trade costs have followed a pattern similar to inter-Africa trade costs, and is as significant as the latter. This is the result of structural deficiencies hindering its regional integration and participation in global trade.

Figure 2.8: Trade Costs by SSA Country, 1995-2015 average



Data from ESCAP-WB Trade Cost Database.

Figure 2.9: Inter-Africa Trade and Intra-Africa Trade Costs, 1995-2015



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Data from ESCAP-WB Trade Cost Database.

Africa's infrastructure deficit increases both inland transport costs and shipping costs because of poor roads and an inefficient port system, respectively (Limão and Venables 2001; Njinkeu, Wilson, and Fosso 2008). Moreover, information and communication costs between traders are higher because telecommunication networks are poor (Portugal-Perez and Wilson 2009). The prevalence of weak institutions implies that corruption is present at various points in the supply chain, which increases transaction costs (Francois and Manchin 2013). Also, the bureaucratic customs procedures in place cause significant delays in getting customs clearances before shipping goods (Freund and Rocha 2011; Jordaan 2014). These problems become more acute for the 15 landlocked countries in SSA as they do not have direct access to the sea and they need to transit through their neighbouring countries (Christ and Ferrantino 2011; Elbadawi, Mengistae, and Zeufack 2006). Transit delays and costs are thus higher.

The World Bank provides estimates of the cost associated with the logistical process of exporting goods across borders. Table 2.6 reports the latest data on the export cost by geographical area associated with compliance with the documentary requirements and customs regulations. As noted, the cost of complying with border procedures (e.g., customs clearance and inspections) when exporting goods from SSA relative to other regions in the world is high. Sub-Saharan Africa also ranks second to the Middle East and North Africa in terms of the highest cost for obtaining, preparing, and submitting documents in the export process.

Table 2.6: Cost to Export Across Borders, Regional Average

Region	**Border compliance (US$)**	**Documentary compliance (US$)**
East Asia and Pacific	365.87	105.38
Europe and Central Asia	140.78	57.18
Latin America & the Caribbean	534.35	112.39
Middle East and North Africa	427.80	236.00
North America	173.00	84.00
South Asia	343.49	151.69
Sub-Saharan Africa	613.24	172.18

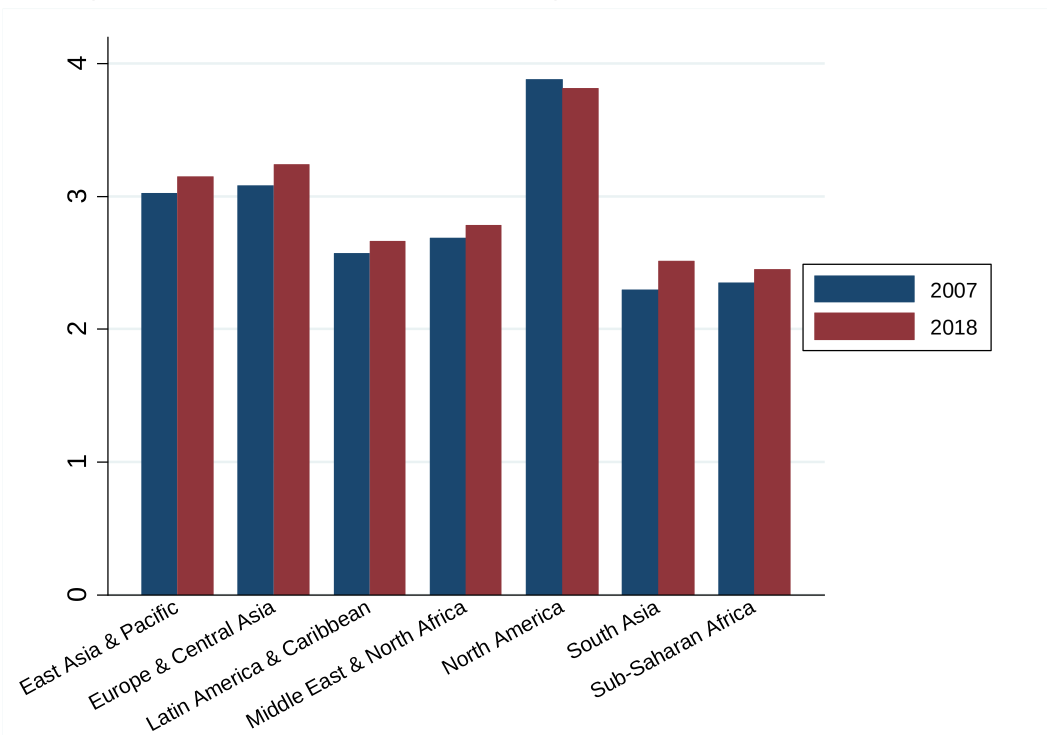
Data from World Bank, Doing Business 2019.

Another prominent proxy for the extent of trade-related, supply-side weaknesses faced by SSA countries compared to other geographical areas in the world is the Logistics

Performance Index (LPI) reported by the World Bank every two years since 2007. The LPI is a weighted average of country scores from their customs efficiency, transport and telecommunications infrastructure quality, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, and timeliness of shipments in reaching their destination (Arvis et al. 2018). Figure 2.8 compares the average performance of different regions in the world by their LPI score between 2007 and 2018.

Over the ten years studied, SSA has remained the lowest performer in terms of its LPI score. Despite an improvement over the years, from an average LPI of 2.35 in 2007 to 2.45 in 2018, the LPI values remain very low and underscore the need for better policies to address these supply-side deficiencies and reduce the high trade costs faced by the region.

Figure 2.10: Evolution of LPI by Region in 2007 and 2018



Data from World Bank, Logistics Performance Index.

Chapter 3 explores the sources of trade costs in further depth, and in an attempt to guide policy actions, provides a quantitative assessment of the factors that might explain the high trade costs faced by SSA.

2.4 Aid for Trade: Definition, Objectives, Trends and Determinants

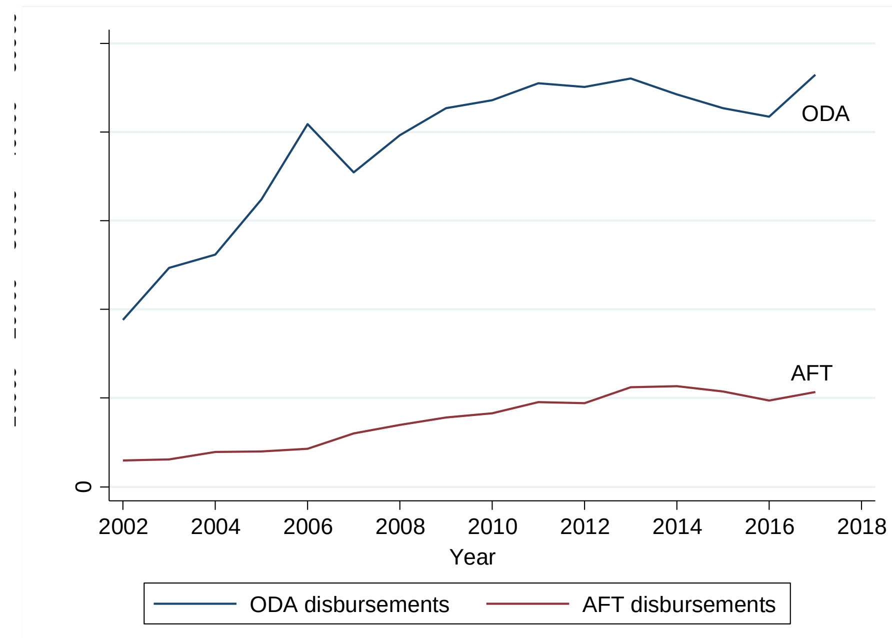
After nearly 15 years of multilateral negotiations, the Doha Round, also known as the Doha Development Agenda (DDA), finally came to an end after the WTO Nairobi Ministerial in 2015 and following the failure to reach a comprehensive agreement (Martin and Mercurio 2017). One of the legacies of the DDA is the Aid for Trade (AfT) initiative that was introduced during the 2005 Hong Kong Ministerial Conference. The AfT initiative is based on the premise that trade and development policies are complementary, and that developing countries will not be able to fully exploit the expanded trading opportunities offered by greater market access to the developed markets unless they address their supply-side constraints.

Among others, the supply-side limitations take the form of inadequate or defective infrastructure, poorly performing customs, cumbersome and time-consuming border procedures, and limited access to finance (OECD/WTO 2015). As highlighted in the previous section, SSA suffers from these deficiencies more than any other region in the world, making trade costs relatively high and exports comparatively less competitive. Potential comparative advantages in higher-productivity sectors, such as agro-food and manufacturing, remain unexploited, which partly explains the region's poor export performance. Limited supply capacity and high trade costs also contribute to the continent's low integration in global value chains (GVCs), despite GVC participation being a promising route for SSA to regain some of its lost ground in economic development (AfDB 2014; IMF 2015).

The AfT initiative was brought forward to provide financial and technical assistance to developing countries in addressing supply-side deficiencies. Successful implementation of structural reforms is expected to turn market opportunities through multilateral trade liberalisation, preferential trading arrangements, and regional trade agreements into market presence. Aid for trade[5] is part of Official Development Assistance (ODA), which is provided mostly by official agencies (OECD-DAC donors) and multilateral institutions but is targeted at trade-related development programmes or projects. In 2002, AfT represented 15.88% of ODA provided to SSA and this proportion increased to 23.02% in 2017 (OECD 2018).

Figure 2.9 shows the evolution of AfT flows in SSA for the period 2002-2017. Although the initiative was introduced in 2005, aid flows directed towards trade-related needs have a longer history. For data accountability purposes, however, the WTO Task Force set up in 2006 to monitor and evaluate the AfT initiative, established the year 2002 as the baseline period.

Figure 2.11: Total ODA and AfT received by SSA from all donors: 2002-2017

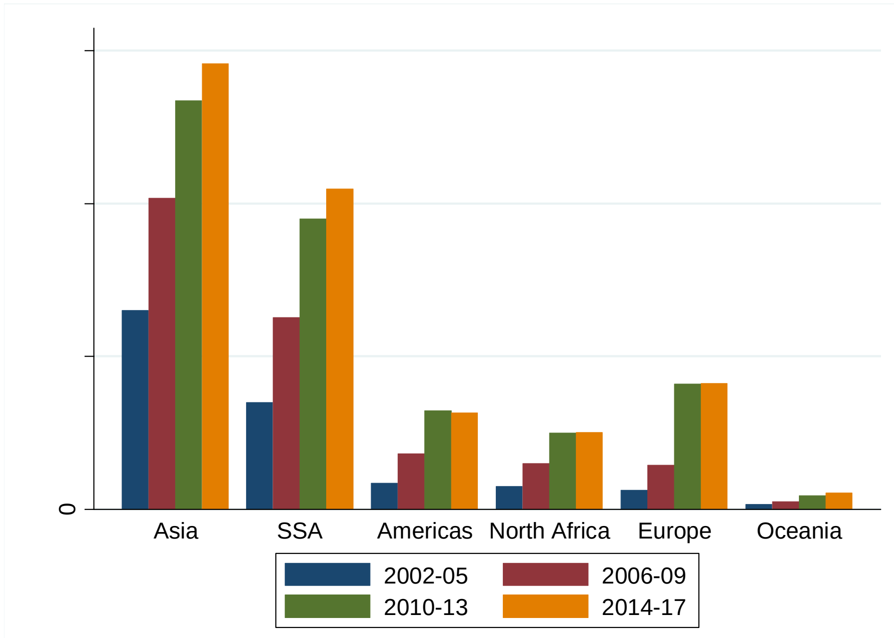


Data from OECD-Creditor Reporting System database.

[5] Aid for trade constitutes grants and concessional loans with a grant element of 25% or above. Other trade-related official flows are thus not counted in AfT financing as they do not meet the criteria for ODA (OECD/WTO 2011).

Aid for trade disbursements to SSA have increased more than threefold since its inception, rising from US$2,989 million in 2002 to around US$10,702 million in 2017. Having benefitted from a cumulative amount of US$118,927 million compared to US$178,382 million in Asia, SSA is the second largest recipient of AfT over the period studied (see Figure 2.10).

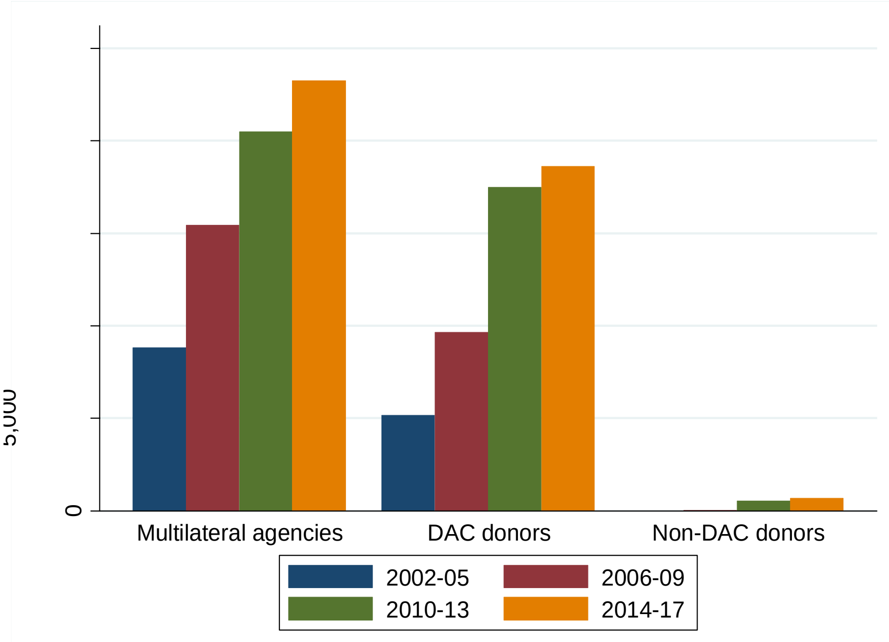
Figure 2.12: Total AfT disbursements by Region, 2002-2017 (4 years cumulative)



Data from OECD-Creditor Reporting System database.

It is worth analysing AfT flows to SSA by donor type (see Figure 2.11). The data reveals that around 56.6% of total AfT flows provided to SSA come from multilateral agencies such as the IMF, the World Bank, and the African Development Bank, 42.4% are sourced from DAC donor countries, and only 1.01% comes from non-DAC donor countries.

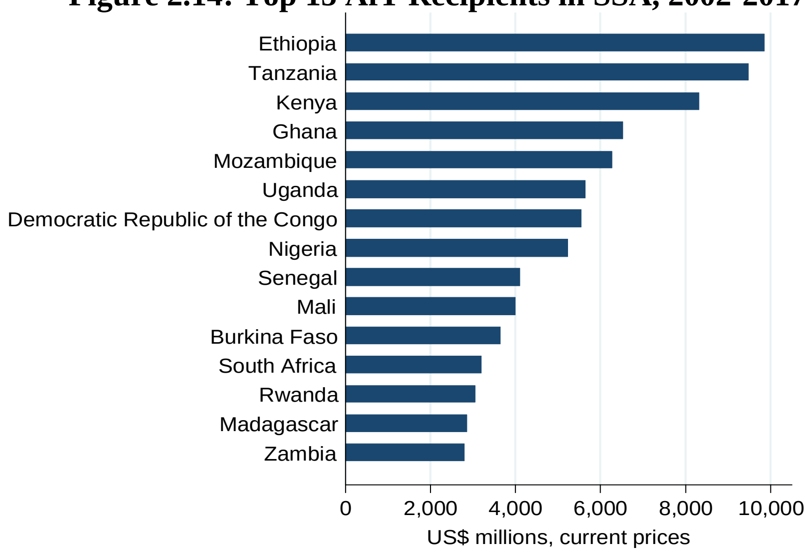
Figure 2.13: AfT disbursed to SSA by Donor Type, 2002-2017 (4 year cumulative)



Data from OECD-Creditor Reporting System database.

The heterogeneity observed in AfT disbursements across regions and countries (see Figure 2.10 and Figure 2.12) has prompted researchers to investigate the factors determining AfT allocation. Understanding the determinants of AfT is crucial in assessing the effectiveness of the initiative because it analyses whether more AfT is being provided to countries that need it the most.

Figure 2.14: Top 15 AfT Recipients in SSA, 2002-2017 (cumulative)



Data from OECD-Creditor Reporting System database.

Samy and Imai (2010) analysed the determinants of bilateral and multilateral AfT allocated to all recipient countries over the period 1996 to 2006, and find that AfT is properly allocated since it is positively related to recipient needs (per capita GDP or infant mortality), political factors (democracy) and government effectiveness (institutions and policies). This is in contrast with the work of Tadasse and Fayissa (2009) who conclude that donor self-interest dominates AfT allocations by the US to 54 countries during 1999 to 2005.

In addition, Lee, Park, and Shin (2015) argue that WTO membership is a crucial determinant of AfT allocation. Their analysis shows that LDC WTO member countries receive higher AfT on average than other non-member LDC countries over the period 2001 to 2010, suggesting that countries that are more committed to free trade are likely to receive more AfT funding from donors. Gamberoni and Newfarmer (2014) constructed a measure of a recipient country's need for AfT in the form of a trade-related capacity indicator - a weighted average of the quality of infrastructure, trade-related institutions, and export policy incentives. They find that on average, countries with the highest potential demand (low trade-related capacity score) receive the most AfT as a share of GDP after controlling for GDP per capita and the rule of law. Their analysis, however, also reveals that some countries, most of which are in SSA, have been underserved during the period 2007 to 2010. Gnangnon (2018d) emphasises the role of financial openness in determining AfT allocation. Focusing on 126 countries over the period 1995 to 2015, they find that a higher level of financial openness has a dampening effect on AfT inflows into recipient developing countries as they have greater access to international capital flows as an alternative financing option.

In assessing the effectiveness of AfT, it is worthwhile identifying which type of AfT works best in achieving the desired objectives. According to the OECD-CRS database, there are three broad categories of AfT:
(a) *aid for economic infrastructure* - using aid to develop the infrastructure (roads, ports, telecommunications, energy) to connect domestic markets to the global economy;

(b) *aid for productive capacity building* - using aid to improve the productive capacity of the economy so that comparative advantages are better exploited;
(c) *aid for trade policies and regulations, and trade-related adjustment* - using aid to provide technical assistance to developing countries for the formulation of trade policy, participation in negotiations and implementation of trade-related agreements, and to help developing countries adjust to freer trade or to overcome transition costs from trade liberalisation. This includes *aid for trade facilitation*; defined as the simplification and harmonisation of international import and export procedures.

Table 2.7 provides a view of total AfT disbursements to SSA by category over the period 2002 to 2017. The bulk of AfT (52.55%) represents aid for economic infrastructure, 44.5% concerns aid for building productive capacity, and a relatively small proportion (2.95%) is allocated for trade policies and regulations. It is worth noting that the trade policies and regulations category includes aid for trade facilitation that accounts for only 1.21% of the total AfT provided to SSA.

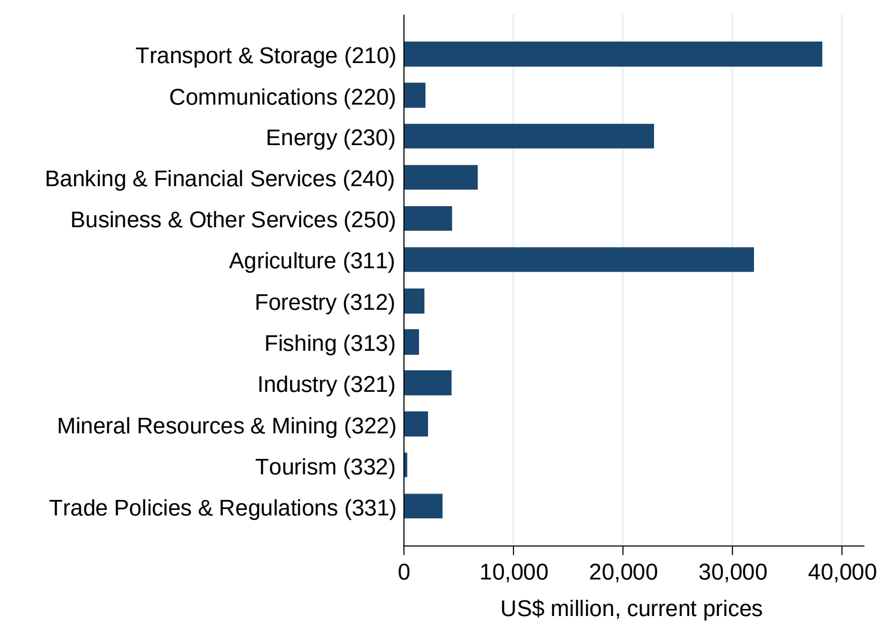
Table 2.7: AfT disbursed to SSA by Category, 2002-2017 cumulative

AfT category	**Sector Code**	**US$ million, current prices**	**%**
Aid for economic infrastructure	210, 220, 230	63137.42	52.55
Aid for building productive capacity	240, 250, 311, 312, 313, 321, 322, 332	53467.22	44.50
Aid for trade policies & regulations	331	3542.49	2.95
Aid for trade facilitation	*33120*	1459.02	1.21

Data from OECD-Creditor Reporting System database.

An analysis of the distribution of total AfT disbursements to SSA reveals that the transport and storage, energy, and agricultural sectors have benefitted most from the initiative (see Figure 2.13).

Figure 2.15: Sectoral Decomposition of AfT disbursed to SSA, 2002-2017 cumulative



Data from OECD-Creditor Reporting System database.

2.5 Preliminary Analysis of Hypothesised Relationships

Aid for trade inflows are expected to reduce trade costs through improvements in infrastructure, productive capacity building, and trade facilitation, and promote export growth at both the intensive and extensive margins. Export growth at the intensive margin refers to a rise in the export value of existing product lines, while export growth at the extensive margin results from a rise in exports of new product lines, i.e. export variety (Shepherd 2010)[6]. While export diversification is generally about exporting a greater variety of products and is thus closely associated with export growth at the extensive margin, the literature suggests the concept can also embody the intensive margin if the diversification of exports is caused by a more equal distribution of the share of exports across existing products (see for example, Amurgo-Pacheco and Pierola 2008; Gnangnon

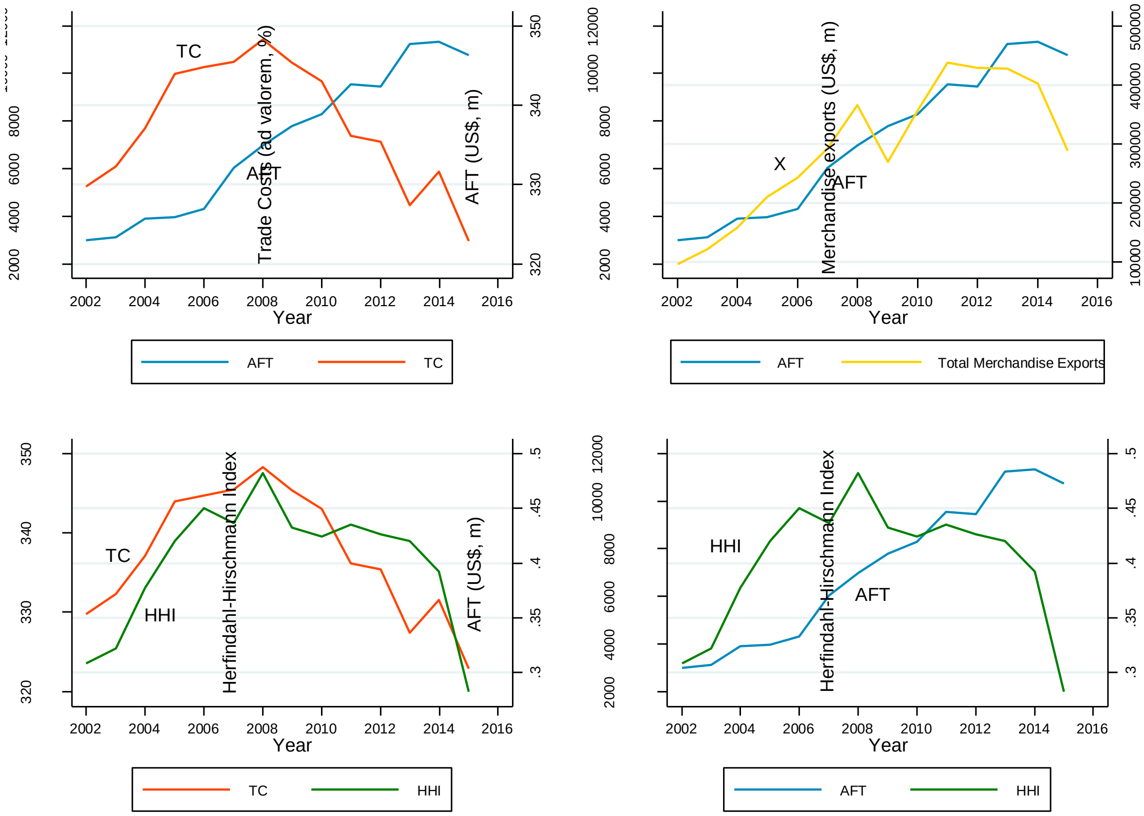
[6] Export growth at the extensive margin can also occur from a rise in exports of existing products to new geographical regions; more specifically called the 'geographical extensive margin' in the literature. However, the present study focuses on the 'product extensive margin', henceforth, simply the 'extensive margin'.

and Roberts 2015; Kim 2017). This implies exports are no longer concentrated on a few existing products, and the country is exporting more of other existing products.

Export diversification is considered to be one of the most urgent priorities of the AfT initiative among recipient countries (OECD/WTO 2011; UNECA 2015), particularly in SSA where exports are concentrated on a narrow range of unprocessed primary commodities. Low export diversification makes the SSA countries significantly vulnerable to terms of trade shocks and prevents resources from moving into higher productivity sectors (Cirera and Winters 2015; Clarke 2005). The success of the AfT initiative, therefore, relies on the extent to which it is able to reduce trade costs, and promote exports in SSA at both the intensive and extensive margins. Figure 2.14 shows the evolution of AfT against some of the variables of interest in the present study: trade costs, the value of merchandise exports, and the concentration index for SSA over the period 2002 to 2015.

As noted in the previous section, there has been a rising trend in AfT funds disbursed to SSA over the period considered. The value of total merchandise exports has also risen between 2002 and 2011, the exception being in the period 2008-2009 when the global financial crisis hit SSA's exports. During the period 2011 to 2015, however, there seems to have been a trend break, with the value of total merchandise exports declining. Average trade costs followed an upward trend from 2002 to 2008, but have been on a downward trajectory since. The concentration index (HHI) demonstrated a similar trend; rising until 2008 and projecting a declining trend between 2008 and 2015. The four panels in Figure 2.14 project some preliminary observations on the hypotheses of the present study.

Figure 2.16: Evolution of AfT, TC, X, and HHI in SSA: 2002-2015

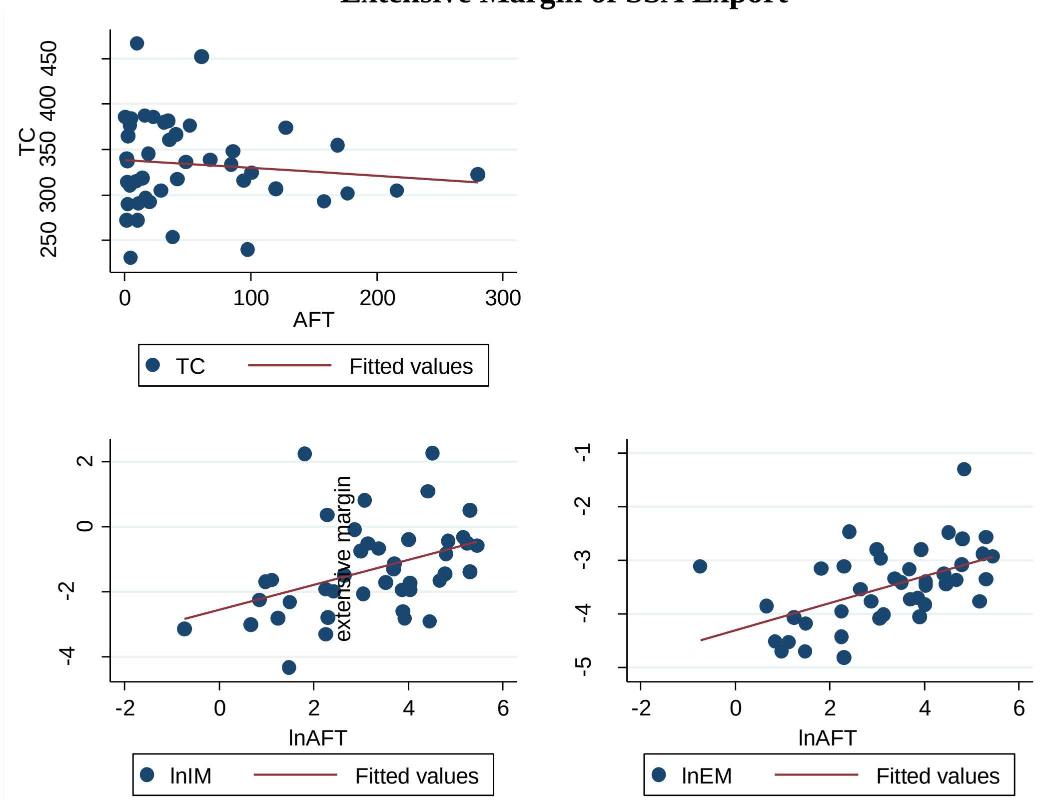


Data from ESCAP-WB Trade Cost database, OECD-CRS database, and UNCTADstat.

It appears that the AfT initiative has been able to reverse the trend in rising average trade costs and the concentration index only after 2008. This is not surprising as it takes time for aid funds to transform into concrete trade-related projects that serve to reduce trade costs and diversify export baskets. There seems to be a positive relationship between average trade costs and the concentration index as well, which may suggest that higher trade costs may be impeding export diversification. Aid for trade and merchandise exports have also moved in tandem over the period analysed, and this may be hinting at the effectiveness of AfT in promoting export growth.

While Figure 2.14 allows some initial interpretations on the study hypotheses, they do not provide any insight into the correlations between the variables of interest. Figure 2.15 displays the correlation patterns between AfT, trade costs, and exports decomposed into the intensive and extensive margins using the Hummels and Klenow (2005) methodology[7] for the SSA sample. The data is averaged across the time period of study. The graphs depicted suggest that AfT and trade costs are negatively correlated, while AfT is positively correlated with exports at both the intensive and extensive margins. It is important to mention, however, that the behaviour observed between the variables of interest reflects correlation and not causation. For causal links to be established, a more in-depth econometric analysis is required. This is the focus of Chapters 4 and 5 of the thesis.

Figure 2.17: Scatterplots of AfT and TC, AfT and Intensive Margin, with AfT and Extensive Margin of SSA Export



[7] Data used to convert SSA's merchandise exports into the intensive and extensive margins was obtained from the BACI database created by CEPII using the UN COMTRADE import and export data reported at the 6-digit Harmonised System (HS) level of product disaggregation.

2.6 Conclusion

This chapter provides a foundation to the understanding of the role of AfT in reducing trade costs and promoting exports at the intensive and, particularly, the extensive margin in SSA. The economic performance of Africa is reviewed, trends in Africa's merchandise exports and trade cost patterns are analysed, the objectives of the AfT initiative are discussed, and AfT disbursement flows are scrutinised.

The analysis reveals that despite the recent progress achieved, SSA has not been able to establish itself on a sustainable growth path. The relatively high economic growth rate it recorded in the past few decades can be attributed to good governance and fiscal management, increased public investment spending on infrastructure, and higher private sector participation in economic affairs flowing from government reforms to improve the business climate. It may also be due to the commodity price boom, which is driven by the emergence of China and the rising demand for Africa's commodity resources. Such growth is not sustainable because it is dependent on commodity prices that are currently falling on account of the slowing down of the Chinese economy (AfDB 2017). Moreover, the continent is significantly marginalised in world exports and has failed to industrialise. Africa's exports remain highly concentrated on a narrow range of unprocessed primary products and a decrease in unemployment has not accompanied the recent growth. The continent has also acquired a considerable infrastructure deficit over time, despite the rise of public investment spending.

The literature points to various inter-related factors explaining Africa's marginalisation in world trade. These can be grouped into destiny-related factors (tropical climate, geography, low population density, ethnic fragmentation, and the natural resource curse) and policy-induced factors (protectionism, poor infrastructure, low human capital, and weak institutions). While African governments have significantly liberalised their trade regimes and SSA countries have sufficiently large market access to the rest of the world, because of structural deficiencies non-traditional barriers to trade remain. These supply-side weaknesses manifest themselves in the form of significantly high trade costs, preventing SSA countries from tapping their trade potential fully, and from diversifying their exports into higher value-added products.

The AfT initiative could, therefore, play an important role in achieving structural transformation and industrialisation in SSA. Determination of the effectiveness of AfT in helping to achieve the objectives remains an empirical exercise, and this is what the present study, in part, aims to do. The primary hypothesis to be tested in the context of SSA is that AfT reduces trade costs, which serves to promote export diversification at both the intensive and extensive margins. The preliminary analysis of the correlation between the main variables of interest provides some insight into the validity of the hypothesis, but a more robust econometric approach is warranted to disentangle causality relationships. This is addressed in subsequent chapters of the thesis.

CHAPTER 3

SOURCES OF TRADE COSTS

3.1 Introduction

It has long been recognised that trade is a potential engine of growth and can lift countries out of poverty. However, SSA countries remain marginalised in world trade despite the significant gains it can obtain from greater integration (ADR 2010; Portugal-Perez and Wilson 2009; UNECA 2013). Africa's marginalisation is largely attributed to the presence of high trade costs facing the region (OECD/WTO 2015). Trade costs broadly encompass all costs, other than the marginal cost of producing the goods, which add to the price paid by the final foreign users. Trade costs act as barriers to trade and can take the form of outdated infrastructure, complex border procedures, poor communication systems, corruption, as well as the traditional tariff barriers and non-tariff barriers (NTBs) such as quotas and product regulations.

While the sources of trade costs in developing countries have been amply investigated, a unified approach to analyse the relative contribution of each possible factor behind the high trade costs in SSA is lacking. Such research is useful and timely as multilateral organisations, together with policymakers and the private sector, gather efforts to reduce trade costs and promote trade as a means to achieve sustainable economic growth (OECD/WTO 2015; UNECA 2015). Measuring the relative influence of the different sources of trade costs faced by SSA when trading regionally and with the rest of the world is meaningful as it will help stakeholders prioritise their policies to increase the continent's integration in regional and global trade.

The present study, therefore, fills this gap in the literature by using a bilateral trade cost model similar to Arvis et al. (2013), and Chen and Novy (2011), but which is innovative in at least three ways. First, this study controls for cross-country heterogeneity in the dataset using panel estimation techniques while previous studies use cross-sectional analysis. Second, the bilateral trade cost equation is equipped with four additional explanatory variables developed by Portugal-Perez and Wilson (2012) to obtain a narrower disaggregation of the sources of trade costs. These concerns proxy variables constructed to account for the quality of physical infrastructure, communication infrastructure, border and transport efficiency, and the business regulatory environment. Third, while previous similar studies have been conducted on developing countries in general, this study is conducted in the context of SSA, a geographical region where trade costs have historically been higher than elsewhere. The sources of trade costs when trade occurs within the region and when SSA trades with the rest of the world are also investigated.

The remainder of the chapter is organised as follows. Section 3.2 reviews the theoretical and empirical literature on the sources of trade costs. Section 3.3 describes the econometric methodology employed to estimate the relative contribution of each possible source of trade cost in SSA and the data used for the study. Section 3.4 presents and discusses the estimation results, while Section 3.5 concludes the chapter with a few policy implications.

3.2 Literature Review

3.2.1 Trade Costs: Meaning and Components

Broadly defined, trade costs embrace "all costs involved in getting a good to a final user other than the marginal cost of producing the good itself" (Anderson and van Wincoop 2004, p. 691). In their pioneering study, Anderson and van Wincoop provide an extensive survey of the different components of trade costs. They categorise them into (i) policy-imposed trade costs (tariff barriers and non-tariff barriers such as quotas) and (ii) environment-based trade costs (transport costs, information costs, contract enforcement costs, currency barriers, language barriers, legal and regulatory costs). They further estimate, using directly observed evidence and inferences made from indirect measures[8], that overall trade costs for a typical rich country amount to the equivalent of 170 percent ad valorem tariff barrier on trade. This is decomposed into 21 percent attributed to transportation costs, 44 percent owing to border-related barriers, and 55 percent to retail and distribution costs. Delving further into what constitutes the border-related barriers indicate that only 8 percent relates to tariff barriers while the rest is composed of other barriers: 7 percent language barrier, 14 percent currency barrier, 6 percent information cost barrier, and 3 percent security barrier.

More recently, some researchers (such as Khan and Kalirajan 2011; Portugal-Perez and Wilson 2009) have found it useful to decompose trade costs into (i) natural costs, (ii) behind-the-border costs, and (iii) border-related costs. Natural costs emanate from the geographical distance between countries and comprise mainly transportation costs incurred when goods are traded internationally. Behind-the-border costs include costs associated with institutional inefficiencies such as corruption and bureaucratic red tape, and weak internal infrastructure (e.g., poor road quality and communication networks). Border-related costs are tariffs barriers and non-tariff barriers such as quotas, complex customs and port procedures, inefficient port infrastructure, and costs associated with language and currency differences.

Recent trade models (e.g., Chaney 2008; Helpman, Melitz, and Rubinstein 2008) also make the distinction between fixed and variable trade costs. Fixed trade costs are those costs that do not depend on the volume of shipment (Persson 2013). These include a one-time sunk cost such as information costs and product adaptation costs that traders incur when entering export markets (Melitz 2003; Roberts and Tybout 1997). There are also some fixed compliance costs exporters incur behind-the-border and at-the-border each time they export their goods. The variable costs, on the other hand, vary with the size of the shipment and include costs such as transportation costs and tariffs.

[8] Indirect measures relate to the use of the gravity model to make inferences from trade volumes as well as extracting information about trade costs from price data.

3.2.2 Trade Costs and Trade Flows: The Theoretical Thread

Trading across borders is not frictionless. It is costly to move goods internationally because of the presence of policy-imposed and environment-based barriers as highlighted in the previous section. Until the late 1970s, international trade models were constructed from an ideal world, where trading across countries has been perceived as costless (Kónya 2006). However, the importance of trade costs in understanding the pattern of trade has led trade theorists to incorporate them into their models. Krugman (1980) is one of the first researchers to have included trade costs, modelled in the 'iceberg' form following Samuelson (1954), into his trade model. Trade costs have eventually been more rigorously theorised in what is called the gravity model of trade (Egger 2008).

The gravity model is one of the few models in the field to have known empirical success before being equipped with robust theoretical foundations (Anderson 2011; Head and Mayer 2013). It has been used as a workhorse model to study the determinants of bilateral trade flows for more than 50 years since being introduced intuitively by Tinbergen (1962). The *traditional* gravity model is inspired by Newton's law of universal gravitation. Applied in the context of international trade, the traditional gravity model suggests that bilateral trade flows between country *i* and country *j* are directly proportional to the product of the two countries' gross domestic products and inversely proportional to the distance between them to reflect trade resistance (Baldwin and Taglioni 2006; Candau and Dienesch 2011).

Although the *traditional* gravity model was applied empirically with success, economists cast doubts about its reliability because it lacked theoretical foundations. During the past few decades, however, concerted efforts of trade theorists have succeeded in deriving solid theoretical roots for the so-called *structural* gravity model. The theoretical gravity literature has now reached a phase where "any plausible model of trade would yield something very like the gravity equation…" (Deardorff 1998, p. 12). The main contributors to the development of the *structural* gravity theory are Anderson (1979), Bergstrand (1985, 1989), Deardorff (1998), Eaton and Kortum (2002), Anderson and van

Wincoop (2003), and more recently, Helpman, Melitz, and Rubinstein (2008), and Chaney (2008).

Nonetheless, the work of Anderson and van Wincoop (2003) is considered to be a pioneer study in the field since their gravity model not only transforms itself into a workable empirical model but also serves to solve McCallum's (1995) border puzzle[9], with the inclusion of what they refer to as 'multilateral resistance' indexes. Thus, in what follows, the structural gravity model of Anderson and van Wincoop (2003), [AvW hereafter], is presented since it is considered to be one of the most robust theoretical attempts to link trade costs and bilateral trade flows in a multilateral context.

The AvW model assumes that all goods are differentiated by country of origin, and each country specialises in the production of only one good. Since it is a demand-side model of international trade, the supply of each good is kept fixed. Consumers across countries have identical and homothetic preferences represented by a Constant Elasticity of Substitution (CES) utility function. Firms are assumed to have identical technology.

The aggregate utility function of consumers of country *i*'s good in country *j*, U_j is given by:

$$(3.1) \qquad U_j = \left(\sum_i \beta_i^{(1-\sigma)/\sigma} c_{ij}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}$$

where c_{ij} represents the consumption of a good produced in country *i* by consumers in country *j*, β_i is an inverse measure of the attractiveness of country *i*'s good and σ is the elasticity of substitution between different goods.

[9] This relates to the work of McCallum (1995) who estimated interprovincial trade within Canada to be greater than trade between Canada and the US by 2200 per cent as the consequence of an unexplained US-Canada border effect.

Consumers in country *j* would then seek to maximise their utility subject to the budget constraint:

$$(3.2) \qquad \sum_i p_{ij} c_{ij} = y_j$$

where y_j is the nominal income of country *j*'s agents and p_{ij} is the price of country *i* goods as charged in country *j*. p_{ij} is in turn formulated as $p_{ij} = p_i t_{ij}$, with p_i representing the supply price of the exporter in country *i* and t_{ij} denotes the bilateral trade costs, which is higher than one. p_{ij} thus differs across countries in response to differences in trade costs. Assuming that the exporter shifts all trade costs burden onto importers in country *j*, the latter's import expenditure $p_{ij}c_{ij}$ would represent exporter *i* earnings x_{ij}.

Solving for expression of x_{ij} through a maximisation exercise of Equation (3.1) subject to Equation (3.2) yields the following:

$$(3.3) \qquad x_{ij} = \left(\frac{\beta_i p_i t_{ij}}{\tilde{P}_j} \right)^{(1-\sigma)} y_j$$

where $\tilde{P}_j$ is the consumer price index of *j*, given by:

$$(3.4) \qquad \tilde{P}_j = \left[\sum_i \left(\beta_i p_i t_{ij} \right)^{(1-\sigma)} \right]^{1/(1-\sigma)}$$

By assuming nation-wide market equilibrium for country *i*, i.e. all goods *i* produced is sold to country *j*, its income can be expressed as:

$$(3.5) \qquad y_i = \sum_j x_{ij}$$

Replacing Equation (3.3) in Equation (3.5) results in:

$$(3.6) \qquad y_i = \sum_j \left(\frac{\beta_i p_i t_{ij}}{\tilde{P}_j} \right)^{(1-\sigma)} y_j$$
$$= (\beta_i p_i)^{(1-\sigma)} \sum_j \left(\frac{t_{ij}}{\tilde{P}_j} \right)^{(1-\sigma)} y_j \quad \forall i$$

Solving Equation (3.6) for $(\beta_i p_i)^{(1-\sigma)}$ yields:

$$(3.7) \qquad (\beta_i p_i)^{(1-\sigma)} = \frac{y_i}{\sum_j \left(\frac{t_{ij}}{\tilde{P}_j} \right)^{(1-\sigma)} y_j}$$

Defining nominal world income by $y^W = \sum_j y_j$ and income shares by $\theta_j \equiv y_j / y^W$, and substituting Equation (3.7) in Equation (3.3) generates the AvW micro-founded gravity equation:

$$(3.8) \qquad x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{\Pi_i \tilde{P}_j} \right)^{(1-\sigma)}$$

where

$$(3.9) \qquad \Pi_i \equiv \left(\sum_j \left(\tau_{ij} / \tilde{P}_j \right)^{(1-\sigma)} \theta_j \right)^{1/(1-\sigma)}$$

Substituting the equilibrium scaled prices into Equation (3.4) gives:

$$(3.10) \qquad \tilde{P}_j = \left(\sum_i \left(t_{ij} / \Pi_i \right)^{(1-\sigma)} \theta_i \right)^{1/(1-\sigma)}$$

If symmetry of trade costs is imposed, i.e. $t_{ij} = t_{ji}$, then $\prod_i = \tilde{P}_i$. The gravity equation can thus be reformulated as:

$$(3.11) \qquad x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{\tilde{P}_i \tilde{P}_j} \right)^{(1-\sigma)}$$

Equation (3.11) suggests that the exports from country *i* to country *j* are positively related to the supply capacity of country *i* (y_i) and the demand capacity of country *j* (y_j) relative to the world economy, but negatively related to *relative trade costs*. The latter is made up bilateral trade costs (t_{ij}) relative to the average trade barriers faced by the two countries when trading with other countries, and are given by the outward and inward multilateral resistance indexes, $\tilde{P}_i$ and $\tilde{P}_j$, respectively (Anderson and van Wincoop 2004). It is worth noting that σ should be greater than one if there is to be an adverse effect of t_{ij} on trade.

3.2.3 Measurement of Trade Costs

The inclusion of trade costs in international trade models following the work of Anderson and van Wincoop (2003; 2004) and its relevance at the international policy level in the so-called 'trade facilitation'[10] agenda of the World Trade Organisation (WTO) indicates its importance in understanding why some countries trade less than others. While there is now a common consensus on what constitutes trade costs theoretically, the actual measurement of trade costs remains a daunting exercise. Direct measures of trade costs are scarce and, if available, they have limited country and time coverage. Also, they are not all-inclusive as they capture only a fraction of overall trade costs (Chen and Novy 2011).

Some authors have used the 'cost and time of exporting and importing a standard container by sea' from the World Bank's Doing Business database as proxies for trade costs. This

[10] Broadly defined, trade facilitation refers to the reduction of trade costs, particularly the non-traditional ones such as complex customs procedures, inefficient port infrastructure, poor transport and communication system, and poor institutions.

is because these data are user-friendly and are available for a large set of countries. However, these are not actual trade costs, i.e. they are not trading costs incurred by traders but instead they are estimates made by consultants based on surveys (Sourdin and Pomfret 2012). Other authors have used the 'cost insurance freight (CIF) – free on board (FOB) gap value' as a proxy for trade costs. Consistent CIF-FOB data is available only for a handful of importers namely the US, Australia, New Zealand, Brazil, Chile, and other Latin American countries. In addition, the CIF-FOB gap is better suited to reflect transportation costs and ignores other trade costs, e.g. the time costs of international trade, which are critical for goods such as perishables or fashion items, and some behind-the-border costs that impede international trade (Sourdin and Pomfret 2012).

The recent work of Novy (2013), following Head and Ries (2001) and Head and Mayer (2004), has made possible the computation of a micro-founded trade costs measure that captures a host of natural, behind-the-border, and at-the-border trade barriers. This trade cost measure is derived from an inverse-gravity approach to the work of AvW. In fact, Novy (2013) shows that the trade cost measure can be derived from any leading international trade models such as Eaton and Kortum (2002), Chaney (2008), and Melitz and Ottaviano (2008).

The basic premise of the trade cost model is that a change in average trade barriers faced by a country when dealing with other countries not only influence international trade flows but intra-national trade as well. For example, increased trade barriers would reduce international trade that would, in turn, lead to a rise in intra-national trade because more goods are traded locally. Adjusting Equation (3.8) from the AvW gravity model to predict intra-national trade, say in country *i*, yields the following result:

$$(3.12) \qquad x_{ii} = \left(\frac{y_i y_i}{y^W}\right)\left(\frac{t_{ii}}{\prod_i P_i}\right)^{1-\sigma}$$

Using Equation (3.12) to solve for the product of multilateral resistance $\prod_i P_i$, which represents the weighted averages of all bilateral barriers, yields:

$$(3.13) \qquad \Pi_i P_i = \left((x_{ii}/y_i) / (y_i/y^W) \right)^{1/\sigma-1} t_{ii}$$

The gravity equation (3.8) should then be multiplied by its counterpart formulated to predict bilateral trade flows in the opposite direction, i.e. x_{ji} to obtain:

$$(3.14) \qquad x_{ij} x_{ji} = \left(\frac{y_i y_j}{y^W} \right)^2 \left(\frac{t_{ij} t_{ji}}{\Pi_i P_i \Pi_j P_j} \right)^{1-\sigma}$$

By substituting Equation (3.13) in Equation (3.14) and re-arranging the expression into a trade cost equation gives:

$$(3.15) \qquad (t_{ij} t_{ji}) / (t_{ii} t_{jj}) = \left[(x_{ii} x_{jj}) / (x_{ij} x_{ji}) \right]^{1/\sigma-1}$$

Given that international trade costs can be asymmetric ($t_{ij} \neq t_{ji}$) and intra-national trade costs differ across countries ($t_{ii} \neq t_{jj}$), it is convenient to work with the geometric mean of the barriers. Therefore, when expressed in ad valorem tariff equivalent, the micro-founded trade cost measure can be computed as follows:

$$(3.16) \qquad \tau_{ij} = \left(\frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} \right)^{\frac{1}{2}} - 1$$

$$\Rightarrow \qquad \tau_{ij} = \left(\frac{x_{ii} x_{jj}}{x_{ij} x_{ji}} \right)^{\frac{1}{2(\sigma-1)}} - 1$$

where τ_{ij} is a geometric average of the bilateral trade costs relative to domestic trade costs, expressed in ad valorem terms. A rise in τ_{ij} would raise domestic trade relative to bilateral trade and vice-versa. It is noteworthy that this measure of trade costs is micro-founded and does not rely on an ad hoc functional form. Also, it does not need to assume trade barriers are symmetric between countries as in the gravity literature and lends itself to an extensive cross-country and time-series coverage since it can be computed from the readily available output and trade data. It does not require the estimation of multilateral resistance indexes as these are netted out from the model. Moreover, this trade cost model allows the measurement of trade costs for industries producing goods and those supplying services as done in Chen and Novy (2011), and Miroudot, Sauvage, and Shepherd (2013), respectively.

3.2.4 Empirical Evidence of the Sources of Trade Costs

Given the difficulty to measure trade costs comprehensively, the empirical literature on the sources of trade costs can be sub-divided into two parts. Firstly, there are studies making inferences about the relative magnitude of possible trade cost elements by estimating their impact on trade flows using the gravity model of trade. This can be referred to as the *indirect approach* to quantify the relative contribution of different factors causing high trade costs. Secondly, there is the *direct approach*, which uses observable data on trade cost as dependent variable and a set of possible sources of trade costs as independent variables in an estimation equation to gauge their relative influence.

3.2.4.1 The Indirect Approach

This strand of the literature is very large, and it is beyond the scope of this study to review all of it. However, a tabular summary of the main studies is presented in Table A3.1 of the Appendix, and a synthesis of the main findings is made below.

These studies can be categorised according to various dimensions of trade costs. Researchers mainly attempt to measure the significance of non-traditional trade barriers on trade flows after accounting for the traditional tariff and non-tariff barriers. These include unofficial trade barriers such as *distance* (e.g., Disdier and Head 2008), *language dissimilarity* (e.g., Egger and Lassmann 2012), *high communication costs* (e.g., Clarke and Wallsten 2006; Fink, Mattoo, and Neagu 2005; Freund and Weinhold 2004; Lin 2015), *poor physical infrastructure* (e.g., Blonigen and Wilson 2008; Limão and

Venables 2001; Nordås and Piermartini 2004), *weak institutions* (e.g., Anderson and Marcouiller 2002; Briggs 2013; Dutt and Traca 2010; Ranjan and Lee 2007), and *trading time delays* (e.g. Djankov, Freund, and Pham 2010; Shepherd 2013). All studies confirm the significance of these trade cost elements in impeding trade flows and, in many cases, their magnitude can be as large as tariff imposition. The results are robust to alternative estimations of the gravity model, datasets, and choice of proxy variables.

Studies that seek to measure the impact of *trade facilitation* on trade flows using the gravity model are also relevant for the present study. No single definition exists for trade facilitation (Grainger 2011), but researchers usually distinguish between a 'narrow' and 'broad' meaning of the concept (Milner, Morrissey, and Zgovu 2005). In a narrow sense, trade facilitation refers to the "simplification, harmonization, standardization and modernization of trade procedures" (Grainger 2008, p. 20). This is the definition broadly adopted by practitioners and international organisations involved in the trade facilitation process; the World Trade Organization (WTO) and the World Customs Organization (WCO) among others. Researchers, however, usually adopt a broader definition of trade facilitation to include both 'soft/intangible' and 'hard/tangible' measures aimed at reducing trade costs other than tariffs (Portugal-Perez and Wilson 2012). These measures, in turn, are not restricted to border procedures but include behind-the-border features such as the infrastructure and institutional quality of the trading country as well.

Although trade facilitation has benefits to both the country undertaking the reforms unilaterally and its trade partners, such initiatives involve significant upfront investment costs. Although very few studies incorporate the implementation costs of trade facilitation into their models (Hoekman and Shepherd 2015; Iwanow and Kirkpatrick 2007), they all conclude that the benefits largely outweigh the costs (see for example, Buys, Deichmann, and Wheeler 2010; Duval 2006; Mirza 2009; Shepherd and Wilson 2007). Nonetheless, owing to limited resources, trade facilitation reforms may not be implemented simultaneously. Priorities have to be identified, and the studies that were done in this regard augment the gravity equation with a set of trade facilitation proxies. All conclude that trade facilitation is beneficial under alternative estimation strategies, but they differ in terms of the priority areas identified for the sample of countries chosen (see for example, Francois and Manchin 2013; Hoekman and Nicita 2011; Iwanow and Kirpatrick 2007; Niru 2014; Portugal-Perez and Wilson 2012; Wilson, Mann and Otsuki 2003, 2005).

In regards to empirical evidence in the African context, studies reveal that the reduction of high trade costs through trade facilitation reforms would bring significant trade gains. Njinkeu, Wilson, and Fosso (2008) employed Wilson, Mann, and Otsuki's (2003) methodology to find that improvements in the port and service infrastructures tend to contribute more to the expansion of intra-African trade than reforms in the customs and regulatory environments. Using a larger dataset, Iwanow and Kirpatrick (2009) find that a 10 percent improvement in regulations and infrastructure improves export performance by 9 to 11 percent and 8 percent, respectively while the same proportionate improvement in on-the-border customs-related reforms brings a 5 percent rise in exports. The need for infrastructural reforms to overcome Africa's supply-side weaknesses has also been emphasised in Bouet, Mishra, and Roy (2008), and Limão and Venables (2001). They argue that poor transport and telecommunications infrastructure largely explain why the continent under-trades with the rest of the world. However, in the context of trade between South Africa and a selection of 15 African countries over the period 2008-2010, Jordaan (2014) observes that an improvement in the customs environment within the importing country provides the most significant gain in terms of increasing trade flows, followed by the regulatory environment and domestic infrastructure.

Freund and Rocha (2011) focused on the impact of domestic export delays – (disaggregated into transit time, documentation, port handling, and customs clearance) on Africa's exports. They find that inland transit delays have the most economically and statistically significant impact on exports in Africa rather than delays related to documentation, port handling, and customs clearance. In particular, a one day increase in inland transit time reduces exports by 7 percent on average. They also calculate that trade facilitation in the form of reducing inland travel times by one day is nearly equivalent to a 2 percentage point decrease in all importing-country tariffs. They further observe that the long inland transport delays result from weak institutional structures rather than geography. Christ and Ferrantino (2011) also conclude that high inland transport delays, combined with high transport costs and uncertainty, particularly for landlocked countries in Africa, discourage firms from participating in the global value chain.

3.2.4.2 The Direct Approach

Inferences made from the gravity model on the relative contribution of different sources of trade costs can guide policymakers in identifying priority areas when attempting to promote trade. However, this approach may suffer from the omitted variable bias if some variables, which affect trade flows but are also correlated with the trade cost proxy variables, are not included (Arvis et al. 2013; Baldwin and Taglioni 2006). Another important concern with this approach is that of a potential endogeneity problem caused by reverse causality between trade volumes and trade costs. For example, countries that export more may have better financial means to invest in time-reducing infrastructure. Also, many time-saving techniques are only available in high volume ports. Moreover, increased trade volumes may create a congestion problem and delay the delivery of goods (Djankov, Freund, and Pham 2010; Freund and Rocha 2011). The simultaneity bias may result in an underestimation of the trade cost proxy coefficients in the regression as it leads to the estimators moving towards zero.

An alternative to the inference approach, which overcomes the limitations mentioned above, is to use observable data on trade cost as regressand and a set of possible determinants of trade costs as regressors in an estimating equation. Few researchers have employed this approach because of the difficulty to obtain a comprehensive observable trade cost measure and most who have tried have relied on transport cost data or the CIF-FOB ratio.

Limão and Venables (2001) estimated the determinants of trade costs using two sources of transport cost data: shipping company quotes for the cost of transporting a standard container from Baltimore in the US to selected destinations, and the ratio of CIF and FOB values. In their transport cost equation, they used distance, dummies indicating whether the countries share a common border, whether a country is landlocked and whether it is an island, per capita income, and an infrastructure measure as regressors. All variables have the expected signs and are statistically significant but, more importantly, they conclude that poor infrastructure significantly increases transport costs and this effect is greater for landlocked countries than for coastal countries. Limão and Venables calculate that poor infrastructure accounts for 40 percent of the predicted transport costs for coastal countries and up to 60 percent for landlocked ones.

Clark, Dollar, and Micco (2004) investigated the determinants of shipping costs to the US over the period 1996 to 2000 and find port efficiency to be an important determinant among other factors such as distance, volumes, and product characteristics. They estimate that improving port efficiency from the 25th to 75th percentile reduces shipping costs by around 12 percent. They further explored the reasons behind port inefficiencies and find excessive regulation, poor infrastructure and organised crime to be the leading causes.

Pomfret and Sourdin (2010) employed the annual CIF and FOB values of Australia's imports disaggregated at the HS 6-digit level for the period 1990 to 2007 to compute an average trade costs measure. This was then used to quantify the determinants of trade costs with distance, value/weight ratio (a country selling heavy goods will have higher transport costs), exporting country GDP or total bilateral trade (to capture scale effects), and institutional quality (corruption index) as regressors using 2007 data. The regression was run using product fixed effects in a first stage and panel data for the period 1998 to 2007 in a second stage. They conclude that distance, weight and size as well as institutional quality explain part of the variation in trade costs. However, the influence of institutional quality on trade costs varies across mode of transport and commodities. They show that good institutions (lower corruption) reduce trade costs relatively more for air freight than for sea freight. In addition, they find that the link between institutions and trade costs is stronger for manufactured goods than for agricultural goods.

A few recent studies employ Novy's (2013) comprehensive measure of trade costs to obtain econometric evidence on the factors driving variation of trade costs across countries and time. Jacks, Meissner, and Novy (2010) used it to generate bilateral trade costs for 18 developed countries during the first wave of globalisation (1870 to 1913) and find that overall trade costs seem to have fallen by roughly 10 percent to 16 percent. The authors also investigated the determinants of the fall in trade costs in that period by estimating an equation with distance, tariffs, exchange rate volatility, the density of rail roads, adherence to the gold standard, and membership of the British Empire as regressors. They conclude that these determinants can explain slightly over 50 percent of the variation in trade costs. Except for exchange rate volatility which can be explained by the adoption of the gold standard by countries during that era, the results are as expected and statistically significant.

In an extended study, Jacks, Meissner, and Novy (2011) calculated trade costs for a larger sample of 130 countries across the Americas, Asia, Europe, and Oceania over the period 1870 to 2000. To analyse the determinants of trade costs, they used the distance between trading partners, the establishment of fixed exchange rate regimes, the existence of common language, membership of a European overseas empire, and the existence of shared borders as regressors. The regressions were run for four samples: a pooled sample and for three sub-samples for the 130 dyads between 1870 and 1913 (pre-World War I trade boom), 1921 and 1939 (interwar trade bust), and 1950 and 2000 (post-World War II trade resurgence).

Concerning the pooled sample, all coefficients have the expected signs and are statistically significant. However, their magnitudes differ because the impact of joint membership of a European empire, and sharing a common border on overall trade costs seem to be twice the impact of fixed exchange rate or sharing of a common language. However, the effect of the fixed exchange rate system is stronger in the pre-World War I and post-World War II periods. Also, common language seems to have exerted a slightly stronger influence on the trade cost measure in the period 1870 to 1913 than subsequently. The effect of the association of European empires appears to have diminished over the years while distance has become more important in the post-1950 era.

Duval and Utoktham (2011) used Novy's (2013) methodology to study the evolution of tariff and non-tariff trade barriers in Asia between 1996 and 2007. They find that non-tariff trade costs account for a significant proportion of overall trade costs while tariff barriers have been significantly reduced. They also evaluated the importance of various determinants of non-tariff trade costs. They find that improving port efficiency (as measured by the Liner Shipping Connectivity Index) and enlarging access to ICT facilities reduce trade costs. Improving the overall business environment (measured by the World Bank's Ease of Doing Business indicator) also helps to reduce non-tariff trade costs. The undervaluation of the country's currency against the US dollar was also beneficial in reducing trade costs.

Chen and Novy (2011) computed these trade costs across 11 EU countries for 163 manufacturing industries over the period 1999 to 2003. They also estimated the sources of trade barriers across their dataset by relating the trade cost measure to observable trade cost proxies typically used in the gravity literature. The main findings are that countries that are weakly integrated into international trade are those that have recently joined the EU and that have not yet implemented the Schengen Agreement. On the other hand, trade integration tends to be low in industries characterised by high Technical Barriers to Trade (TBTs) such as high standards and safety requirements, low productivity, high transportation costs, and low degree of transparency in public procurement.

Arvis et al. (2013) added to previous studies by calculating the comprehensive bilateral trade costs for a larger set of developed and developing countries over the period 1995 to 2010. They followed Chen and Novy (2011) by using a regression approach to analyse the determinants of bilateral trade costs, but by including a broader range of possible sources of trade costs. They used the Air Connectivity Index (ACI), distance, entry costs, exchange rate, logistics performance index (LPI), Liner Shipping Connectivity Index (LSCI), tariffs and a set of dummies typically employed in the gravity literature to control for country characteristics. A cross-sectional analysis was conducted since ACI was available for only one year – 2005. They find that transport, entry costs, and logistics matter for trade costs. The coefficients of LPI and LSCI are together higher than for geographical distance, thereby implying there is scope to reduce trade costs significantly via appropriately devised trade facilitation measures.

By employing a comprehensive trade cost measure, and by providing the econometric estimates of the relative size of its different sources, Arvis et al. (2013) overcame the limitations of previous studies. However, the study does not account for the unobserved cross-country heterogeneity that could influence the results because it employs a cross-sectional econometric analysis. The present study, therefore, improves on the work of Arvis et al. (2013) by employing a panel estimation technique to control for unobserved heterogeneity in the SSA context. More importantly, it uses a finer disaggregation of what trade facilitation constitutes broadly, and equips the trade cost equation with four additional proxy variables that can better guide policymakers to identify priority areas to reduce the continent's trade costs.

3.3 Methodology and Data

Based on the work of Arvis et al. (2013), and Chen and Novy (2011), the following trade cost equation is specified and estimated using standard panel estimation techniques:

$$(3.17) \qquad \begin{aligned} \ln TC_{ijt} &= \beta_0 + \beta_1 \ln PI_{it} + \beta_2 \ln ICT_{it} + \beta_3 \ln BTEF_{it} + \beta_4 \ln BREV_{it} \\ &+ \beta_5 \ln TARIFF_{ijt} + \beta_6 RTA_{ijt} + \beta_7 \ln distance_{ij} \\ &+ \beta_{8-14} Gravity\ Dummies_{ij} + \mu_{jt} + \lambda_t + \varepsilon_{ijt} \end{aligned}$$

where μ_{jt} captures the unobserved time-variant partner effects, λ_t accounts for the unobserved time-varying effects, and ε_{ijt} stands for the usual stochastic error term. TC_{ijt}, the dependent variable, represents the bilateral trade costs between SSA exporting country *i* and importing country *j*. The data is sourced from the ESCAP-WB database that is compiled by Arvis et al. (2013) based on Novy's (2013) methodology. The bilateral trade costs are available for both trade in agricultural goods and manufacturing goods in ad valorem form.

PI captures the quality of seaport, air transport, road, and railroad infrastructure, while *ICT* measures the extent to which the latest technologies are available and absorbed by businesses, their extent of Internet use, and the degree of government prioritisation of ICT in the country. *PI* and *ICT* are part of the 'hard infrastructure' dimension of trade facilitation. *BTEF* reflects the efficiency of customs procedures and domestic transport in terms of the time and number of documents required to move goods across borders. *BREV* is constructed upon indicators that reflect the efficiency of the government in facilitating business. This relates mainly to the extent of corruption among public officials and politicians and serves as a measure of institutional quality. Taken together, BTEF and BREV portray the 'soft infrastructure' aspect of trade facilitation. Since the focus of the study is to analyse the sources of trade costs in SSA, only the trade facilitation scores for SSA countries are taken, while those of partner countries are subsumed in the time variant partner fixed effects included in the estimating equation. The sign of the coefficients for the four trade facilitation indicators is expected to be negative, predicting that an improvement in any of these trade facilitation proxies will reduce trade costs.

Data on the four trade facilitation proxies are constructed using Portugal-Perez and Wilson's (2012) methodology. Although their dataset is available from the World Bank's Trade Facilitation database, it has only four years (2004-2007) of coverage. To benefit from more recent data available from the same primary sources (World Economic Forum, Doing Business, and Transparency International), and to allow for more variation in the estimation, their methodology is employed to extend the dataset to include five additional years (2008-2012). The construction of these four indicators is detailed in Appendix 3.1A.

Tariff data, particularly the trade-weighted average effectively applied tariff is obtained from the WITS-TRAINS database. By definition, the effectively applied tariff is the lowest available tariff. If a preferential tariff exists, it is used as the effectively applied tariff. Otherwise, the Most Favoured Nation (MFN) applied tariff applies. Thus, the trade-weighted average effectively applied tariff is an average of all effectively applied tariffs weighted by their corresponding trade value. The geometric average of unity, plus the trade-weighted average effectively applied tariff imposed by country *i* (SSA) on country *j*'s exports ($tariff_{ijt}$), and by country *j* on country *i*'s exports over each period ($tariff_{jit}$) is computed using Equation (3.18).

$$(3.18) \qquad TARIFF_{ijt} = \sqrt{\left(1+tariff_{ijt}\right)\times\left(1+tariff_{jit}\right)}$$

The sign for the coefficient of the *TARIFF* covariate is expected to be positive since higher tariff rates make it costlier to trade.

The dataset of de Sousa (2012) is used to obtain information on Regional Trade Agreements (RTAs) formed between the SSA countries included in the sample and its trading partners. An RTA can be in the form of a Free Trade Agreement, Customs Union, Economic Integration Agreement, or a Partial Scope Agreement. *RTA* is thus a dummy equal to one if country *i* and *j* are members of the same trade agreement. The sign of the *RTA* coefficient is expected to be negative since the formation of RTA reduces tariff and non-tariff trade barriers across member countries, thereby decreasing trade costs.

A set of explanatory variables typically included in an empirical gravity model as trade cost proxies related to geography is also included. These include *distance* as measured by the great circle formula using the geographic distance (in km) between the two principal cities of country *i* and *j*, and a host of dummy variables equal to one if the country pairs were ever in a colonial relationship (*colony*), share a common land border (*common border*), were colonised by the same power (*common coloniser*), share a common language (*common language),* are landlocked (*landlocked*), or were ever part of the same country (*same country*). Data on these variables are obtained from the CEPII database. The sign of the coefficient for *distance* and *landlocked* is expected to be positive, while a negative coefficient is predicted for the other gravity dummies.

An unbalanced panel dataset of 20 SSA countries and 107 partner countries over the period 2004 to 2012 is used for the study. The choice of the time period and the sample size of SSA countries is dictated by the availability of data for our variables of key interest. In particular, the available data limits the computation of the four trade facilitation indicators to only 20 SSA countries. Table A3.2 of the Appendix displays the list of SSA countries and trading partners used in the analysis, while Table A3.6 presents standard descriptive statistics on the variables employed.

3.4 Empirical Results and Discussions

3.4.1 Diagnostic Tests

It is necessary to perform some diagnostic tests before estimating the model[11]. Firstly, the suitability of the dataset for panel data estimation techniques is checked using the F test (Baltagi 2008; Kunst 2009), and the Lagrange multiplier (LM) test (Breusch and Pagan 1980). The F test is used to compare the efficiency of the Pooled OLS to the Fixed Effects Model (FEM) to assess whether the latter improves the goodness-of-fit. Table A3.7 in the Appendix reports the calculated F values, which are statistically significant and thus in favour of the FEM.

In order to determine the efficiency of the pooled OLS over the REM, Breusch and Pagan (1980) devised the LM test to diagnose the presence of random unobserved effects in the panel setting. The LM calculated values (see Table A3.7) are statistically significant suggesting that the REM is able to deal with heterogeneity better than does the Pooled OLS.

The Hausman test (Hausman 1978) is then used to determine whether the FEM or the REM is the most appropriate panel data estimator. The Hausman test compares the FEM to the REM under the null hypothesis that the unobserved effects are uncorrelated with any regressor in the model. The Hausman test statistics are statistically significant as observed from Table A3.7, implying the null hypothesis is rejected. This result favours the FEM over the REM because the former is more efficient when the unobserved heterogeneity is correlated with the observed explanatory variables included in the estimating equation.

[11] A detailed discussion of the diagnostic tests performed is reported in Appendix 3.2A.

Efficient panel data estimation relies on the assumption of homoscedasticity and no serial correlation. If these assumptions are not satisfied, the results will be biased and inconsistent. Thus, the presence of heteroscedasticity and serial correlation in the data are tested using the Modified Wald test (Greene 2003) and the Wooldridge test (Wooldridge 2010), respectively. The test statistics for both the modified Wald test and the Wooldridge test are statistically significant, implying the presence of both heteroscedasticity and serial correlation in the estimations.

3.4.2 Analysis of Estimation Results

Table 3.1 presents the estimation results of the model specified by Equation (3.17) using the Pooled OLS, the FEM, and the REM. The diagnostic tests reveal that the model suffers from heteroscedasticity and serial correlation. This is addressed by clustering the coefficients' standard errors at the country pair level within each observation. The robust standard errors are reported in parentheses in the table. Also, the discussion of the estimation results is based on the FEM following the results of the model specification tests highlighted in the previous section.

Except for the 'BREV' variable, the non-traditional barriers to trade as proxied by the trade facilitation indices are all statistically significant (mostly at the 1% level) and have the expected sign. The estimation results confirm that an improvement in both the hard and soft infrastructure quality in SSA will contribute to a reduction in bilateral trade costs, other things remaining equal. A 10 percent improvement in the physical infrastructure index for an SSA country is expected, on average and holding other factors constant, to decrease bilateral trade costs by 0.80% for all goods, 0.64% for manufactured goods, and 0.91% for agricultural goods.

This confirms the hypothesis of Bougheas, Demetriades, and Morgenroth (1999) that better infrastructure acts as a cost-reducing technology for traders. The larger coefficient for agricultural goods can be explained by the sensitivity of agricultural goods over manufactured goods. Delays in transit time caused by poor physical infrastructure can prove more costly for traders of agricultural goods (Djankov, Freund and Pham 2010; Hummels and Schaur 2012).

The coefficients of 'ICT' and 'BTEF' are approximately the same and exhibit roughly the same pattern when decomposed by type of goods. A 10 percent improvement in the ICT and BTEF indices for SSA is each predicted to lower bilateral trade costs by approximately 1.11%, all else remaining unchanged. This influence is higher for manufactured goods than for agricultural goods in both cases (1.41% as opposed to 0.79% for 'ICT', and 1.44% compared to 0.49% for 'BTEF').

The empirical findings confirm the theoretical hypothesis that because of the complex or differentiated nature of manufactured goods compared to homogeneous agricultural goods, development of a good communication system is paramount (Fink, Mattoo, and Neagu 2005; Tang 2006). A good communication system will contribute to reduce the fixed costs of entry into the global marketplace by making it easier for exporters to acquire relevant information, and help them meet with potential buyers (Freund and Weinhold 2004). An effective cross-border system is also crucial as it reduces trade times. The longer it takes for goods to cross borders, the higher will be the costs of holding inventory in transit and the associated depreciation costs (Hummels 2001).

Table 3.1: Pooled OLS, Panel Fixed and Random Effects Estimates of the Sources of Trade Costs

	Pooled OLS			Panel Fixed Effects			Panel Random Effects		
Variables	*(a)*	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*
Ln PI_{it}	-0.0580***	-0.0540***	-0.0534*	-0.0798***	-0.0640***	-0.0912***	0.00876	-0.00478	0.00172
	(0.0173)	(0.0193)	(0.0276)	(0.0135)	(0.0159)	(0.0260)	(0.00634)	(0.00668)	(0.0119)
Ln ICT_{it}	-0.0743***	-0.0763***	-0.0552**	-0.111***	-0.141***	-0.0795***	-0.0478***	-0.0355***	-0.0378***
	(0.0163)	(0.0182)	(0.0230)	(0.0141)	(0.0169)	(0.0240)	(0.00798)	(0.00846)	(0.0124)
Ln $BREV_{it}$	0.0205	0.0380*	0.0568*	0.0468***	0.0660***	0.0799***	0.0124	0.0217*	0.0250
	(0.0203)	(0.0225)	(0.0296)	(0.0175)	(0.0198)	(0.0303)	(0.00953)	(0.0115)	(0.0153)
Ln $BTEF_{it}$	-0.0625**	-0.125***	-0.00970	-0.114***	-0.144***	-0.0485**	-0.117***	-0.0840***	-0.0514**
	(0.0290)	(0.0321)	(0.0439)	(0.0235)	(0.0275)	(0.0411)	(0.0159)	(0.0179)	(0.0219)
Ln $Tariff_{ijt}$	1.239***	1.374***	0.907***	0.651***	0.977***	0.249**	0.337***	0.402***	0.246**
	(0.169)	(0.187)	(0.250)	(0.144)	(0.164)	(0.260)	(0.0632)	(0.0820)	(0.125)
RTA_{ijt}	-0.323***	-0.308***	-0.220***	-0.401***	-0.367***	-0.338***	-0.159***	-0.138***	-0.192***
	(0.0477)	(0.0476)	(0.0556)	(0.0361)	(0.0375)	(0.0526)	(0.0309)	(0.0281)	(0.0423)
Ln $Distance_{ij}$	0.0482*	0.108***	-0.0110	0.163***	0.182***	-0.00235	0.0832***	0.134***	0.0147
	(0.0254)	(0.0274)	(0.0371)	(0.0346)	(0.0375)	(0.0518)	(0.0268)	(0.0291)	(0.0356)
Common $border_{ij}$	-0.614***	-0.746***	-0.442***	-0.634***	-0.643***	-0.583***	-0.741***	-0.829***	-0.552***
	(0.0965)	(0.125)	(0.145)	(0.0985)	(0.122)	(0.143)	(0.109)	(0.110)	(0.138)
Common $language_{ij}$ (off.)	-0.0519	-0.119***	-0.148***	-0.111***	-0.139***	-0.130**	-0.0402	-0.0904**	-0.0806
	(0.0362)	(0.0395)	(0.0525)	(0.0375)	(0.0439)	(0.0602)	(0.0376)	(0.0405)	(0.0506)
Common $language_{ij}$ (ethno.)	-0.0846**	-0.0136	0.0599	-0.0759**	-0.00722	0.0269	-0.118***	-0.0730*	0.00933
	(0.0362)	(0.0398)	(0.0531)	(0.0328)	(0.0357)	(0.0480)	(0.0384)	(0.0401)	(0.0512)
$Colony_{ij}$	-0.613***	-0.593***	-0.439***	-0.176**	-0.249***	-0.322***	-0.689***	-0.678***	-0.521***
	(0.0534)	(0.0624)	(0.0779)	(0.0897)	(0.0955)	(0.0840)	(0.0653)	(0.0782)	(0.0883)
Common $colonizer_{ij}$	0.0695**	0.0576	0.0686	0.0647	0.112	0.128	0.0554	0.0456	0.104**
	(0.0348)	(0.0357)	(0.0418)	(0.0359)	(0.0380)	(0.0572)	(0.0360)	(0.0372)	(0.0438)
Same $country_{ij}$	0.178	0.329*	0.170	-0.100	-0.191	-0.159	0.128	0.150	0.118
	(0.151)	(0.196)	(0.250)	(0.145)	(0.146)	(0.211)	(0.159)	(0.168)	(0.201)
$Landlocked_{ij}$	0.112**	0.133**	0.215**	0.154***	0.168**	0.224**	0.144***	0.163***	0.199**
	(0.0522)	(0.0585)	(0.0920)	(0.0484)	(0.0607)	(0.0866)	(0.0517)	(0.0542)	(0.0808)
No. of observations	11,662	9,343	5,508	11,662	9,343	5,508	11,662	9,343	5,508
R-squared	0.215	0.219	0.124	0.592	0.575	0.451	0.187	0.184	0.111
Partner dummies				Yes	Yes	Yes			
Year dummies				Yes	Yes	Yes			

Notes: Dependent variables: Columns (a), (d) and (g): Ln Trade $Costs_{ijt}$ (of All Goods); (b), (e), (h): Ln Trade $Costs_{ijt}$ (of Manufactured Goods); and (c), (f), (i): Ln Trade $Costs_{ijt}$ (of Agricultural Goods). Robust standard errors are in parentheses. ***, **, and * denote statistical significance from zero at the 1%, 5% and 10% levels, respectively.

The coefficient for ‘BREV’ is statistically significant at the 1% level, but its sign is different from a priori expectations. The estimation results reveal that a 10 percent improvement in the business regulatory environment is associated with a 0.47% increase in bilateral trade costs for all goods, 0.66% for manufactured goods, and 0.80% for agricultural goods, assuming the other explanatory variables are kept constant. While one would expect a well-functioning business regulatory environment to reduce trade costs, the opposite effect is also possible. This supports the views held by Niru (2014) and Portugal-Perez and Wilson (2012) who argue that the prevalence of corruption may be indicative of a country that accepts bribes in return for overcoming trade barriers such as tariffs, which in turn enhances trade. This is referred to as the trade-enhancing evasion effect as opposed to the trade-impeding extortion effect whereby corruption results in customs officials taking bribes from traders, which eventually impedes trade (Dutt and Traca 2010). The literature suggests that the trade-enhancing evasion effect is more likely to prevail when the level of corruption and tariff protection the country imposes are both high. This finding is supported by the recent study of Worku, Mendoza, and Wielhouwer (2016) who find that the high corruption level prevailing in SSA encourages tariff evasion. Thus, a rise in BREV would imply higher institutional quality and less scope for traders to give bribes to overcome tariff payments. In effect, trade costs would rise.

The results also demonstrate the significance of tariffs in driving up trade costs. The coefficient for the average bilateral tariff is positive and is statistically significant, indicating higher tariff levels add to the cost of trading. Precisely, the estimates show that a 10 percent fall in the average effective applied tariff can decrease bilateral trade costs by 6.51% for all goods, 9.77% for manufactured goods, and 2.49% for agricultural goods, other things being equal. Participation in a form of RTA as suggested by de Sousa (2012) also lowers trade costs between SSA and its trading partners as indicated by the negative sign of its coefficient and its statistical significance at the 1% level. Members of an RTA are not subject to trade barriers and their bilateral trade costs are approximately 28-33%[12] lower than for non-members.

[12] The coefficients for the dummies are converted into elasticity using the formula $exp(\beta) - 1$, where β is the estimated dummy coefficient.

The distance coefficient is also positive for the costs of trading in all goods and the costs of trading in manufactured goods. The sign is negative for trade costs in agricultural goods but is statistically insignificant. It is worth noting that the literature points out that distance has often been used as a proxy for transport costs and other distance-related costs such as communication costs, information costs, and search costs (Berthelon and Freund 2008; Coe, Subramanian, and Tamirisa 2007). The model estimates that a 10 percent increase in geodesic distance translates into a 1.63% rise in bilateral trade costs for trade in all goods, on average. The distance effect is, therefore, larger than the effect of infrastructure quality or border efficiency. However, distance is a natural barrier to trade and is exogenous to policy.

The standard gravity covariates generate coefficients that carry the expected sign and are statistically significant in most cases. In particular, the results confirm the hypothesis that countries sharing a common border, a common official language, and which have once been in a colonial relationship trade at a lower cost compared to those who do not share these features. However, the dummy indicating whether the country dyads were ever part of the same country is statistically insignificant, albeit having the expected sign. Conversely, the dummy representing whether the same power colonised the country pairs has a positive sign, contrary to theoretical predictions. However, the coefficients are statistically insignificant. Lastly, the landlocked dummy has the expected positive sign and is statistically significant, confirming the latter as a natural barrier to trade.

3.4.3 Sources of Intra-African and Extra-African Trade Costs

The model specified in Equation (3.17) is also used to estimate the relative influence of each factor causing the high trade costs within the region (intra-African trade costs) and outside the region (extra-African trade costs). Although regional integration offers a promising route to achieving higher growth, the proportion of trade occurring within SSA remains low at around 15%. An understanding of the causes behind the high intra-regional trade costs, and the region’s low regional integration can help unlock the continent’s potential through subsequent appropriately designed policy measures. To this end, the model is reconsidered with a dataset consisting of only SSA partner countries and, secondly, a dataset involving only partner countries from the rest of the world. Table 3.2 displays the estimation results using the FEM.

Of the four trade facilitation indicators, an improvement in the quality of physical infrastructure is expected to bring the most significant reduction in total trade costs within Africa. A 10% improvement in the 'PI' index has the potential to reduce total trade costs by 1.41% as opposed to 1.21% for 'ICT'. This finding is shared with Geda and Seid (2015), who conclude that weak infrastructure represents an acute export supply constraint which penalises African export trade. The coefficients for the business regulatory environment and border efficiency are, however, not significant for all three categories of intra-African trade costs. This result confirms the findings of the study by Njinkeu, Wilson, and Fosso (2008) that reforms in the customs and regulatory environment do not contribute much to the expansion of intra-African trade.

Regional trade costs can also be significantly reduced from further tariff liberalisation and the formation of trade agreements between SSA countries. A 10% cut in average tariff rates imposed by trading countries has the potential to reduce total trade costs by 8.5%, holding other things constant, while the formation of RTAs can reduce trade costs by around 25%. The empirical results, therefore, lend support to the formation of the ambitious Continental Free Trade Area (CFTA).

Tariff reductions and the formation of RTAs are also important in reducing trade costs when trading outside the region. Of the four trade facilitation indicators, however, improving border and transport efficiency ('BTE') seems to have greater priority for the reduction of extra-African trade costs compared to 'ICT' and 'PI', although the latter is statistically and economically significant. The coefficient for 'BREV' is positive and favours the 'trade-enhancing evasion' hypothesis.

Among the sources exogenous to policy, intra-African trade costs are lower the less distant trading partners are and if they share a common border and a common official language. The same applies to extra-African trade costs, but which are additionally lower if country pairs have been in a colonial relationship, were colonised by the same power, and are not landlocked.

Table 3.2: Sources of Intra-African and Extra-African Trade Costs using Fixed Effects Model (FEM)

	Intra-Africa			Extra-Africa		
Variables	*(a)*	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*
Ln PI_{it}	-0.141**	-0.217**	-0.151	-0.0762***	-0.0613***	-0.0921***
	(0.0682)	(0.0950)	(0.164)	(0.0135)	(0.0159)	(0.0264)
Ln ICT_{it}	-0.121**	-0.107	0.0475	-0.108***	-0.139***	-0.0793***
	(0.0579)	(0.0986)	(0.119)	(0.0146)	(0.0171)	(0.0244)
Ln $BREV_{it}$	0.0400	0.0957	0.0404	0.0543***	0.0697***	0.0857***
	(0.0749)	(0.100)	(0.151)	(0.0178)	(0.0204)	(0.0310)
Ln $BTEF_{it}$	-0.0660	0.0985	0.132	-0.118***	-0.154***	-0.0533
	(0.113)	(0.133)	(0.292)	(0.0235)	(0.0277)	(0.0413)
Ln $Tariff_{ijt}$	0.850**	1.689***	0.953	0.624***	0.943***	0.155
	(0.357)	(0.458)	(0.859)	(0.156)	(0.170)	(0.271)
RTA_{ijt}	-0.292***	-0.305***	-0.300	-0.392***	-0.376***	-0.323***
	(0.105)	(0.107)	(0.190)	(0.0377)	(0.0413)	(0.0581)
Ln $Distance_{ij}$	0.315***	0.238**	0.0357	0.0882**	0.176***	-0.0377
	(0.0904)	(0.0958)	(0.155)	(0.0388)	(0.0442)	(0.0584)
Common $border_{ij}$	-0.608***	-0.669***	-0.587***	-0.177**	na.	-0.00409
	(0.103)	(0.141)	(0.198)	(0.0880)		(0.0722)
Common $language_{ij}$ (off.)	-0.144*	-0.254**	0.0646	-0.110**	-0.111**	-0.179***
	(0.0809)	(0.102)	(0.188)	(0.0438)	(0.0489)	(0.0661)
Common $language_{ij}$ (ethno.)	-0.236	-0.103	-0.213	-0.00854	0.00365	0.0785
	(0.0691)	(0.0867)	(0.166)	(0.0392)	(0.0392)	(0.0520)
$Colony_{ij}$	0.859	0.464	-0.232	-0.281***	-0.293***	-0.317***
	(0.129)	(0.145)	(0.203)	(0.0664)	(0.0966)	(0.0855)
Common $coloniser_{ij}$	0.122	0.141	0.0623	0.0459	0.118***	0.127**
	(0.0922)	(0.115)	(0.190)	(0.0388)	(0.0406)	(0.0605)
Same $country_{ij}$	-0.0196	-0.112	-0.0533	na.	na.	na.
	(0.138)	(0.181)	(0.260)			
$Landlocked_{ij}$	-0.021	0.084	-0.073	0.170***	0.191***	0.311***
	(0.0944)	(0.151)	(0.198)	(0.0536)	(0.0660)	(0.0987)
No. of observations	1,324	560	374	10,338	8,783	5,134
R-squared	0.740	0.770	0.661	0.558	0.540	0.424

Notes: Dependent variables: Columns (a), (d): Ln Trade Costsijt (of All Goods); (b), (e): Ln Trade Costsijt (of Manufactured Goods); and (c), (f): Ln Trade Costsijt (of Agricultural Goods). Robust SEs are in parentheses. ***, **, and * denote statistical significance from zero at the 1%, 5% and 10% levels, respectively.

3.5 Conclusion

Sub-Saharan Africa's marginalisation in world trade is inextricably linked to the prevalence of high trade costs facing traders. While different sources of these high trade costs have been cited in the literature, there have been few empirical studies of the relative influence of each factor on total trade costs, particularly in the context of SSA. The present study provides a unified approach to the understanding of which endogenous and exogenous factors are behind the continent's high trade costs to guide policymakers' efforts to increase regional and global integration.

A bilateral trade cost equation is estimated using a panel dataset consisting of 20 SSA countries over the period 2004 to 2012. After controlling for partner-year fixed effects and year fixed effects, the empirical results show that an improvement in SSA's border and transport efficiency by streamlining customs procedures and cutting red tape will have the most substantial influence in reducing extra-African trade costs. Improvement in ICT and physical infrastructure will also, in turn, reduce extra-African trade costs. In regards to intra-African trade costs, the opposite is observed; improvements in physical infrastructure are expected to reduce trade costs by a larger extent than improvements in ICT. However, the coefficient for border efficiency is not statistically significant implying that border efficiency may not be an obstacle for regional trade in SSA.

In regards to the business regulatory environment, which includes measures of transparency, regulations, and corruption, a statistically significant positive relationship is noted with extra-African trade costs. This indicates that an improvement in the business regulatory environment (fall in corruption) in SSA is expected to increase trade costs, and reduce trade flows with the rest of the world. This unusual finding is theoretically explained by the presence of high tariff levels imposed by the importing country such that traders seek to offer bribes to corrupted customs officials to evade tariff payments (Dutt and Traca 2010). However, with a fall in corruption levels, traders would be subject to tariff payments that add to their costs. This hypothesis is supported by the relatively high impact of average tariff on overall bilateral trade costs. Policy-wise, the findings suggest that SSA should complement efforts to reduce corruption with tariff reductions to reverse the trade-enhancing evasion effect. Increased participation in regional trading agreements would also work towards that end as member countries are not subject to tariff or other non-tariff barriers.

The model also indicates the presence of exogenous factors, related to geography that explain the variation in bilateral trade costs SSA faces. Being landlocked and located far from each other raises trade costs between the trading partners that are due to the higher costs of transportation. Since these are natural trade barriers, intervention by the government as a facilitator is limited to the fostering of competition in the transport sector to reduce costs. Sharing a common land border, being colonised by the same power, and using a common official language also lowers bilateral trade costs between trading partners.

On a concluding note, the findings of this chapter demonstrate that trade facilitation combined with further trade liberalisation is necessary to dampen the steep trade costs SSA faces. It, therefore, implies that SSA stands to benefit significantly from the recently concluded Trade Facilitation Agreement (TFA)[13]. However, the reduction of trade costs demands financial resources, which are limited in SSA because of its high debt history. In this context, the trade community has called for increased financial and technical assistance to be given to the developing countries under the Doha Round and, consequently, the Aid for Trade (AfT) initiative was launched at the Hong Kong WTO Ministerial Conference in December 2005. Sub-Saharan Africa has registered significant growth in AfT flows since the 2002 to 2005 baseline average and is now, after Asia, the second largest recipient among the different regions. However, there is a paucity of quantitative evidence regarding the effectiveness of AfT in achieving its objectives, particularly in reducing trade costs and promoting export diversification in SSA. Subsequent chapters of the thesis fill this gap in knowledge.

[13] "The TFA contains provisions for expediting the movement, release and clearance of goods, including goods in transit. It also sets out measures for effective cooperation between customs and other appropriate authorities on trade facilitation and customs compliance issues. It further contains provisions for technical assistance, and capacity building in this area. The agreement will help improve transparency, increase possibilities to participate in global value chains, and reduce the scope for corruption." (WTO 2016)

CHAPTER 4

AID FOR TRADE AND TRADE COSTS

4.1 Introduction

During the past two decades, tariff barriers have declined following successive rounds of multilateral negotiations led by the WTO and the growing number of Regional Trade Agreements (RTAs). Despite having increased market access, developing countries, especially the poorest and smallest ones, have not been able to reap the benefits of the negotiations or the agreements (Razzaque and te Velde 2013). This can be largely attributed to the weak supply response of those countries following trade liberalisation, among other reasons because of their weak infrastructure, lack of expertise regarding product development, and excessive red tape over border procedures (Ferro, Portugal-Perez, and Wilson 2014).

The trade community, therefore, called for increased financial and technical assistance to be given to the developing countries under the Doha Round and, consequently, the Aid for Trade (AfT) initiative was launched at the Hong Kong WTO Ministerial Conference in December 2005. Its main purpose is to help developing countries, particularly the most vulnerable ones, integrate with the global economy by addressing trade policy regulations, and infrastructure-constraints and capacity-related constraints that often result in exorbitant trade costs. High trade costs make countries' exports uncompetitive, prevent them from exploiting their comparative advantages and restrict firms' ability to move up the global value chain (OECD/WTO 2015).

While many countries managed to reduce trade costs to varying degrees, SSA is still lagging behind and continues to be marginalised in world trade (Hoekman and Nicita 2011; Portugal-Perez and Wilson 2009). However, SSA has registered significant growth in AfT flows and is the second largest recipient after Asia. The bulk of AfT flows go towards financing economic infrastructure projects in the recipient countries and to building their productive capacity. A comparatively smaller proportion of AfT financing goes towards trade policy regulations that include aid for trade facilitation.

Given the significance of AfT finance and its role in reducing trade costs, it is worthwhile assessing its effectiveness and to examine what type of AfT works and what does not. This is of great interest to policymakers, and particularly the donor community, at a time when they are facing pressure to cut back on foreign aid to meet their own needs (Hallaert 2013). However, very few studies have been done to examine the effectiveness of AfT in reducing trade costs, notably in SSA (Calì and te Velde 2011). In addition, the literature is also inconclusive with regards to what makes AfT more effective in helping developing countries increase their participation in the global trade system[14].

The objective of this study is, therefore, to conduct an empirical assessment of the impact of AfT flows received by SSA countries on bilateral trade costs. The present work progresses the few existing studies in two main respects. Firstly, the data and methodology employed to conduct the analysis is more robust. In particular, the newly available comprehensive micro-founded measure of trade costs of Novy (2013) and a more refined AfT data using the methodology of Hühne, Meyer, and Nunnemkamp (2014b) are used as dependent and independent variables, respectively. The study also controls for a larger number of trade cost determinants in the regression equation to minimise the risk of omitted variable bias. Secondly, this is one of the first attempts to analyse the effect of different types of AfT flows on bilateral trade costs between SSA recipient countries and their trading partners. It also distinguishes between intra-African and extra-African trade costs to assess which type of AfT is working to reduce the costs of trading within SSA and with the rest of the world.

The remainder of the chapter is organised as follows. Section 4.2 reviews the theoretical and empirical literature on the causal link between AfT and trade costs. In Section 4.3, the econometric methodology and the sources of data are described. The estimation results, discussions, and the robustness checks of the findings are presented in Section 4.4. Section 4.5 concludes with some policy implications.

[14] See Cadot et al. (2014) for a survey of the literature.

4.2 Literature Review

4.2.1 Theoretical Link between AfT and Trade Costs

The AfT initiative was set up to address trade policy regulations, and infrastructure-constraints and capacity-related constraints that often result in exorbitant trade costs. Thus, a negative relationship between AfT and trade costs can be hypothesised. Calì and te Velde (2011) modified the trade cost function employed in Bouet, Mishra, and Roy (2008) to establish the link between AfT and trade costs. In particular, they specify the trade cost function as follows:

$$\tau_{ij} = \frac{(1+t_{ij})b_i(A_{TF})b_j d_{ij}}{(A_{INF}+I_D)_i + I_j} \quad (4.1)$$

where, τ_{ij} represents bilateral trade costs between domestic (exporting) country *i* and foreign (importing) country *j*, which includes different types of trade costs: t_{ij}, the bilateral import tariff applied by country *j* on exports from country *i*; b_i and b_j, represent administrative and legal barriers in country *i* and *j*; d_{ij}, distance between trading partners, and the inverse of the level of economic infrastructure in country *i* and *j* denoted by $(A_{INF}+I_D)_i$ and I_j, respectively.

They conjecture that aid for trade facilitation (A_{TF}) in country *i* will reduce the time and costs of processing trade and is negatively related to b_i. In addition, trade costs are assumed to vary inversely with the level of economic infrastructure, and the latter is expressed as the sum of aid to economic infrastructure (A_{INF}) and domestically-financed infrastructure (I_D) in the domestic country *i*. Thus, a rise in either A_{INF} or A_{TF} is hypothesised to reduce trade costs.

Cadot and de Melo (2014) also confirm the channels of intended impacts of AfT on trade costs. They argue that aid for economic infrastructure is expected to reduce logistics and communication costs caused by poor physical and ICT infrastructure, while aid for trade policy and regulations and other trade-related adjustment is anticipated to simplify border-related policies and reduce border-related costs such as customs administration. Aid for productive capacity building, an AfT category overlooked by Calì and te Velde (2011), can also reduce trade costs, particularly the behind-the-border costs, by creating a favourable business environment and improving the efficiency of institutions.

An important concern when examining the link between AfT and trade costs is that of reverse causality. In particular, more AfT may go towards countries that need it the most, i.e. where trade costs are high. Gamberoni and Newfarmer (2014) constructed a trade-related capacity indicator that is inversely proportional to trade costs emanating from inadequate infrastructure, weak institutions and trade-inhibiting policies, and analysed whether it is a factor driving the allocation of AfT. Controlling for other factors, they find support for their hypothesis that countries with the worse infrastructure and institutions, and thus the highest trade costs, obtain higher AfT.

Other studies (e.g., Burnside and Dollar 2000; Collier and Dollar 2002; Lee, Park, and Shin 2015) find that countries with higher institutional quality, as opposed to countries where political corruption is high, and aid money gets wasted, receive more development aid as they can use it more effectively. If poor institutions, which contribute to high behind-the-border trade costs (Francois and Manchin 2013), results in countries receiving less AfT finance, the reverse causality relationship may also be negative. In either case, not accounting for possible reverse causality in the current empirical study would result in simultaneity bias.

4.2.2 Empirical Literature

The main objective of AfT funding is to reduce trade costs, and to help countries achieve a better export performance. A survey of the literature by Cadot et al. (2014) reveals, however, that there is scant empirical evidence of the effectiveness of AfT in achieving its targeted outcomes. Most of the existing studies focus on the impact of AfT in boosting export performance, as proxied by aggregate export values or bilateral exports (see for example, Brazys 2013; Calì and te Velde 2011; Ferro, Portugal-Perez, and Wilson 2014; Helbe, Mann and Wilson 2012; Huhne, Meyer and Nunnenkamp 2014a; 2014b; Pettersson and Johansson 2013). These studies are not reviewed here as the aim of the present study is to consider the impact of AfT on trade costs. Nonetheless, it is worth mentioning that the evidence of the impact of AfT on export outcomes has been mixed, despite attempts to control for estimation problems such as omitted variable bias and reverse causality. The empirical evidence varies by type of AfT, the geographical area being studied, the direction of the exports (i.e., is it from recipients to donors or between recipients), and the way AfT programs are designed and implemented by donors.

Relatively little work has been done to assess the effectiveness of AfT in reducing trade costs faced by recipient countries. The paucity of empirical evidence can be explained by the difficulty to measure trade costs comprehensively, given its multi-dimensional nature. Direct measures of trade costs, e.g. transport costs, are scarce and, if available, they have limited country and time coverage. Furthermore, they are not all-inclusive as they capture only a fraction of overall trade costs (Chen and Novy 2011). Researchers dealing with trade costs have mostly relied on proxy indicators.

The study by Calì and te Velde (2011) is one of the first attempts to fill this gap in the literature by analysing the impact of aid for trade policy and regulation, and its sub-component, aid for trade facilitation, on the cost of exports and imports using a sample of 130 developing countries over the period 2005 to 2009. They obtain mixed findings from their analysis; a 100% increase in aid for trade facilitation decreases the cost of trade (export and import) by 5% and unconvincing results for aid for trade policy and regulation. However, when the sample is restricted to SSA, the coefficients are larger in magnitude and are statistically significant. Using a similar approach, applied to a panel dataset of 100 developing countries over the period 2004 to 2009, Busse, Hoekstra, and Königer (2012) find that both aid for trade policy and its sub-component, trade facilitation, serve to reduce the cost of exporting and importing. However, the trade cost reducing effect of aid for trade facilitation is relatively larger.

These two studies share a similar methodology - both used a fixed effects estimation approach, controlling for time-specific and country-specific effects with relevant dummies along with other factors deemed to influence trade costs such as income, population, and regulatory quality. However, not all of these control variables are found to be statistically significant. Also, both studies employ the ‘cost of exporting and importing a standardised container by sea’ from the World Bank’s Doing Business database as the dependent variable. However, as critiqued by Sourdin and Pomfret

(2012), such measures are not actual trade costs, i.e. they are not trading costs incurred by traders but are estimates made by consultants based on surveys. Thus, empirical estimates obtained based on such measures of trade costs may not be precise.

In both papers, the authors also estimated the impact of AfT using an alternative proxy for trade costs – the time to export and import, as measured by the number of days required to comply with all import and export procedures. The latter is expected to be positively correlated with border-related trade costs such as complex customs and port procedures. However, Busse, Hoekstra, and Königer (2012) do not obtain statistically significant results in their regression on the impact of AfT (and its sub-types) on time to export or import. Calì and te Velde (2011) find that aid for trade facilitation reduces the time to import by a magnitude similar to their export/import cost proxy, but aid for trade policy and regulation seems to exert an insignificant effect on this variable.

The conflicting results obtained by previous studies can be explained by the reliability and adequacy of the trade cost proxies used to measure the impact of AfT that may not capture all costs incurred in providing the good to the final user. The export/import cost used includes only border-related costs, e.g. documentation costs, administrative fees associated with clearing customs procedures, and inland transport costs. It ignores costs associated with language barriers between trading countries, poor communication systems, and inefficiencies related to the sea or air transport infrastructure. This may explain why the inclusion of aid for economic infrastructure in the estimating equation of Calì and te Velde (2011) yields an insignificant result on their measure of trade cost despite such aid representing a sizable proportion (around 63%) of total AfT (Cadot et al. 2014). Also, the empirical results may have been driven by the lack of variation in their dependent variable because of a small time series employed in their panel dataset and the slow-changing nature of trade costs in general.

To improve upon these existing studies, the theoretically founded comprehensive measure of trade costs developed by Novy (2013) is used in the present investigation of the impact of different types of AfT. A study that comes close to the present work is that of Tadesse, Shukralla, and Fayissa (2017). They also employed Novy's (2013) comprehensive measure of ad valorem tariff equivalent bilateral trade costs as the dependent variable in their multilevel mixed-effects model to assess the impact of AfT.

Using a panel dataset consisting of 123 AfT recipient countries spanning the period 2002 to 2010, they find that a 10% increase in aggregate AfT reduces total bilateral trade costs by 0.249%, after controlling for the standard gravity covariates such as distance, common language, common border, and whether the country is landlocked. Tadesse, Shukralla, and Fayissa also decomposed AfT flows into those originating from bilateral sources and multilateral sources, and included an interaction term to test the possible complementary effect the latter has in determining the reduction of trade costs. They conclude that AfT serves best to reduce trade costs in recipient countries where there is proper coordination between bilateral and multilateral AfT flows.

However, their work does not distinguish between different categories of AfT and does not suggest which type of AfT is working or is more effective in reducing trade costs of recipient countries. The present study fills this gap in knowledge in the SSA context. As well, use of a more refined AfT dataset computed using the methodology of Hühne, Meyer, and Nunnemkamp (2014b) is made. Although the AfT initiative was formalised at the Hong Kong WTO Ministerial Conference in December 2005, AfT flows have a longer history in the form of development assistance provided to traders. However, good coverage of AfT disbursements data in the OECD-CRS database is only available from 2002 (Kim 2017).

Notwithstanding, the methodology proposed by Hühne, Meyer, and Nunnemkamp (2014b) allows researchers to trace AfT flows back in the 1990s (Lee and Ries 2016). Also, the present study focuses on the specific case of SSA, distinguishing between the impact of AfT on intra-SSA trade costs and extra-SSA trade costs. The findings of this study are therefore worthwhile for African policymakers given their aim is to unlock the continent's potential by promoting both regional and global integration. A knowledge of which type of AfT may be more effective in reducing trade costs will help them to prioritise the use of aid funds.

4.3 Methodology and Data

A fixed effects regression framework similar to that used by Ali and Milner (2016), Milner and McGowan (2013), and Miroudot and Shepherd (2014) is first specified:

$$(4.2) \qquad \ln TC_{ijt} = \beta_0 + \beta_1 \ln AfT_{it-1} + \gamma_{ij} + \lambda_t + \varepsilon_{ijt}$$

where TC_{ijt} is bilateral trade costs faced by the SSA aid-recipient country *i* with partner *j* at time *t*. AfT_{it-1} is the aggregate aid for trade flows received by SSA country *i* from all donor countries lagged by one period. The *AfT* variable could be aggregate aid for trade (AfT^{total}) or *AfT* components, such as aid for economic infrastructure (AfT^{INF}), aid for productive capacity (AfT^{PC}), or aid for trade policy and regulations and trade-related adjustment (AfT^{TPR}). In line with previous studies, lagged values of AfT are used to mitigate the possible endogeneity bias caused by reverse causality between AfT and trade costs, and to account for the possible lagged effect of AfT on trade costs. γ_{ij} is a country-pair fixed effects term to control for time-invariant variables related to geography, and cultural and historical ties that are not included in the specification but which influences bilateral trade costs as the gravity literature suggests. λ_t is a time fixed effects term included to control for time-specific factors, and ε_{ijt} is assumed to be a stochastic *i.i.d.* error term. The coefficient of interest is β_1 and is expected to be negative in sign.

One issue with estimating the equation above using natural logarithms concerns the loss of observations with zero AfT flows. While some researchers add one to the AfT value before converting into a natural logarithm, this method is not recommended as it is sensitive to the unit of measurement. Since AfT flows are measured in millions of USD, adding one where zero values are present is not immaterial and would bias the analysis. Thus, the approach adopted by Calì and te Velde (2011), and Lee and Ries (2016) is followed to adjust the aid variable as follows:

$$(4.3) \qquad \beta_1 \ln AfT_{it-1} = \beta_{11} \ln \max\left(1, AfT_{it-1}\right) + \beta_{12} NAfT_{it-1}$$

where NAfT is a no-aid dummy, which takes the value of 1 when AfT = 0 and zero otherwise. Hence, β_{11} measures the elasticity of trade cost when AfT is positive and

β_{12} acts as an adjustment factor to the intercept β_0 in Equation (4.2) when AfT is zero. In this way, the data is allowed to determine how to handle cases of zero AfT values.

Data on the dependent variable, bilateral trade costs, is obtained from the ESCAP-WB database compiled by Arvis et al. (2013) based on Novy's (2013) methodology. Such data is available in ad valorem tariff equivalent form for both the agricultural and manufacturing sectors, and total trade in goods. AfT is a subset of general aid and is thus generally sourced from the OECD International Development Statistics (IDS) database, which contains data on Official Development Assistance (ODA) provided by Development Assistance Committee (DAC) members. Under the IDS, the Creditor Reporting System (CRS) reports detailed sector-specific aid data while the DAC statistics provide aggregate figures on the different types of aid. The methodology of Hühne, Meyer, and Nunnemkamp (2014b) is used to calculate AfT by sector *s* for recipient *i*, aggregating over all donors *j*, at time *t* as follows:

$$(4.4) \qquad Aft_{sit} = \sum_j aft_{sjit}^{com\,CRS} \frac{aid_{jit}^{disb\,DAC}}{\sum_s aid_{sjit}^{com\,CRS}}$$

$aft_{sjit}^{com\,CRS}$ represents sectoral AfT commitments obtained from the CRS database, while $aid_{jit}^{disb\,DAC}$ is aggregate aid disbursements reported by the DAC statistics. $aid_{sjit}^{com\,CRS}$ takes aid commitments aggregated by sector from the CRS database. All aid data are reported in million USD measured at current prices.

To adequately capture the five classes of AfT identified by the WTO Task Force, the OECD uses three proxies: aid for *building productive capacity*, aid for *economic infrastructure*, and aid for *trade policy and regulations and trade-related adjustment (including trade facilitation).* To apply Equation (4.3), aid data on those three sectors have been collected from the OECD-IDS database and combined accordingly. Such an approach is deemed to generate sector-specific disbursements of AfT data that corrects for both a potential upward and downward bias in the raw data. A potential upward bias may occur as aid commitments tend to be higher than the actual aid disbursed while the downward bias follows from the possible under-reporting of project-based aid disbursed in the CRS. This methodology also enables a more extensive coverage of developing countries and time periods compared to the raw AfT data on disbursements from the CRS which begins from 2002 (Lee and Ries 2016). The dataset used in the study is an unbalanced panel of 47 SSA countries spanning the period 1995 to 2014. Table A4.1 of the Appendix shows the list of SSA countries used in the sample. Summary statistics of the two main variables and their sub-components identified in Equation (4.2) are presented in Table A4.2 of the Appendix.

4.4 Empirical Results and Discussions

4.4.1 Baseline Estimation

Table 4.1 presents the results obtained by estimating the baseline trade cost equation specified by Equation (4.2) using a fixed effects model, which is favoured by the Hausman test over a random effects model (see Table A4.3 of the Appendix for the results of the diagnostic tests performed).

In most of the specifications, AfT is found to exert a statistically (at the 1% level) negative effect on the costs of trading faced by SSA recipient countries with their trading partners. Given the double logarithmic nature of the model, the coefficients can be interpreted in elasticities. A 10% rise in AfT^{total}_{t-1} is estimated to reduce total bilateral trade costs by 0.11%, other things remaining equal. It is also found that the trade cost reducing effect of AfT is stronger in the case of agricultural goods (0.20%) than for manufactured goods (0.09%).

Table 4.1: AfT flows and Bilateral Trade Costs: Baseline Regression Results

	Dependent Variable: Log of Bilateral Trade Costs					
	Total Trade in goods		*Manufactured goods*		*Agricultural goods*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Ln AfT^{total}_{t-1}	-0.011***		-0.009***		-0.020***	
	(0.002)		(0.003)		(0.004)	
Ln AfT^{TPR}_{t-1}		-0.017***		-0.018***		-0.010**
		(0.003)		(0.004)		(0.004)
Ln AfT^{INF}_{t-1}		-0.009***		-0.006***		-0.016***
		(0.002)		(0.002)		(0.002)
Ln AfT^{PC}_{t-1}		-0.008***		-0.009***		-0.005
		(0.002)		(0.003)		(0.004)
Observations	48,921	48,921	40,301	40,301	20,316	20,316
Number of country pairs	4,335	4,335	3,795	3,795	2,011	2,011
R-squared	0.833	0.834	0.823	0.823	0.804	0.805

Notes:
(a) All regressions include fixed effects by country-pair and by year, and are mostly significant.
(b) The models include non-AfT dummies to deal with zero AfT flows, but the coefficients are not reported as they are not of direct interest.
(c) Robust standard errors (in parentheses) clustered by country-pair to correct for heteroscedasticity and auto-correlation (see Table 4.3A of the Appendix for the diagnostic tests).
(d) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

When decomposed by sub-components, aid for trade policy and regulations is estimated to have a larger negative effect on bilateral trade costs than aid for economic infrastructure and aid for productive capacity. A 10% rise in AfT^{TPR}_{t-1} decreases trade costs by 0.17%, while a 0.09% and 0.08% reduction in trade costs is observed following a 10% increase in AfT^{INF}_{t-1} and AfT^{PC}_{t-1}, respectively. A similar sector-wise pattern is observed, except for agricultural bilateral trade costs where aid for economic infrastructure is estimated to have a dominant effect relative to aid for trade policy and regulations – 0.16% compared to 0.10%, other things equal. It is also observed that the aid for productive capacity coefficient is not statistically significant in this category.

Table 4.2: Aid for Trade Facilitation and Bilateral Trade Costs

	Dependent Variable: Log of Bilateral Trade Costs		
	Total Trade in goods	*Manufactured goods*	*Agricultural goods*
	(1)	*(2)*	*(3)*
Ln AfT^{TF}_{t-1}	-0.041***	-0.055***	-0.033***
	(0.005)	(0.007)	(0.009)
Ln AfT^{TPR}_{t-1} *excluding trade facilitation*	-0.004	-0.006*	-0.004
	(0.003)	(0.003)	(0.004)
Ln AfT^{INF}_{t-1}	-0.009***	-0.006***	-0.016***
	(0.002)	(0.002)	(0.002)
Ln AfT^{PC}_{t-1}	-0.008***	-0.009***	-0.005
	(0.002)	(0.003)	(0.004)
Observations	48,921	40,301	20,316
Number of country pairs	4,335	3,795	2,011
R-squared	0.834	0.824	0.805

Notes:

(a) All regressions include fixed effects by country-pair and by year, and are mostly significant.
(b) The models include non-AfT dummies to deal with zero AfT flows, but the coefficients are not reported as they are not of direct interest.
(c) Robust standard errors (in parentheses) clustered by country-pair to correct for heteroscedasticity and auto-correlation (see Table 4.3A of the Appendix for the diagnostic tests).
(d) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

In line with previous studies, the estimation is also run by including a narrower sub-component of aid for trade policy and regulations – aid for trade facilitation (AfT^{TF}_{t-1}), to examine its effectiveness in reducing trade costs. The results are reported in Table 4.2.

The estimation results confirm the findings of Calì and te Velde (2011); aid for trade facilitation seems to be driving the results of aid for trade policy and regulations. The coefficients for AfT^{TPR}_{t-1}, *excluding trade facilitation*, become insignificant (except for costs of trading in manufactured goods) once AfT^{TF}_{t-1} is inserted in the specifications. A 10% rise in AfT^{TF}_{t-1} contributes to a 0.41% reduction in total bilateral trade costs. This effect is stronger when restricted to trade in manufactured goods (0.55%) compared to agricultural goods (0.33%).

4.4.2 Robustness Checks

A series of robustness checks on the baseline estimation results are undertaken to verify their validity.

4.4.2.1 Using Extended Lagged Values of AfT

Firstly, the delayed effects of AfT on trade costs are checked by allowing for longer lags of the AfT variable and its sub-components. Since some of the AfT categories can take several years to be operative, e.g. aid for economic infrastructure and productive capacity, assessing its effect on trade costs over a one-year time lag only, may mask any possible delayed impacts. Also, the use of extended lags of the AfT variable can help to mitigate endogeneity concerns arising from reverse causality between the variables of interest.

Table 4.3 presents the results of using up to five lags of the AFT variable in the baseline model. Many of the coefficients carry the expected negative sign, with the exception of aid for trade policy and regulations when the effect of its sub-component, aid for trade facilitation, is measured separately. In addition, aid for trade facilitation continues to exert a stronger trade cost reducing effect than the other AfT categories, at least for the short term. The use of AfT^{TF} lagged by three or more years generates mostly statistically insignificant coefficients. These findings, therefore, support the claim often made by proponents of trade facilitation that the latter, defined narrowly in terms of the simplification and harmonisation of trade procedures, can improve trade outcomes faster and at a cheaper cost than improvements in hard infrastructure (see for example, Felipe and Kumar 2012).

The other two categories of aid for trade, AfT^{INF} and AfT^{PC} seem to contribute to a reduction in trade costs in the medium to long term. Indeed, investments in infrastructure and productive capacity take time to reduce the cost of trading. Although these investments require large sums of aid money, their impact is lower than aid for trade facilitation. A 10% rise in AfT^{INF} and AfT^{PC} contributes to a 0.05% and 0.08% reduction, respectively, in trade costs relating to total trade in goods. Contrary to the baseline results, AfT^{PC} is found to exert a statistically significant trade cost reducing effect even for trade in agricultural goods after a time lag of four years.

Table 4.3: Regression Results Using Extended Lagged Values of the AfT variable

	Dependent Variable: Log of Bilateral Trade Costs											
	Total Trade in Goods				*Manufacturing Goods*				*Agricultural Goods*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	t-2	t-3	t-4	t-5	t-2	t-3	t-4	t-5	t-2	t-3	t-4	t-5
Ln AfT^{TF}	-0.038***	0.011	-0.005	0.034	-0.044***	0.024	0.023	0.303***	-0.041***	0.008	-0.053	-0.089
	(0.007)	(0.014)	(0.022)	(0.102)	(0.008)	(0.018)	(0.027)	(0.105)	(0.012)	(0.021)	(0.037)	(0.173)
Ln AfT^{TPR} *excluding TF*	-0.012***	-0.003	0.005	-0.000	-0.020***	-0.008**	0.010**	-0.001	0.000	0.007	0.001	-0.008
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Ln AfT^{INF}	-0.002	-0.001	0.002	-0.005***	-0.003*	-0.004**	-0.009***	-0.004**	-0.011***	-0.010***	-0.007***	-0.007***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Ln AfT^{PC}	-0.011***	-0.011***	-0.008***	-0.008***	-0.008***	-0.011***	-0.010***	-0.001	-0.011	-0.014	-0.011***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	47,635	46,007	44,205	42,248	39,259	37,922	36,431	34,798	19,796	19,093	18,320	17,471
R-squared	0.837	0.841	0.845	0.850	0.827	0.832	0.837	0.843	0.808	0.814	0.818	0.822

Notes:

(a) All regressions include fixed effects by country-pair and by year, and are mostly significant.

(b) Robust standard errors, clustered by country-pair, in parentheses.

(c) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

4.4.2.2 Alternative Specification of the Model

As a further robustness check of the empirical results, the specification of the baseline estimating equation is altered to include a set of variables, in addition to the AfT variable, to capture the different dimensions of trade costs. These include proxy variables to capture the quality of infrastructure and institutions prevailing in SSA, trade policy, participation in RTAs, the distance between trading countries, and a set of dummies usually included in a gravity specification to control for cultural and historical factors that are common to a country-pair but do not vary over time. Full details of these additional covariates were presented in Chapter 3.

The motivation of this alternative specification is that the exclusion of these variables from the estimating equation can result in an omitted variable bias, thereby producing inconsistent results. Such covariates are correlated with both the variable of interest, i.e. AfT flows, and the dependent variable, bilateral trade costs, captured by the theoretical trade cost function of Bouet, Mishra, and Roy (2008) and later modified by Calì and te Velde (2011). For the same reason mentioned above, the estimation of Equation (4.5) below also serves as a robustness check of the empirical evidence about the sources of SSA's trade costs.

$$\begin{aligned}(4.5)\qquad \ln TC_{ijt} = {} & \beta_0 + \beta_1 \ln AfT_{it-1} + \beta_2 \ln PI_{it} + \beta_3 \ln ICT_{it} + \beta_4 \ln BTEF_{it} \\ & + \beta_5 \ln BREV_{it} + \beta_6 \ln TARIFF_{ijt} + \beta_7 RTA_{ijt} + \beta_8 \ln DIST_{ij} \\ & + \beta_{9-15} Gravity\ Dummies_{ij} + \mu_{jt} + \lambda_t + \varepsilon_{ijt}\end{aligned}$$

Since some of these covariates are country-pair specific, particularly the gravity-dummy variables, dyadic fixed effects are removed from Equation (4.1) to avoid multicollinearity. Instead, since the focus of the analysis is on SSA-specific factors influencing bilateral trade costs, partner-country year fixed effects (μ_{jt}) are used. The time effects λ_t continue to control for any systematic factors affecting all trading countries each year such as changes in fuel prices. The inclusion of the four trade facilitation indicators, however, reduces the sample size to only 20 SSA countries with data spanning the period 2004 to 2012.

The results are reported in Table 4.4. It is noteworthy that direct comparisons of the size of the estimated coefficients from Equation (4.5) should not be made with the baseline results since the number of observations has decreased. The information of interest to check the sensitivity of the results is the sign and statistical significance of the AfT variables, in particular, and the relative magnitude of the coefficients across AfT components in this sample. The sign and size of the remaining coefficients can be compared, however, with those reported in Table 3.1 of Chapter 3 using the fixed effects model as they share the same dataset.

From Table 4.4, it is observed that the coefficients of the variable of interest (AfT) remain statistically significant (except aid for trade policy and regulations, excluding trade facilitation) and are negative in sign. This lends support to the theoretical hypothesis that AfT reduces trade costs of recipient countries. On an aggregate level, a 10% rise in AfT^{total}_{t-1} is associated with a 0.73% reduction in total bilateral trade costs, other things remaining equal. On a sectoral level, the corresponding effects are estimated at 0.70% and 0.79% reduction in the cost of trading with partner countries in manufactured and agricultural goods, respectively. The disaggregated AfT variables mostly confirm the robustness of the results. Aid for trade facilitation is associated with a larger trade cost reducing effect than aid for economic infrastructure in the context of total trade and trade in agricultural goods. The coefficients for aid for productive capacity also have the expected negative sign and are statistically significant. An exception is noted, however, with the coefficient of aid for trade facilitation in the case of manufacturing goods being positive and statistically significant at the 1% level.

The coefficients of *PI*, *ICT,* and *BTEF* are negative and statistically significant, reinforcing the importance of physical and communications infrastructure, border and transport efficiency as determinants of trade costs. However, the size of the coefficients is smaller than the estimates obtained before (see Table 3.1 of Chapter 3). This is expected with the introduction of the AfT variable, which diminishes some of the effects of these soft and hard infrastructure variables on trade costs on account of their inter-correlated relationship specified in Equation (4.1). The coefficient of *BREV*, which is a proxy for the business regulatory environment, remains positive but loses statistical significance.

The other trade cost determinants are statistically significant in the majority of the cases. Lower tariff rates, participation in RTA, sharing a common border and a common language, reduce trade costs. Being landlocked and geographically distant from each other also increases trade costs.

Table 4.4: Regression Results with the Inclusion of Trade Cost Determinants

	Dependent Variable: Log of Bilateral Trade Costs					
	Total Trade in Goods		*Manufacturing Goods*		*Agricultural Goods*	
Independent Variables:	(1)	(2)	(3)	(4)	(5)	(6)
Ln AfT^{total}_{t-1}	-0.073***		-0.070***		-0.079***	
	(0.006)		(0.006)		(0.010)	
Ln AfT^{TF}_{t-1}		-0.035*		0.076***		-0.048**
		(0.018)		(0.021)		(0.031)
Ln $AfT^{TPR}_{t-1\ excluding\ TF}$		0.005		0.014**		-0.001
		(0.005)		(0.006)		(0.008)
Ln AfT^{INF}_{t-1}		-0.012***		-0.016***		-0.013*
		(0.004)		(0.004)		(0.007)
Ln AfT^{PC}_{t-1}		-0.066***		-0.036***		-0.100***
		(0.007)		(0.008)		(0.011)
Ln PI_{it}	-0.054***	-0.049***	-0.037***	-0.040***	-0.076***	-0.059**
	(0.013)	(0.012)	(0.014)	(0.014)	(0.025)	(0.025)
Ln ICT_{it}	-0.094***	-0.102***	-0.133***	-0.124***	-0.070***	-0.101***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.023)	(0.023)
Ln $BREV_{it}$	0.008	0.012	0.015	0.015	0.060	0.067
	(0.015)	(0.015)	(0.018)	(0.017)	(0.028)	(0.027)
Ln $BTEF_{it}$	-0.103***	-0.104***	-0.105***	-0.091***	-0.035**	-0.047**
	(0.021)	(0.021)	(0.027)	(0.025)	(0.041)	(0.039)
Ln $Tariff_{ijt}$	0.762***	0.737***	1.047***	1.017***	0.384***	0.342***
	(0.137)	(0.136)	(0.153)	(0.154)	(0.245)	(0.244)
RTA_{ijt}	-0.408***	-0.399***	-0.364***	-0.342***	-0.335***	-0.337***
	(0.033)	(0.033)	(0.036)	(0.036)	(0.054)	(0.055)
Ln $Distance_{ij}$	0.152***	0.155***	0.215***	0.223***	0.022	0.029
	(0.032)	(0.032)	(0.038)	(0.038)	(0.053)	(0.053)
Common $border_{ij}$	-0.656***	-0.663***	-0.652***	-0.648***	-0.661***	-0.673***
	(0.097)	(0.096)	(0.120)	(0.118)	(0.148)	(0.147)
Common $language_{ij}$ (off.)	-0.080**	-0.082**	-0.111**	-0.113***	-0.113*	-0.118*
	(0.034)	(0.034)	(0.044)	(0.042)	(0.062)	(0.062)
Common $language_{ij}$ (ethno.)	-0.154***	-0.152***	-0.108***	-0.104***	-0.073	-0.072
	(0.031)	(0.031)	(0.034)	(0.033)	(0.048)	(0.048)
$Colony_{ij}$	-0.178**	-0.178**	-0.141	-0.142	-0.289***	-0.287***
	(0.075)	(0.075)	(0.123)	(0.122)	(0.074)	(0.073)
Common $coloniser_{ij}$	0.050	0.057	0.089	0.088	0.107	0.119
	(0.033)	(0.033)	(0.036)	(0.035)	(0.060)	(0.059)
Same $country_{ij}$	-0.055	-0.058	-0.039	-0.054	-0.075	-0.075
	(0.130)	(0.129)	(0.154)	(0.152)	(0.211)	(0.207)
$Landlocked_{ij}$	0.088***	0.083***	0.081**	0.074**	0.138**	0.144**
	(0.048)	(0.048)	(0.059)	(0.059)	(0.108)	(0.107)
Observations	11,885	11,885	10,103	10,103	6,002	6,002
R-squared	0.622	0.624	0.602	0.610	0.480	0.487

Notes:

(a) All regressions include partner-year and year dummies to capture fixed effects and are mostly significant.

(b) Robust standard errors, clustered by country-pair, in parentheses.

(c) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

4.4.3 Impact of AfT on Intra-African and Extra-African Trade Costs

The effect of AfT on trade costs incurred when trading within SSA (intra-African trade costs) and on trade costs incurred when SSA countries trade with the rest of the world (extra-African trade costs) is examined separately. The motivation for this analysis is to determine whether AfT is helping to promote integration within the region as much as with the outer world, and to assess which type of AfT may be working better in each case. Table 4.5 reports the findings.

In both samples, the coefficient of the total AfT variable (AfT^{total}_{t-1}) remains negative and statistically significant at the 1% level, other things remaining equal. Interestingly, the coefficients are approximately the same size, implying a 10% rise in AfT flows is predicted to contribute to a 0.7% reduction in intra-African and extra-Africa trade costs alike. However, these effects are not driven by the same type of AfT. In the case of intra-African trade costs, only the coefficients for aid for economic infrastructure (AfT^{INF}_{t-1}) and aid for productive capacity building (AfT^{PC}_{t-1}) are negative and statistically significant. Since the coefficient is statistically insignificant, aid for trade facilitation does not seem to have contributed to a reduction in trade costs within the region. These results are consistent with previous findings about which policy-induced factors determine trade costs within SSA. As re-affirmed by the findings in Table 4.5, the coefficient for *BTEF* (a proxy for trade facilitation in the narrow sense, representing border and transport efficiency) becomes insignificant when the estimation is done on the intra-regional sample, while the coefficients for *PI* and *ICT* (representing hard infrastructure) remain significant.

This is not the case with the inter-regional sample, where the coefficients of all three categories of AfT are statistically significant. Aid for productive capacity building seems to be having the most substantial impact on extra-African trade costs, followed by aid for trade facilitation and aid for economic infrastructure. This is again consistent with the coefficient for *BTEF*, which carries the expected sign and is statistically significant along with the coefficients for *PI* and *ICT*.

Table 4.5: Impact of AfT on Intra-African and Extra-African Trade Costs

	Dependent Variable: Log of Bilateral Total Trade Costs			
	Intra-Africa		*Extra-Africa*	
Independent Variables:	(1)	(2)	(3)	(4)
Ln AfT^{total}_{t-1}	-0.075***		-0.074***	
	(0.021)		(0.006)	
Ln AfT^{TF}_{t-1}		0.015		-0.033*
		(0.076)		(0.018)
Ln $AfT^{TPR}_{t-1\ excluding\ TF}$		0.026		0.001
		(0.020)		(0.005)
Ln AfT^{INF}_{t-1}		-0.032*		-0.007*
		(0.017)		(0.004)
Ln AfT^{PC}_{t-1}		-0.039*		-0.072***
		(0.023)		(0.007)
Ln PI_{it}	-0.063**	-0.048**	-0.054***	-0.048***
	(0.057)	(0.056)	(0.013)	(0.012)
Ln ICT_{it}	-0.140***	-0.160***	-0.088***	-0.093***
	(0.053)	(0.055)	(0.014)	(0.014)
Ln $BREV_{it}$	-0.034	-0.032	0.020	0.023
	(0.069)	(0.070)	(0.015)	(0.015)
Ln $BTEF_{it}$	-0.111	-0.087	-0.102***	-0.110***
	(0.095)	(0.091)	(0.021)	(0.021)
Ln $Tariff_{ijt}$	0.895***	0.897***	0.731***	0.693***
	(0.327)	(0.314)	(0.148)	(0.148)
RTA_{ijt}	-0.331***	-0.307***	-0.370***	-0.353***
	(0.105)	(0.105)	(0.035)	(0.035)
Ln $Distance_{ij}$	0.302***	0.320***	0.062*	0.059*
	(0.085)	(0.084)	(0.036)	(0.035)
Common $border_{ij}$	-0.598***	-0.580***	-0.223**	-0.222**
	(0.101)	(0.098)	(0.088)	(0.088)
Common $language_{ij}$ (off.)	-0.129*	-0.153**	-0.083**	-0.086**
	(0.077)	(0.074)	(0.040)	(0.040)
Common $language_{ij}$ (ethno.)	-0.317***	-0.311***	-0.085**	-0.080**
	(0.070)	(0.066)	(0.036)	(0.036)
$Colony_{ij}$	0.631***	0.578***	-0.265***	-0.265***
	(0.121)	(0.116)	(0.060)	(0.061)
Common $coloniser_{ij}$	0.137	0.163*	0.030	0.033
	(0.087)	(0.086)	(0.035)	(0.035)
Same $country_{ij}$	0.013	0.014	-	-
	(0.135)	(0.130)		
$Landlocked_{ij}$	-0.141	-0.137	0.159***	0.151***
	(0.100)	(0.100)	(0.050)	(0.050)
Observations	1,356	1,356	10,529	10,529
R-squared	0.758	0.763	0.591	0.594

Notes:

(a) All regressions include partner-year and year dummies to capture fixed effects and are mostly significant.

(b) Robust standard errors, clustered by country-pair, in parentheses.

(c) *** p<0.01, ** p<0.05, * p<0.1

4.5 Conclusion

This chapter discusses the effectiveness of AfT received by SSA countries in reducing their cost of trading regionally and internationally. The innovation brought to the existing literature lies mainly in the selection of data to address the research question, in the way the regression analysis is run to minimise the possibility of bias, and the geographical focus of the study. In particular, the newly available comprehensive measure of trade costs computed using Novy's (2013) methodology is used as the dependent variable, and a more refined AfT data following the methodology of Hühne, Meyer, and Nunnemkamp (2014b) is used to construct the main regressors. This methodology also enables longer time coverage of the AfT flows than do the few existing studies. Furthermore, a larger number of covariates is added to the regression function to better isolate the impact of AfT on trade costs. Last, the present analysis is undertaken in the context of SSA, a geographical region that has historically experienced higher trade costs than other regions in the world. Previous work investigated whether AfT has reduced trade costs in developing countries in general.

The empirical results reveal that the AfT initiative is helping to reduce the costs of trading in goods within SSA, and between SSA countries and the rest of the world. In most of the specifications, aid for economic infrastructure and aid for capacity building are found to exert a statistically significant reducing effect on bilateral trade costs between SSA and trading partners. The influence of aid for trade facilitation on trade costs is observed to be relatively larger and significant in the baseline regression and with the inclusion of additional covariates in the trade cost equation with the full sample. However, it loses significance when the sample is restricted to include only SSA partner countries, implying that efforts to design trade facilitation projects should be geared towards the simplification and harmonisation of import and export procedures between SSA and the rest of the world. Projects designed to address infrastructure-constraints and capacity-constraints to trade should instead consider both the regional and international context.

The study findings are, therefore, in favour of additional AfT funds to further reduce trade costs. However, at a time when donors are facing increasing pressure to reduce aid as they refocus on domestic priorities (Hallaert 2013) and are more concerned about the effectiveness of such aid since the Paris declaration of 2006, it is crucial to identify where aid can create the highest value for money. Trade facilitation initiatives do not require significant upfront investments compared to infrastructure-related projects (OECD 2012), but they can contribute as much to the reduction of trade costs. However, according to the OECD-CRS statistics, aid for trade facilitation represents only around 1.2% of total AfT funding disbursed to SSA. While these statistics may imply the costs of implementing trade facilitation projects are relatively low, they may also be pointing at the lack of attention this form of aid deserves. The following study extends on the present findings by considering the impact of AfT on one of the most sought after objective in SSA – export diversification.

CHAPTER 5

AID FOR TRADE AND EXPORT DIVERSIFICATION

5.1 Introduction

The previous chapter described the effectiveness of AfT in reducing trade costs faced by SSA countries. However, the ultimate objective of the AfT initiative is to improve the export performance of recipient countries and to contribute to putting them on a sustainable development path (OECD/WTO 2015, 2017). Notwithstanding, there is still limited evidence on the effectiveness of AfT and previous studies not only come up with inconclusive results but also focus on analysing the effect of AfT on aggregate or bilateral export values of recipient countries (Cadot and de Melo 2014; Gnangnon 2018c). There have been very few attempts to analyse the effectiveness of AfT on export diversification, despite this being one of the principal objectives of the AfT initiative (OECD/WTO 2011; UNECA 2015).

While there are several measures of export diversification in the literature[15], this study focuses on the intensive and extensive margins decomposition of export growth. Export growth at the intensive margin occurs from a rise in the export share of existing products, while an increase in the export share of new products is referred to as the extensive margin export growth (Gnangnon and Roberts 2015; Shepherd 2010). Broadly defined, export diversification can embody both a rise in exports at the intensive and extensive margins although from a narrower perspective it is more closely associated with the latter, i.e. export variety (Amurgo-Pacheco and Pierola 2008; Samen 2010).

This decomposition is, therefore, useful in assessing the effectiveness of the AfT initiative on export diversification. Diversification is much needed in SSA given the continent's over-reliance on a few unprocessed primary commodities (Gupta and Yang 2006; Mosley 2018; Nicita and Rollo 2015). On the one hand, a more equal distribution

[15] Amurgo-Pacheco and Pierola (2008), and Samen (2010) provide a good discussion on the different interpretations and measures of export diversification.

of export shares among existing primary products is desirable to reduce SSA's vulnerability to commodity price changes, while, on the other hand, developing comparative advantages in new, higher value-added export sectors is necessary to promote sustainable economic growth (AfDB 2017; IMF 2017; UNECA 2015).

Against this background, the contributions of the present study are threefold. First, it is one of the first attempts to establish a conceptual model to analyse causality links between AfT and export diversification decomposed at the intensive and extensive margins. Second, an empirical investigation is conducted to assess the effectiveness of AfT along the two margins of exports while previous studies have focused on aggregate and bilateral export values, or export diversification without any distinction between the two margins. Third, it uses the gravity model, an empirical methodology that has robust theoretical foundations, and employs the Flex estimator, the most suitable estimation method for this analysis proposed by Santos Silva, Tenreyro, and Wei (2014), to estimate the specified model in a panel setting of 42 SSA countries over the period 1995 to 2014.

The rest of the chapter is organised as follows. Section 5.2 critically reviews the literature on the link between AfT and export performance, while Section 5.3 describes the conceptual model developed to establish causality links between AfT and export growth at the two margins. Section 5.4 reviews the theoretical and empirical developments in the gravity trade literature followed by the methodology and data used to test the specified model. The estimation results, discussions, and the robustness checks of the findings are presented in Section 5.5. Section 5.6 offers some concluding remarks and discusses the policy implications of the analyses.

5.2 Literature Review

The present study is linked to the broader literature on the relationship between foreign aid and trade. Several theories have been proposed to establish a causality connection between these two variables. The hypothesised transmission mechanisms depend mainly on whether one is analysing the impact of aid on exports of donors or on exports of recipients, and whether the direction of the relationship is from aid to trade or vice versa.

Foreign aid can promote donor exports either through formal tying (i.e., aid is given to recipient countries to fund the purchase of goods from donor countries) or informally when the recipients feel obliged to import goods from donors to secure aid in the future (Osei, Morrissey, and Lloyd 2004; Silva and Nelson 2012). Aid can also translate into more exports for donors if it is used productively in growth-enhancing projects in the recipient countries. Capital goods and raw materials may have to be imported from donors to meet the needs of the aid-financed projects, and eventually, with higher economic growth, more consumer goods may be imported by recipient countries (Morrissey 2006; Suwa-Eisenmann and Verdier 2007; Wagner 2003).

The literature also mentions a possible negative link between foreign aid and recipient exports via the ‘Dutch disease’ effect. It is theorised that more aid implies increased demand of non-tradable domestic goods, which in turn contributes to a rise in domestic prices and a real appreciation of the currency that makes tradable exports less competitive in the international market (McGillivray and Morrissey 1998; Rajan and Subramanian 2011). A rise in general aid can thus reduce recipient exports via the Dutch disease channel. Aid may also not bring the intended positive outcomes due to ‘fungibility’, i.e. if it is used for purposes other than those it was originally intended for. In other words, aid intended for investment may be treated as income that is used to finance consumption instead (Suwa-Eisenmann and Verdier 2007).

Calì and te Velde (2011), on the contrary, explore the possibility of a positive link between a specific category of aid, aid for trade (AfT), and recipient export performance. It is worth highlighting that the present study is based on this strand of the literature. Aid for trade broadly concerns assistance given to developing countries to overcome their structural weaknesses and to enable them to participate deeply and widely in international trade. Such aid is intended to be used in productive capacity building, improving economic infrastructure, and facilitating trade. Given these specific targeted outcomes, AfT should help in making the recipient countries’ goods more attractive by improving their quality and reducing their prices. In particular, aid directed towards capacity building should contribute to improving the quality of domestic products while aid used to improve economic infrastructure and trade facilitation should be decreasing the costs of trading with the recipient country and making their goods more price competitive. Aid for trade can thus promote recipients’ exports and its positive effect can offset any possible negative Dutch disease influence. Proponents of AfT argue that there may not be any real exchange rate appreciation since AfT is intended to generate a positive supply effect that prevents domestic prices from rising because of increased domestic demand (Adam and Bevan 2006; Gnangnon 2018b).

The empirical findings on the effectiveness of AfT in boosting the export performance of recipient countries are scanty and inconclusive (Cadot and de Melo 2014). The evidence varies across country samples, types of AfT, data employed to account for AfT flows, export performance measures, and estimation methods. Calì and te Velde (2011) find evidence of a small but positive influence of *aid for economic infrastructure* on recipient-country aggregate exports using a sample of 100 developing countries over the period 2002 to 2007. However, they did not find any significance of *aid for productive capacity building* in boosting exports. Helbe, Mann and Wilson (2012) used a more extensive panel dataset (a set of 40 donor countries and about 170 country trading pairs spanning over the period 1990 to 2005) to assess the effectiveness of *total aid for trade (sum of AfT flows across all categories)* on bilateral exports and imports of recipient countries in a gravity setting. They find evidence of a small but positive and statistically significant impact on both exports and imports, with the magnitude of the export effect being larger. A disaggregation of AfT flows by sub-categories reveals that a 1% increase in *aid for trade policy and regulations* raises exports of recipient countries by about US$415 million.

In a similar study, Hühne, Meyer and Nunnenkamp (2014b) simultaneously tested the impact of AfT on recipient exports to donors and recipient imports from donors, and find that a doubling of total AfT increases recipient exports by about 5% while recipient imports rises by about 3%, with *aid for trade policy and regulations* driving the results. Since the former effect dominates, the study rejects the hypothesis that donors allocate AfT to promote their exports. This finding is validated by a related study (Hühne, Meyer and Nunnenkamp 2014a), in which evidence of a positive relationship between AfT given by OECD donors and South-South trade is found.

In search of more robust results, Vijil and Wagner (2012) used a two-step estimation procedure to test the transmission channel of AfT. Using a sample of 99 developing countries and averaged data for the period 2002 to 2008, they first find that an increase of 10% in aid to infrastructure per capita leads to an increase in the quality of infrastructure by 1.14%. Secondly, they tested the impact of infrastructure quality on export performance and conclude that a 10% improvement in infrastructural quality leads, on average, to a 20.6% increase in exports over GDP ratio. The authors thus deduce that an increase of 10% in *aid for infrastructure* leads to an average increase in the exports over GDP ratio of an aid recipient by 2.34%.

In dealing with a possible reverse causality effect between AfT and recipient export performance, namely that more aid is given to promising or already well performing export sectors (Brenton and von Uexkull 2009; Calì and te Velde 2011; Lemi 2017), previous authors employed the instrumental approach. In most cases, lagged aid flows have been used as instruments because of the difficulty of finding other instrumental variables for aid. Ferro, Portugal-Perez, and Wilson (2014) employed an innovative estimation procedure to deal with this endogeneity concern. They used an identification strategy similar to Rajan and Zingales (1998) and investigated the impact of AfT on the service sectors on downstream manufacturing exports. A reduced form equation for exports applied to a sample of 132 countries over the period 2002 to 2008 was used for the analysis, and the evidence reveals that *aid to transportation, energy and banking services sectors* has a more significant positive impact on downstream manufacturing exports; specifically, a 10% increase in aid in these sectors raises manufacturing exports by 2%, 6.8% and 4.7%, respectively. The authors also estimated the equation across income groups, and the findings suggest that aid to the transport sector has the largest impact on export growth in low-income countries while in higher-income countries, aid to business services and energy appear to be more important.

Other studies on the effectiveness of AfT in improving export performance of recipient countries emphasised the role of the right conditions for AfT to work. Brazys (2013) examined the impact of donor heterogeneity on the effectiveness of AfT in stimulating recipient exports and finds that differences in the design and implementation of the AfT programs by the donors help explain the differences in export effects across recipients. Another study by Vijil (2014) finds that AfT, particularly *aid for trade* *policy and regulations*, works better in boosting trade when it is given to countries that are members of the same economic integration agreement.

Relatively fewer works on AfT effectiveness have been undertaken with a focus on SSA. The continent deserves attention given that it is the second largest recipient of AfT flows in absolute terms and given its low degree of participation in world trade. Calì and Razzaque (2013) replicated the methodology employed by Calì and te Velde (2011) to examine the impact of AfT on the SSA region. They find similar results, namely, aid for economic infrastructure in the finance, business services, and transport and energy sectors is serving to improve export performance, but no discernible impact concerning aid for productive capacity building is found. Pettersson and Johansson (2013) examined the effect of AfT on both donor and recipient exports. They find that the positive effect on donor exports is more than on recipient exports in the SSA region, thereby lending support to the 'tied aid' hypothesis. Hühne, Meyer, and Nunnenkamp (2014b) point out that the positive effect of AfT on exports is more significant in recipient countries in East Asia and Latin America than in the more needy countries in SSA. Lemi (2017) examined the differential impact of AfT given by OECD donors as opposed to China on the exports of 50 African recipients over the period 2002 to 2012. They find that only AfT in the education and training clusters increases African exports to the OECD donors. The other types of AfT increase only Africa's imports from OECD donors. Aid for trade provided by China does not seem to be effective in boosting the export performance of African countries. This finding is shared by Cirrera and Winters (2015), who investigated the role of AfT on the structural transformation in SSA, and conclude that AfT has an insignificant impact on aggregate and bilateral trade flows.

While most of the prior studies examine the impact of AfT on *merchandise aggregate or bilateral export values* of recipient countries, a few scholars have begun examining its influence on other dimensions of export performance. Martínez-Zarzoso, Nowak-Lehmann, and Rehwald (2017) investigated the impact of AfT on the *conditional distribution of exports of both goods and services* using a novel estimation approach referred to as the panel quantile regression technique. For their panel dataset of 124 countries over the period 2000 to 2011, they conclude that countries having a weak export capacity are benefitting most from AfT with the effect being mainly driven by the impact on exports of goods rather than services. Gnangnon (2018a) studied whether AfT for productive capacity influences *export instability* in recipient countries. Applying a Within Fixed Effects estimator to a sample of 119 recipients spanning the period 2002 to 2013, he finds evidence of a greater impact of AfT on reducing export revenue instability in low income developing countries than in relatively more advanced developing countries. This reduction impact is greater when AfT for productive capacity is complemented with multilateral trade liberalisation.

Wang and Xu (2017) analysed the impact of AfT on the *export quality* of recipient countries over the period 2002 to 2010 using a gravity-like regression equation. They find evidence that the amount of *AfT given for trade policy and regulations* over the period of study has contributed to about a 2% upgrade in the export quality of recipients, with the effect being less discernible, less significant, or even negative for other AfT flows. Secondly, they analysed the results by exploring the market and product dynamics of the export quality effect and find that around half of the effect relates to quality improvement of continued products in continued markets, and the other half by the upgrading of new products in continued markets and existing products in new markets.

Although one of the main targets of AfT is to help recipient developing countries diversify their exports (OECD/WTO 2011; UNECA 2015), very few evaluation studies have been done in this area. Munemo (2011) studied the impact of foreign aid on the degree of export diversification of 69 developing countries over the period 1983 to 2003. A regression equation having measures of foreign aid, the level of development, infrastructure, natural resources, and transaction costs as explanatory variables was used. Two measures of export diversification, namely the Herfindahl-Hirschman index (HHI) and the share of manufactured exports in GDP were used as dependent variables. Controlling for fixed effects and endogeneity, Munemo concludes that foreign aid increases export diversification but only up to a certain point. Foreign aid of over more than 20 per cent of GDP stifles export diversification. A similar study by Osakwe (2007) conducted using panel data for African countries over the period 1985 to 2002 reveals that an increase in foreign aid has a statistically negative effect on diversification measured by the share of manufactures in total exports. This lends support to the Dutch disease effect. However, in both studies, foreign aid is defined in terms of total official development assistance (ODA) flows, and the findings may not apply to AfT flows specifically.

A few recent studies focused on the impact of AfT flows on export diversification in recipient countries but came up with mixed results. Using a system-GMM estimation approach, Gnangnon (2018c) investigated the influence of AfT disbursements on export diversification of 104 recipient countries over the period 2002 to 2015. Gnangnon finds that a one dollar increase in real total AfT is associated with a 0.019 point decline in the HHI (increase in export diversification) and that the impact is similar in both LDCs and ODCs. Kim (2017) employed a larger dataset of 133 AfT recipient countries over the period 1996 to 2013, and a similar empirical methodology, but finds that, except for aid for productive capacity, total AfT and its sub-categories contribute to a rise in export diversification only in the short run.

The main limitation of these two studies is the use of the HHI as their dependent variable. The HHI is an export concentration index that measures inequality in export shares across the country's export product lines. The closer the HHI is to 0, the lower the degree of inequality in export shares, and the less concentrated a country's export values are on a small range of export products. However, the index does not distinguish between a rise in export diversification that occurs among existing product lines (intensive margin) and those arising from new export products (extensive margin)[16]. This decomposition is worthwhile, particularly in the context of SSA, whose exports remain concentrated on unprocessed primary production (Gupta and Yang 2006; Mosley 2018; Nicita and Rollo 2015). Pursuing export strategies that lead to the diversification of exports into higher value-added primary commodities and manufacturing are necessary to put SSA economies on a sustainable development path (AfDB 2017; IMF 2017; UNECA 2015).

Gnangnon and Roberts (2015) instead used the Theil index[17] of export concentration, which distinguishes between the intensive margin and the extensive margin, to investigate the interaction between AfT and FDI flows and their relative influence in

[16] See Kim (2017) and WTO/UNCTAD (2012) for more details on the calculation and limitations of the HHI.
[17] See Cadot, Carrère, and Strauss-Kahn (2013) for a discussion on the Theil index.

upgrading the exports of 86 recipient countries over the period 1995 to 2010. They find that total AfT flows have a substantial positive impact on the volume and quality of existing exports, while insignificant results for the expansion of new exports are obtained. The Theil index, however, like any other export concentration index, does not account for the expansion potential of new export product lines. The present study employs the methodology of Hummels and Klenow (2005) to decompose SSA's bilateral exports along the intensive and extensive margins, and where new export product lines are weighted by their share in world trade to reflect their expansion potential.

Hühne, Meyer, and Nunnenkamp (2014c) employed a different estimating equation – an aggregated gravity model, augmented with AfT flows, to assess the impact of the AfT initiative on exports of primary commodities and manufactured goods over the period 1990 to 2012. They find that AfT is effective in promoting the exports of manufactured goods to both donor countries and non-donor countries. The results for primary commodities are, however, insignificant. Notwithstanding, their results are not specific to the case of SSA, and they do not embody the latest developments in the estimation of their gravity model. This present study formulates an empirical gravity model based on the 'new-new' trade theory and applies a variant of the PPML estimation technique, the Flex estimator, to assess the impact of AfT on export growth disaggregated into the intensive and extensive margins using Hummels and Klenow's (2005) methodology. No previous studies have employed this approach to assess the effectiveness of AfT on export diversification. In the next section, a conceptual framework is proposed to guide the empirical specification of the model that is to be estimated.

5.3 Conceptual Framework for the Link between AfT and Export Diversification at the Intensive and Extensive Margins

A review of the literature on AfT effectiveness reveals that AfT has had mixed effects on the export performance of recipient countries, and the findings vary across the different subcategories of AfT flows. Most of these existing studies used aggregate or bilateral export values as a proxy for export performance. This approach, however, does not reveal whether AfT is helping to promote export growth at the intensive and extensive margins. Export growth at the intensive margin broadly occurs from a rise in the export share of existing product lines, while an increase in exports of new product lines is referred to as the extensive margin export growth (Gnangnon and Roberts 2015; Shepherd 2010).

Broadly defined, export diversification can embody both a rise in exports at the intensive and extensive margins, although from a narrower perspective, it is more closely associated with the latter, i.e. export variety (Amurgo-Pacheco and Pierola 2008; Samen 2010). Alternative measures of export diversification are proposed in the literature, namely the Herfindahl, Gini, and Theil concentration indices, but the 'margins' approach is preferable for this study given SSA's over-reliance on a few unprocessed primary commodities (Gupta and Yang 2006; Mosley 2018; Nicita and Rollo 2015). On the one hand, a more equal distribution of export shares among existing primary products is desirable to reduce SSA's vulnerability to commodity price changes; while on the other hand, developing comparative advantages in new, higher value-added export sectors is necessary to promote sustainable economic growth (AfDB 2017; IMF 2017; UNECA 2015). This decomposition of trade margins is well echoed in the 'new-new' trade theory (Ranjan and Raychaudhuri 2016), and therefore lends itself to a more robust empirical modelling approach and analysis.

Export diversification features as one of the priority objectives of the AfT initiative since its setup in 2005 (OECD/WTO 2011), but has mostly been overlooked in research on AfT effectiveness conducted by scholars and practitioners. The present study is one of the first to investigate the impact of AfT on export growth along both the intensive and extensive margins. The study is warranted because the literature is largely in favour of pursuing export diversification in sectors where a comparative advantage can be developed as an export strategy to promote sustainable economic growth. Hausmann, Hwang, and Rodrik (2007) argue that what a country exports matters and those countries exporting products with higher productivity contents grow more rapidly than others.

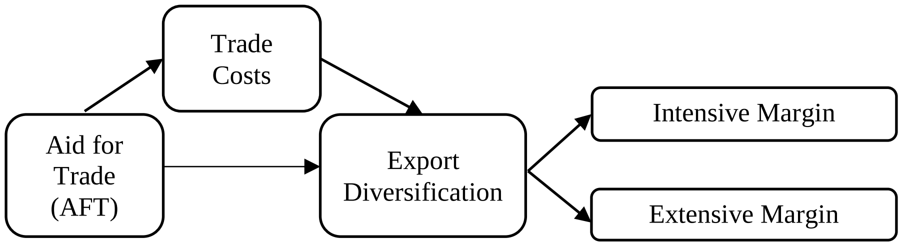
The positive link between export diversification and growth relies on three main arguments[18]. First, export diversification reduces an economy's exposure to external demand shocks, domestic supply disruptions, fluctuations in export prices in world markets, and political crises, among others. It thus alleviates economic volatility, which in turn promotes growth. Second, export concentration on primary commodities results in frequent fluctuations in export earnings and declining terms of trade, which translate into low productivity growth and poor growth prospects for the economy. This is particularly relevant to Africa, given the continent's high concentration on the export of primary goods. The third explanation is that export diversification into new sectors may generate positive spillovers on the rest of the economy because of the learning-by-doing and learning-by-exporting effects driven by competitive pressures in world markets (Herzer and Nowak-Lehnmann 2006). The beneficial effect of export diversification on growth has also received empirical support in most of the investigations (e.g., Al-Marhubi 2000; Fu, Wu, and Zhang 2017; Herzer and Nowak-Lehnmann 2006; Mau 2016). A recent study conducted by Lin, Weldemicael, and Wang (2016) of 36 SSA countries over the period 1981 to 2000 finds that a 1 percentage point increase in export sophistication is associated with an increase in GDP per capita of about 0.08 percentage points on average.

Thus, in exploring the causality link between AfT and export diversification, an attempt is also made to open the 'black box' linking aid to growth (Bourguignon and Sundberg 2007). The aid-growth relationship remains a complex one to analyse despite the large number of studies undertaken in this regard. While the present study does not review this extensive research with conflicting results, it is worth noting that researchers are in favour of using aid targeted towards a specific growth-promoting outcome as opposed to analysing the effect of overall aid assistance on growth directly. It is argued that the causality link gets disturbed along the way because of fungibility, attribution problems, poor governance, endogeneity problem among others (see for example, Anwar and Cooray 2015; Askarov and Doucouliagos 2015; Burnside and Dollar 2000; Clemens et al. 2011; Doucouliagos and Paldam 2009; Rajan and Subramanian 2008).

[18] See Cadot, Carrère, and Strauss-Kahn (2013) for a comprehensive survey on the link between export diversification and growth.

To study the relationship between aid and growth with a more optimistic approach is to instead consider whether AfT is helping recipient countries diversify their exports. To the extent that export diversification promotes economic growth, and AfT represents aid targeted towards improving the recipient countries' economic infrastructure, productive capacity, and trade policy and regulation, and other trade-related adjustments, the results should be more convincing. This is because it is easier to establish a causality link between AfT and export diversification than to link overall aid to growth.

Figure 5.1: Transmission Channel between AfT and Export Diversification at the Intensive and Extensive Margins



The conceptual model proposed in this study is adapted from Cadot and de Melo (2014), who made one of the first attempts to synthesise the channels through which AfT can impact on trade performance. The present study improves upon their framework by exploring the transmission channels of AFT to export diversification decomposed into the intensive and extensive margins to be able to disentangle diversification effects. The core hypothesis of the proposed conceptual model is that AfT reduces trade costs, thereby making it more profitable for more firms to enter export markets, thus boosting export growth at both the intensive and extensive margins. Some direct effects of AfT on export performance can also be conjectured. Figure 5.1 illustrates this transmission mechanism.

The link between AfT and trade costs was explored and tested in Chapter 4. Aid for economic infrastructure is theorised to reduce logistics and communication costs caused by soft and hard infrastructure deficiencies, while aid for trade facilitation reduces the time and costs of processing trade by simplifying border-related policies and customs procedures. Aid for building productive capacity can serve to reduce behind-the-border trade costs caused by the presence of weak institutions through legal and regulatory reforms to improve the business and investment climate (Cadot and de Melo 2014; Calì and te Velde 2011). The empirical findings of Chapter 4 mostly support this hypothesis.

The influence of trade costs on trade performance was explicitly theorised by Anderson and van Wincoop (2003, 2004). They derive a theory-laden gravity equation that relates bilateral trade flows to the size of trading partners and the *relative* trade barriers they face. In particular, the theory propounds that a rise in trade barriers faced by two countries relative to the average barrier they face when trading with other countries, referred to as 'multilateral resistance', will reduce their bilateral trade flows after controlling for economic size.

However, recent heterogeneous firm trade theories (Chaney 2008; Helpman, Melitz, and Rubinstein 2008; Melitz 2003) highlight the role of trade costs in influencing trade at both the intensive and extensive margins. Trade costs can be decomposed into fixed and variable costs. Fixed trade costs are those costs that do not depend on the volume of shipment (Persson 2013). These include one-time sunk costs such as information costs and product adaptation costs that all traders incur when entering export markets (Melitz 2003; Robert and Tybout 1997). There are also some fixed compliance costs exporters incur behind-the-border and at-the-border each time they export their goods. These include legal and administrative fees an entrepreneur must pay to obtain necessary licenses and to register a company with the authorities. The variable costs, on the other hand, vary with the size of the shipment and include costs such as transportation costs and tariffs. Melitz (2003) suggests that only a subset of heterogeneous firms will export at a given level of fixed and variable trade costs since firms vary by productivity. In particular, his model theorises that for every export destination j, there is a threshold level of productivity that yields zero profit from exports for firms in country i. Only firms in country i with higher productivity than this will make a profit from exporting to j.

Chaney (2008) extends Melitz's (2003) general equilibrium model of trade with heterogeneous firms (i.e., firms differ by productivity) to consider a world with many asymmetric countries separated by asymmetric barriers. The model makes it possible to track the impact of changes in fixed and variable trade costs on the intensive and extensive margins of trade. Chaney theorises that a fall in variable trade costs encourages an increase in the share of exports of each exporter (intensive margin), but also allows some new firms, attracted by the higher profit opportunities in export markets, to enter (extensive margin) in response to a fall in the productivity threshold. A fall in fixed trade costs, on the other hand, also reduces the productivity threshold and allows less productive firms to start exporting. With more active firms in export markets, exports may grow at the extensive margin, but the fall in fixed costs does not affect the intensive margin of trade since these represent sunk costs for existing firms.

The empirical evidence of the impact of trade costs on export diversification supports the theoretical hypotheses. Dennis and Shepherd (2011) explored the impact of trade facilitation on export diversification as measured by the extensive margin of trade. They find that a 10% decrease in trade costs, proxied by the 'costs of exporting' and 'market entry costs' obtained from the World Bank's Doing Business database, increase export diversification by 3% and 1%, respectively, in developing countries. Persson (2013) conducted a similar study and concludes that a 10% fall in the number of days needed to export a good increases the number of exported products by about 5.9%.

Bourdet and Persson (2014) studied the impact of a reduction in the time to comply with export in the exporting country and import procedures in the importing country on both the intensive and extensive margins of trade between EU and non-EU Mediterranean countries. They find that a 1% decrease in the time needed to comply with import and export procedures is associated with increases in exports of existing products of non-EU Mediterranean countries by 0.33% and 0.56%, respectively while the number of exported products rises by 0.29% and 0.19%, respectively.

Beverelli, Neumueller and Teh (2015) studied the impact of the recently ratified WTO Trade Facilitation Agreement on two measures of the extensive margin of trade - the number of products by export destination (product extensive margin), and the number of export destinations by product (geographical extensive margin), in a gravity setting. They find that the trade facilitation index (TFI) coefficient is positive and statistically significant for both types of extensive margin. In particular, a 1% increase in the TFI brings an increase of about 0.3% in the number of products exported by destination and an increase of around 0.38% in the number of destinations to which a product is exported.

While previous researchers acknowledge the limitation of using cross-sectional data to conduct their analyses, Feenstra and Ma (2014) conducted a panel estimation using data for 41 countries over the period 1991 to 2003. After controlling for unobserved cross-country heterogeneity, they conclude that a 10% improvement in bilateral port efficiency increases export variety by about 1.5% to 3.4%.

Thus, by bringing two strands of complementary literature together, it can be hypothesised that AfT serves to reduce trade costs, which then promotes export diversification. Direct links between AfT and export diversification can also be established since AfT is targeted to exert a positive influence on some of its key determinants. The literature suggests that infrastructure quality (e.g., Fonchamnyo and Akame 2017; Regolo 2013), trade openness and market access conditions (e.g., Nicita and Rollo 2015; Parteka and Tamberi 2013), and human capital formation (e.g., Agosin, Alvarez and Bravo-Ortega 2012; Anwar 2008; Jetter and Hassan 2015) are among the main factors influencing export diversification. Thus, aid targeted in these specific areas is expected to promote export diversification.

In particular, aid for economic infrastructure would enhance productivity and competitiveness by enabling more producers to become exporters, a move which can serve to diversify the country’s exports. Aid for trade policy, regulations and other trade-related adjustment help countries to liberalise their trade regimes and implement trade facilitation reforms successfully. This is important for increasing producers’ access to foreign markets, and being faced with a more diverse demand from trading partners would encourage the diversification of export-oriented goods. Also, aid for productive capacity building through educational reforms and improvement to the quality of human capital would enable more product innovation and discoveries that enable export diversification.

The contributions of this present study are, therefore, threefold. First, in the absence of a comprehensive theory of export diversification, a conceptual framework that establishes causality links with AfT is presented by drawing on several theoretical papers and empirical studies. The main hypothesis to be tested is that AfT can promote export diversification in recipient countries indirectly via the trade cost channel and directly by impacting on key drivers of export diversification, infrastructure, human capital, and trade openness. This opposes the existing view that foreign aid may reduce the number of products in the export basket because of the Dutch disease effect (Munemo 2011, Osakwe 2007).

Second, the study is one of the first to empirically investigate the effectiveness of AfT in SSA to promote export diversification at the intensive and extensive margins, measured using Hummels and Klenow's (2005) methodology. Previous work on the impact of AfT has used aggregate or bilateral export values as a proxy for measuring the recipient countries' export performance. Very few studies have investigated the effectiveness of AfT on export diversification, measured by export concentration indices, but which do not distinguish between the intensive and extensive margins. Such decomposition is useful given SSA's export structure.

Third, the study develops on previous studies by employing the latest econometric technique to estimate an aid-augmented gravity model. Based on recent contributions to the econometric estimation of gravity equation models, the Flex estimation technique, which is a variant of the PPML estimation method, is used. This allows the estimation of unbiased elasticity coefficients, even in the presence of heteroscedasticity, and deals with the problem of zero trade flows and the doubly-bounded nature of the dependent variable. Researchers who previously investigated the impact of AfT on bilateral export values using the gravity equation (Helble, Mann, and Wilson 2012; Pettersson and Johansson 2013; Vijil 2014) have employed the log-linear OLS estimation technique that generates biased and inefficient estimates in the presence of heteroscedasticity and zero trade flows that often plague trade data (Gómez-Herrera 2013; Santos Silva and Tenreyro 2006). Also, previous studies do not account for multilateral resistance (MR) terms appropriately since the inclusion of country time fixed effects would have absorbed the influence of AfT. The present study uses an alternative approach, namely the Baier and Bergstrand (2009) methodology to control for MR in the gravity estimation.

5.4 Methodology and Data

In this section, the gravity model of trade and the underlying estimation issues are reviewed. Further, the econometric model is specified and then a discussion on the estimation approach follows. Finally, the data sources are described.

5.4.1 The Gravity Model of Trade

Since the pioneering work of Tinbergen (1962), the gravity model has evolved over the past half century to become the workhorse empirical model in international trade studies. This is largely because of its efficiency in predicting trade flows. The traditional gravity model is inspired by Newton's law of universal gravitation. Applied in the context of international trade, the traditional gravity model suggests that bilateral trade flows (M_{ij}) between country *i* and country *j* is directly proportional to the product of the two countries' gross domestic products (E_i and Y_j), and inversely proportional to the distance between them (D_{ij}) to reflect trade resistance (Head and Mayer 2013). The log-linearised traditional gravity equation can be stated in its stochastic form as follows:

$$(5.1) \qquad \ln\left(M_{ij}\right) = \ln\left(E_i\right) + \ln\left(Y_j\right) - \ln\left(D_{ij}\right) + \varepsilon_{ij}$$

where ε_{ij} is a disturbance term that is assumed to be independent and identically distributed (*i.i.d.*). Equation (5.1) is often augmented to include other trade cost covariates such as tariff levels, participation in regional trade agreements (RTA), and dummies to indicate whether the trading partners share the same border, colony, and language (Baier and Bergstrand 2009).

Although the traditional gravity model has been applied empirically with success, economists have cast doubts over its reliability because it lacked theoretical foundations. During the past few decades, however, concerted efforts of trade theorists have succeeded in deriving solid theoretical roots for the so-called *structural* gravity model. The theoretical gravity literature has now reached a phase where "any plausible model of trade would yield something very like the gravity equation…" (Deardorff 1998, 12). The main contributors to the development of the structural gravity theory are Anderson (1979), Bergstrand (1985, 1989), Deardorff (1998), Eaton and Kortum (2002), Anderson and van Wincoop (2003) and, more recently, Helpman, Melitz, and Rubinstein (2008), and Chaney (2008). However, the debate has now shifted to the correct estimation technique and specification of the gravity equation because of the theoretical developments, econometric sophistication, and modelling concerns when dealing with trade data (Gómez-Herrera 2013; Kabir, Salim, and Al-Mawali 2017; Xiong and Chen 2014).

The pioneering work of Anderson and van Wincoop (2003), henceforth AvW, has prompted researchers to account for the so-called 'multilateral resistance' terms when estimating the gravity equation. The AvW gravity model hypothesises that bilateral trade between country i and j (M_{ij}) is positively related to the supply capacity of country i (Y_i) and the demand capacity of country j (E_j) relative to the world economy (Y_w), but is negatively related to *relative trade costs*. The latter refers to bilateral trade costs (t_{ij}) relative to the average trade barriers faced by the exporting and importing country when trading with the rest of the world and are given by an outward and inward multilateral resistance index ($\Pi_i P_j$). Failure to consider the MR terms in the gravity equation would result in an omitted variable bias. The log specification of the structural gravity equation following AvW's model is:

$$(5.2) \qquad \ln\left(M_{ij}\right)=\ln\left(Y_i\right)+\ln\left(E_j\right)-\ln\left(Y_W\right)+\left(1-\sigma\right)\ln\left(t_{ij}\right)-\left(1-\sigma\right)\ln\left(\Pi_i P_j\right)+\varepsilon_{ij}$$

where ε_{ij} is an *i.i.d.* error term and σ is the constant elasticity of substitution (CES) between different goods.

Feenstra (2002, 2016) recommends the inclusion of exporter and importer fixed effects in a cross-sectional setting, while Olivero and Yotov (2012) are in favour of time-varying exporter and importer fixed effects in a panel setting to account for the MR terms and unobserved heterogeneity. Although it remains an efficient and convenient estimation method, the weakness of this approach, however, is that the researcher cannot estimate the effect of any time-varying, country-specific variable, such as the variable of interest in the present study on trade flows as these are absorbed by the fixed effects terms (Prehn, Brümmer, and Glauben 2016; Proença, Sperlich, and Savaşçı 2015). One can consider using the random effects approach since it allows for the estimation of such variables, but if the unobserved effects are correlated with the explanatory variables, it will yield biased and inaccurate estimates.

An alternative approach to account for the MR terms in a gravity equation is to employ the Baier and Bergstrand (2009) methodology. This involves approximating the MR terms using a simple first-order log-linear Taylor expansion of the theoretically-motivated exogenous variables that proxy for trade costs. Monte Carlo simulations reveal that this method yields nearly the same coefficient estimates as the fixed effects approach while allowing for comparative statics involving the impact of country-specific policy variables on trade flows. The MR terms can be approximated as follows:

$$(5.3) \qquad \ln\left(\Pi_i P_j\right) \approx \frac{1}{N}\left[\sum_{i}^{N} \ln t_{ij} + \sum_{j}^{N} \ln t_{ij} - \frac{1}{N}\left(\sum_{i}^{N}\sum_{j}^{N} \ln t_{ij}\right)\right]$$

This should be calculated and adjusted to each observable bilateral trade cost variable included in the gravity equation such as distance, border, colony, and language. While in the original derivation, Baier and Bergstrand (2009) employ GDP-weights, they later recommend the use of simple averages to deal with endogeneity concerns when estimating the gravity equation (Baier and Bergstrand 2010; Head and Mayer 2013).

Another empirical issue confronting the researcher in gravity-related studies concerns the high incidence of zero trade flows in the data, particularly when comparing a sample of SSA countries with the rest of the world (Afesorgbor 2017; Beverelli, Neumueller, and Teh 2015). This problem is also more acute when using disaggregated trade data (Gómez-Herrera 2013), as in the present study. Zero trade flows may be attributed to the non-trading relationship that some country pairs share, rounding off errors caused by the relatively small (less than US$0.5 million) values of trade flows, or missing information wrongly recorded as zero (Harris, Kónya, and Mátyás 2012).

To deal with the zero flows problem, studies estimating the gravity equation in a log-linear form using OLS have proceeded to simply drop those observations from the dataset (since the log of zero is undefined) or to add a very small constant to replace the zero trade flows. Others have proposed the use of a Tobit estimator. However, these arbitrary approaches are atheoretical, and the improper treatment of zero trade flows in gravity estimation results in the classical selection bias (Heckman 1979) as the zeros are not randomly distributed. In other words, disregarding the exact cause of the zero trade flows overlooks information that is necessary for the analysis of trade patterns, and may result in biased and inaccurate estimates (Krisztin and Fischer 2015).

Helpman, Melitz, and Rubinstein (2008) developed a two-step estimation procedure to rationalise the existence of zero trade flows in the data and thus avoid the bias caused by their omission. Their technique is an extension of Heckman's (1979) estimation method wherein the first stage involves estimating a Probit equation (selection equation) to explain the presence of both zeros and positive trade flows in the data. Predicted components from this equation are then used in the second stage to estimate the gravity equation (outcome equation) in a log-linear form. Their approach has strong theoretical foundations that originate from the 'new-new' trade theory. The 'new-new' trade theory is characterised by firm heterogeneity, whereby firms vary by productivity and only firms that are above a threshold level of productivity will be able to export profitably to a particular destination country. Hence, zero trade flows are explained by the presence of low productivity firms in the source country. However, most studies using this approach apply it to a cross-sectional dataset, and its validity in panel estimation remains to be confirmed (Gómez-Herrera 2013). Moreover, the estimation model of Helpman, Melitz, and Rubinstein is valid under the assumptions of normality and homoscedasticity. Departures from these assumptions may generate biased results (Santos Silva and Tenreyro 2015; Xiong and Chen 2014).

Notwithstanding, there is a general consensus among researchers that trade data is plagued by the heteroscedasticity problem. In other words, the error terms do not have the same variance for all country pairs. This is because the dataset may consist of small countries that exhibit less trade variability than do large countries (Kabir, Salim, and Al-Mawali 2017). Moreover, heteroscedasticity may be caused by the varying quality of the data from diverse national customs (Xiong and Chen 2014). An influential study by Santos Silva and Tenreyro (2006) discusses at length why log-linearising the multiplicative gravity model and using OLS as an estimation technique results in severely biased and inefficient results in the presence of heteroscedasticity. Broadly, they attribute the inaccurate results obtained from the log-linear OLS estimation technique to the Jensen's inequality (expected value of the logarithm of a random variable is different from the logarithm of its expected value). As an alternative, they propose estimating the gravity model in its non-linear form using the Poisson Pseudo-Maximum Likelihood (PPML) estimator.

While Santos Silva and Tenreyro (2006) introduced the PPML estimator as an alternative to the log-linear OLS method of estimating the gravity equation in a cross-sectional setting, Westerlund and Wilhelmsson (2011) extended the discussion to a panel setting using a fixed effects approach. The authors provide strong arguments on how the PPML estimator performs better in the presence of heteroscedasticity than the usual OLS log-linearisation technique. The PPML technique also overcomes the zero trade flows problem since the gravity equation is estimated in its multiplicative form, hence avoiding discarding of zero trade flows from the usual log-transformation approach (Martínez-Zarzoso 2013; Santos Silva and Tenreyro 2011).

Although the PPML estimator was originally devised for count data, Gourieroux, Monfort, and Trognon (1984) note that it is consistent even when the dependent variable is not an integer like trade flows. The data need not also be Poisson distributed. More recently, the work of Arvis and Shepherd (2013), and Fally (2015) further strengthen the case for using the PPML method by demonstrating how it is the only estimator that preserves equality between total predicted trade and total actual trade flows. The aforementioned benefits of the PPML technique justify why it is now the most commonly used method to estimate the gravity equation (Proença, Sperlich, and Savaşcı 2015).

5.4.2 Model Specification

The estimation model follows from recent studies that have investigated the impact of tariffs, distance, WTO membership, immigrants, common currency, exchange rate volatility, economic integration agreements, and trade facilitation on export growth at the intensive and extensive margins[19]. In particular, an augmented gravity model is adopted to analyse the link between AfT and export growth at the two margins.

$$(5.4) \qquad EM/IM_{ijt} = \beta_0 + \beta_1 \ln\left(GDP_{it}\right) + \beta_2 \ln\left(POP_{it}\right) + \beta_3 \ln\left(GDP_{jt}\right) + \beta_4 \ln\left(POP_{jt}\right) + \beta_5 \ln\left(AFT_{it-1}\right) + \beta_6 \ln\left(1 + Tariff_{ijt}\right) + \beta_7 \ln\left(DIST_{ij}\right) + \beta_8 \left(Z_{ij}\right) + \beta_9 \left(RTA_{ijt}\right) + \beta_{10} \left(GSP_{ijt}\right) + \lambda_t + \varepsilon_{ijt}$$

where *i* denotes the exporter, *j* denotes the importer, and *t* denotes a year. The dependent variable is *EM/IM*, which refers to the extensive and intensive margins of trade, respectively. One method to calculate the extensive margin is through a simple count of the number of products exported from country *i* to country *j*, and the intensive margin can be computed as the average value of exports per product traded (Bista 2015; Dutt, Mihov, and Van Zandt 2013). However, Hummels and Klenow (2005) argue that such conventional measures do not account for the weight of each product in trade. Thus, they propose micro-founded weighted indices of the intensive and extensive margins of trade based on the methodology of Feenstra (1994). Recent studies exploring the determinants of trade at the intensive and extensive margins have used their approach successfully (e.g., Baier, Bergstrand, and Feng 2014; Dutt, Mihov, and Van Zandt 2013; Cheong, Kwak, and Tang 2016). The Hummels and Klenow (2005) method (HK hereafter) of calculating the extensive and the intensive margins of goods exported from *i* to *j* in year *t* (EM_{ijt} and IM_{ijt}, respectively) is as follows:

$$EM_{ijt} = \frac{\sum_{m \in M_{ijt}} X_{Wjt}^{m}}{\sum_{m \in M_{Wjt}} X_{Wjt}^{m}} \quad \dots \quad (5.5) \qquad\qquad IM_{ijt} = \frac{\sum_{m \in M_{ijt}} X_{ijt}^{m}}{\sum_{m \in M_{ijt}} X_{Wjt}^{m}} \quad \dots \quad (5.6)$$

where X_{Wjt}^{m} is the value of country *j*'s imports from the world in product *m* in year *t*; M_{Wjt} is the set of all products exported by the world to *j* in year *t*; M_{ijt} is the subset of all products exported from *i* to *j* in year *t*. Hence, EM_{ijt} is a measure of the fraction of all products that are exported from *i* to *j* in year *t*, where each product is weighted by

[19] See, for example, Baier, Bergstrand, and Feng (2014); Beverelli, Neumueller, and Teh (2015); Bista (2015); Bourdet and Persson (2014); Cheong, Kwak, and Tang (2016); Dennis and Shepherd (2011); Dutt, Mihov, and Van Zandt (2013); Feenstra and Ma (2014); Kang (2017); Persson (2013).

the importance of that product in world exports to *j* in year *t*. On the other hand, X_{ijt}^{m} is the value of exports from *i* to *j* in product *m* in year *t*. Thus, IM_{ijt} represents the market share of country *i* in country *j*'s imports from the world within the set of products that *i* exports to *j* in year *t*.

GDP_{it} and GDP_{jt} stand for the exporting and importing country's nominal GDP measured in US$ at time *t*. POP_{it} and POP_{jt} stand for the respective country's population at time *t*. These variables are included to capture the demand capacity of country *j* and the supply capacity of country *i* following the gravity theory. The main variable of interest is AfT received by exporting country *i* from all donor countries. The AfT variable could be aggregate aid for trade (*AfT_total*) or AfT components, such as aid for economic infrastructure (*AfT_inf*), productive capacity (*AfT_prod*), or trade policy and regulations and trade-related adjustment (*AfT_pol*) or its sub-component, aid for trade facilitation (*AfT_tf)*. Aid for trade values are lagged by one period to partially control for any potential endogeneity (Busse, Hoekstra, and Königer 2012; Pettersson and Johansson 2013), and to cater for the view that aid exerts a lagged impact on export performance (Brazys 2013; Calì and te Velde 2011; Vijil 2014). All AfT data are reported in million US$ measured at current prices.

Other explanatory variables are also inserted in the equation to account for bilateral trade costs. These include: $Tariffi_{jt}$, which is the weighted average of the applied tariff rate by the importer *j* on all exporting countries *i* products in year *t*, $DIST_{ij}$ is used to account for the geographical distance in kilometres between the trading partners measured using the great circle formula, and Z_{ij}, which is a vector consisting of a set of dummy variables taking a value of 1 if the trading partners share a common land border (border), have common colonial histories (colony), and share a common language (language), and 0 otherwise. A dummy to indicate the extent to which the countries are landlocked is also inserted, taking a value of 0, 1, 2 depending on whether none, one or both of *i* and *j* are landlocked respectively. Following Anderson and van Wincoop (2003), proper estimation of the gravity equation requires accounting for multilateral resistance, and since the main variable of interest is country specific, this cannot be done using the fixed effects approach. The study uses the Baier and

Bergstrand (2010) methodology to adjust the bilateral trade costs covariates by their MR terms.

Given the non-reciprocal preferential trade arrangements that often exist between SSA countries and developed countries, a dummy for Generalised System of Preferences (GSP) is included. It takes on a value of 1 if the importing developed country *j* grants such preferences to the exporting SSA country *i* at time *t*. A dummy (RTA) equal to one is also inserted if the country pairs are members of a regional trade agreement and zero otherwise. λ_t is a time fixed effects term to account for time-specific factors such as commodity price variations. ε_{ijt} is assumed to be an *i.i.d* stochastic term.

The use of the PPML estimator, as suggested by Santos Silva and Tenreyro (2006) and Westerlund and Wilhelmsson (2011) to circumvent the bias caused by the presence of zero trade flows and heteroscedasticity when estimating Equation (5.4) in its log-linearised form, is considered. Since this involves estimating the gravity equation in its multiplicative nature, the exponential form of Equation (5.4) is considered:

$$(5.7) \qquad E\left(IM_{ijt} / EM_{ijt} \middle| V_{ijt}\right) = \exp[\beta_0 + \beta_1 \ln\left(GDP_{it}\right) + \beta_2 \ln\left(POP_{it}\right) + \beta_3 \ln\left(GDP_{jt}\right) + \beta_4 \ln\left(POP_{jt}\right) + \beta_5 \ln\left(AFT_{it-1}\right) + \beta_6 \ln\left(1 + Tariff_{ijt}\right) + \beta_7 \ln\left(DIST_{ij}\right) + \beta_8\left(Z_{ij}\right) + \beta_9\left(RTA_{ijt}\right) + \beta_{10}\left(GSP_{ijt}\right)] + \lambda_t + \varepsilon_{ijt}$$

Equation (5.7) is interpreted as the conditional expectation of IM_{ijt}/EM_{ijt} given the covariates V_{ijt}. The coefficients of the logged variables of this equation stated in exponential form can still be interpreted as the elasticity of the conditional expectation of IM_{ijt}/EM_{ijt} even though the latter is specified in levels. The Poisson estimation approach is based on the Poisson probability model, with the following probability density:

$$(5.8) \qquad \text{Prob}\left[\gamma_k \middle| v_k\right] = \frac{\exp\left(-\mu_k\right)\mu_k^{\gamma_k}}{\gamma_k!}$$

where $\mu_k = E\left[IM_k / EM_k \middle| v_k\right] = \exp\left(v_k \beta\right)$ written in short form. β is then estimated by maximising the log likelihood function.

While the use of the PPML estimator accounts for the lower bound nature of the dependent variable, it ignores the upper bound that is produced when the HK trade margins decomposition is applied to the data. In particular, the extensive and intensive trade margins following the HK method are bounded between 0 and 1. The existence of these bounds implies that the partial effect of the regressors on the conditional mean of the dependent variable is not constant and tends to zero as the conditional mean reaches its bounds. Therefore, ignoring these bounds can lead to misleading results and Santos Silva, Tenreyro, and Wei (2014) propose a flexible specification (the Flex estimator) that takes into account the doubly-bounded nature of the dependent variable.

$$(5.9) \qquad E\left(IM_{ijt} / EM_{ijt} \middle| V_{ijt}\right) = F\,[\beta_0 + \beta_1 \ln\left(GDP_{it}\right) + \beta_2 \ln\left(POP_{it}\right) + \beta_3 \ln\left(GDP_{jt}\right) + \beta_4 \ln\left(POP_{jt}\right) + \beta_5 \ln\left(AFT_{it-1}\right) + \beta_6 \ln\left(1 + Tariff_{ijt}\right) + \beta_7 \ln\left(DIST_{ij}\right) + \beta_8\left(Z_{ij}\right) + \beta_9\left(RTA_{ijt}\right) + \beta_{10}\left(GSP_{ijt}\right)] + \lambda_t + \varepsilon_{ijt}$$

where *F(.)* is the probability that a randomly drawn export sector in recipient country *i* will export to destination *j*.

In this study, therefore, the Flex estimator is applied to the AfT-augmented gravity equation to ensure plausible coefficients of interest are obtained.

The dataset consists of a panel of 42 SSA countries with export activities being observed with 222 other countries in the rest of the world over the period 1995 to 2014. The selection of this sample size of SSA countries is motivated by trade data availability concerns. Trade data is obtained from the BACI database created by CEPII using the UN COMTRADE import and export data reported at the 6-digit Harmonized System (HS) level of product disaggregation, and is used to calculate the intensive and extensive margins of SSA exports. The BACI database provides more accurate and disaggregated trade statistics since it seeks to reconcile discrepancies between import data reported by the importer and export data reported by the exporter for the same trade flow in UN COMTRADE[20]. This inconsistency arises because firstly, exports are reported FOB (free on board), while imports are reported CIF (cost, insurance and

[20] For details on the methodology used to compute the disaggregated trade data in BACI, see Gaulier and Zignago (2010).

freight) and, secondly, export data tends to be less carefully handled by customs authorities than import data as the latter is officially used to compute tariff to be paid by importers. As a robustness check, unweighted versions of the trade margins using the BACI database are also constructed and applied in the estimations.

Aid data is available from the OECD-IDS database. This is sub-divided into DAC and CRS; DAC reports aggregate aid values, while CRS provides detailed, sector-wise aid values. Since AfT is a subset of general aid, it is usually taken from OECD-CRS where such data is available from 2002 onwards. However, to obtain a longer time span of AfT data, Hühne, Meyer, and Nunnemkamp (2014b)'s methodology is employed. The authors developed an approach to calculate sectoral AfT for each recipient country since 1990. They use AfT commitment values from the CRS and adjust these by multiplying with the ratio of total aid disbursements over total aid commitments obtained from DAC. This corrects for a potential upward bias as commitments tend to be higher than disbursements. They also correct for a second downward bias that is due to possible underreporting of project-based aid in the CRS by multiplying with the ratio of total aid commitments from DAC over the sum of project-based commitments as given in the CRS. Also, since the log of AfT is applied in the estimation equation, and the log of zero is undefined, the methodology of Wagner (2003) and later applied in the studies by Calì and te Velde (2011) and Lee and Ries (2016) is used to allow the data to handle cases of zero AfT flows with the insertion of non-aid dummies in the model.

Gross domestic product and population data are obtained from the World Development Indicators (WDI). The generalised system of preferences data is sourced from Jeffrey Bergstrand's website[21]. Information on the country pairs participating in a regional trade agreement is taken from de Sousa (2012). Tariff data is available from the WITS-TRAINS database, and the other variables, i.e. distance, and the gravity dummies to indicate whether the country pairs share a common language, border, and colony are obtained from the CEPII database. Table A5.1 of the Appendix presents standard descriptive statistics on these variables, and Table A5.2 displays the list of SSA countries used in the analysis.

[21] https://www3.nd.edu/~jbergstr/

5.5 Estimation Results and Discussions

In this section, the estimation results of the model given by Equation (5.9) are reported. It firstly considers whether total AfT received by SSA countries are related to the HK extensive and intensive margins of export growth. The relationship is then analysed by each sub-category of AfT to assess whether the effects vary, and which type of AfT seems to be more effective in boosting export performance at the two margins. Thereafter, the sensitivity of the baseline estimation results is checked against different trade flows. In particular, the effects of AfT on trade within SSA, as opposed to exports of SSA with the rest of the world, are analysed. Last, the robustness of the results are checked by using alternative proxies for the main variables of interest, extended lags of AfT, alternative estimation methods, and additional control variables.

5.5.1 Baseline Estimates

Table 5.1 displays the results of estimating Equation (5.9) with and without total AfT flows using the Flex estimator. Columns (1) and (2) report the effects of AfT flows on the HK extensive margin of exports while columns (3) and (4) project the corresponding intensive margin effects.

The coefficients obtained are mostly in line with a priori expectations. Gross domestic product and population are proxies for the demand and supply capacity of trading countries. The coefficients obtained for these two variables are statistically significant, except for the importing country's population in the extensive margin. The positive sign of the coefficients indicate that larger countries trade more in both the intensive and extensive margins, except for the importing country's GDP in the intensive margin and the exporting country's population in the extensive margin. These results are similar to those of Feenstra and Ma (2014). They also obtain a negative and significant coefficient for the importing country's GDP in the intensive margin. A possible explanation for this result is that when the importing country's GDP increases, the taste and preferences of the population would change such that the SSA exporting country would trade less of the traditional goods (intensive margin) and more of the new goods (extensive margin). The positive and significant coefficient of the importing country's GDP with respect to the extensive margin confirms the explanation for the negative and significant coefficient of the importing country's GDP in the case of the intensive margin.

With regards to aid for trade, which is the main variable of interest, the coefficient is positive and statistically significant at the 1% level in both margins. All else being equal, a 10% rise in total AfT flows appears to contribute to around 1.7% and 1.0% increase in exports of SSA to the world at the extensive margin and intensive margin, respectively. The data, therefore, support the core contention of the study, i.e. AfT serves to reduce trade costs, which then contribute to export growth in both margins. The estimation results imply that the AfT impact is larger along the extensive margin, and this can be taken as evidence that AfT is promoting export variety in SSA.

The specification given by Equation (5.9) includes some control variables, which deserve some attention. Distance, serving as a proxy for variable transport costs and other distance-related costs such as communication costs, information costs, and search costs (Berthelon and Freund 2008; Coe, Subramanian, and Tamirisa 2007), is significant and negative in sign at both margins of trade. This suggests distance reduces both the extensive and intensive margin of exports, although it is lower in magnitude for the latter. Sharing a common border raises exports at the extensive margin, but no statistically significant impact on the intensive margin is noted. This finding is shared with Dutt, Mihov, and Van Zandt (2013).

Having a common language is also necessary for new trading relationships to be established. This is confirmed by the larger positive and statistically significant coefficients for this variable along the extensive margin. Trade depends on direct communication between market participants, and language differences would impede the flow of information and prevent transactions from occurring. Language differences may also imply the contracting of a translator to interpret cross-border information, which adds to trade costs and hinders trade (Lohmann 2011). Having colonial links also positively influence the extensive margin of exports. The coefficients for landlockedness carry the economically correct negative sign, indicating that being landlocked raises transport costs and hinders trade. The coefficients did not, however, obtain statistical significance, probably in response to the inclusion of distance as a proxy for transport costs already in the specification. Statistically significant coefficients are obtained when the distance variable is excluded from the model.

The coefficient for the effectively applied tariff on SSA's exports by other countries is surprisingly positive and obtains statistical significance only when AfT is included in the specification. Also, the tariff variable had to be excluded from the analysis around the intensive margin of exports as it prevented estimation using the Flex method to converge. Its exclusion, however, does not influence the coefficient of main interest or the coefficients of other control variables to any substantial degree. This unexpected result was also obtained by Dennis and Shepherd (2011), and Persson (2013) who attribute it to the presence of a large number of zero entries for the tariff variable. Indeed, SSA countries enjoy a large number of preferences from rich countries, and the effectively applied tariff rates are zero. In the data sample, around 73% of the tariff data entries are zero, confirming that the resulting lack of variation in this variable results in imprecise tariff coefficients.

The GSP dummy is significant at the 1% level but appears to be increasing exports only at the extensive margin. The coefficient of GSP is negative and significant along the intensive margin. This result suggests that SSA countries are exporting less of existing products but more of new products to the developed countries through the GSP. The latter thus appears to be contributing to export diversification in SSA. Finally, participation in an RTA seems to be instrumental in raising exports at the extensive margin only.

Table 5.1: Effects of Total AfT on the Extensive and Intensive Margins of Exports: Full Sample

VARIABLES	HK Extensive Margin *No AfT* (1)	 *Total AfT* (2)	HK Intensive Margin *No AfT* (3)	 *Total AfT* (4)
lnGDP_exporter	1.101***	1.112***	0.252***	0.229***
	(0.031)	(0.031)	(0.023)	(0.023)
lnGDP_importer	0.380***	0.359***	-0.154***	-0.163***
	(0.030)	(0.029)	(0.019)	(0.019)
lnPOP_exporter	-0.338***	-0.479***	0.104***	0.069**
	(0.026)	(0.029)	(0.026)	(0.029)
lnPOP_importer	0.017	0.026	0.051***	0.060***
	(0.030)	(0.029)	(0.019)	(0.020)
lnAFT_total (1yr lag)		**0.167*** **		**0.100*** **
		(0.018)		(0.018)
$(1+\ln tariff_{ijt})$	0.182	0.403**	#	#
	(0.163)	(0.164)		
MRDIST	-1.276***	-1.244***	-0.423***	-0.395***
	(0.072)	(0.067)	(0.056)	(0.058)
MRBORDER	0.622***	0.558***	0.140	0.141
	(0.171)	(0.163)	(0.139)	(0.138)
MRLANG	0.756***	0.763***	0.265***	0.267***
	(0.084)	(0.081)	(0.058)	(0.058)
MRCOLONY	1.142***	1.068***	-0.501**	-0.502**
	(0.254)	(0.245)	(0.213)	(0.203)
Landlocked	-0.017	-0.055	-0.028	-0.055
	(0.056)	(0.052)	(0.042)	(0.043)
GSP	0.441***	0.469***	-0.240***	-0.229***
	(0.071)	(0.068)	(0.079)	(0.079)
RTA	0.905***	0.886***	0.001	0.018
	(0.096)	(0.092)	(0.085)	(0.085)
Observations	123,463	115,447	123,463	115,447
R^2	0.54	0.56	0.40	0.41

Notes:
(a) Estimates are obtained using the Flex estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(f) # Variable dropped because inclusion prevented estimation from converging.

5.5.2 Results by AfT components

In Table 5.2, disaggregated aid for trade data is used, i.e. AfT by sub-components (aid for economic infrastructure, aid for productive capacity, aid for trade facilitation, and aid for trade policy and other regulations, *excluding trade facilitation*) and their effects on the two export margins are investigated.

The results suggest rather convincing results for the different categories of AfT. All receive econometric significance, except for aid for trade facilitation and other trade policy and regulations along the intensive margin. The positive sign of most of the AfT coefficients is also in line with the previous theoretical hypotheses. Aid for trade facilitation seems to be driving the results along the extensive margin followed by aid for productive capacity (3.09% versus 2.21% following a 10% rise in aid, other things remaining unchanged). Aid for infrastructure is, however, contrary to a priori expectations since the coefficient is negative in sign, implying that a 10% rise in such aid reduces exports of SSA along the extensive margin by 0.27%. This may be suggestive of the Dutch disease effect at work. However, such aid is serving to boost exports at the intensive margin by 0.52%, albeit this proportion is smaller than aid for productive capacity where a 1.05% rise could be noted. The findings are similar to studies that suggest aid for trade facilitation works better to promote exports of recipient countries (e.g., Helbe, Mann and Wilson 2012; Hühne, Meyer and Nunnenkamp 2014b; Vijil 2014), but contrasts with the work of Calì and te Velde (2011), and Vijil and Wagner (2012) who find a more significant role for aid for infrastructure. The approach adopted in the present study, however, differs from these studies in that they used total export values as the dependent variable, while disaggregated export data along the intensive and extensive margins is used here.

It is worth mentioning that all the other coefficients of the control variables included in the baseline specification maintain their statistical significance and sign.

Table 5.2: Effects of AfT by Category on the Extensive and Intensive Margins of Exports: Full Sample

	HK Extensive Margin				HK Intensive Margin			
	AfT_inf	*AfT_prod*	*AfT_tf*	*AfT_pol*	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lnGDP_exporter	1.092***	1.093***	1.091***	1.045***	0.241***	0.229***	0.236***	0.229***
	(0.031)	(0.030)	(0.032)	(0.030)	(0.023)	(0.024)	(0.023)	(0.023)
lnGDP_importer	0.367***	0.354***	0.371***	0.364***	-0.162***	-0.164***	-0.163***	-0.163***
	(0.030)	(0.029)	(0.031)	(0.030)	(0.019)	(0.020)	(0.020)	(0.020)
lnPOP_exporter	-0.388***	-0.495***	-0.337***	-0.341***	0.086***	0.065**	0.117***	0.114***
	(0.027)	(0.029)	(0.026)	(0.026)	(0.027)	(0.029)	(0.027)	(0.027)
lnPOP_importer	0.025	0.029	0.022	0.026	0.059***	0.061***	0.059***	0.059***
	(0.030)	(0.028)	(0.030)	(0.029)	(0.020)	(0.020)	(0.020)	(0.020)
lnAfT_*sub-category* (1yr lag)	**-0.027****	**0.221*****	**0.309*****	**-0.068**	**0.052*****	**0.105*****	**-0.066**	**-0.006**
	(0.013)	(0.021)	(0.030)	(0.015)	(0.016)	(0.020)	(0.051)	(0.034)
$(1+\ln tariff_{ijt})$	0.278	0.435***	0.285	0.213	#	#	#	#
	(0.169)	(0.164)	(0.174)	(0.174)				
MRDIST	-1.251***	-1.238***	-1.255***	-1.256***	-0.397***	-0.399***	-0.400***	-0.400***
	(0.071)	(0.066)	(0.073)	(0.070)	(0.056)	(0.059)	(0.055)	(0.056)
MRBORDER	0.609***	0.553***	0.614***	0.600***	0.145	0.145	0.159	0.156
	(0.169)	(0.161)	(0.172)	(0.168)	(0.139)	(0.139)	(0.139)	(0.139)
MRLANG	0.761***	0.771***	0.755***	0.767***	0.265***	0.268***	0.265***	0.265***
	(0.083)	(0.080)	(0.084)	(0.082)	(0.058)	(0.058)	(0.058)	(0.058)
MRCOLONY	1.113***	1.047***	1.134***	1.093***	-0.512**	-0.493**	-0.508**	-0.498**
	(0.249)	(0.243)	(0.255)	(0.252)	(0.210)	(0.204)	(0.215)	(0.212)
Landlocked	-0.053	-0.076	-0.034	-0.053	-0.044	-0.062	-0.043	-0.045
	(0.055)	(0.052)	(0.056)	(0.054)	(0.043)	(0.043)	(0.043)	(0.043)
GSP	0.450***	0.480***	0.436***	0.461***	-0.235***	-0.225***	-0.239***	-0.233***
	(0.070)	(0.067)	(0.071)	(0.069)	(0.079)	(0.079)	(0.080)	(0.079)
RTA	0.919***	0.874***	0.913***	0.887***	0.020	0.012	0.015	0.012
	(0.094)	(0.090)	(0.097)	(0.095)	(0.085)	(0.086)	(0.085)	(0.085)
Observations	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447
R^2	0.56	0.57	0.54	0.55	0.40	0.41	0.40	0.40

Notes:
(a) Estimates are obtained using the Flex estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(f) # Variable dropped because inclusion prevented estimation from converging.

5.5.3 AfT and Intra-African Export Growth

Table 5.3 displays the estimation results when the baseline specification is run on a sample consisting only of SSA exporting and importing countries. In other words, the effects of AfT on intra-African export growth are considered. Interestingly, the AfT coefficients turn out to be statistically significant only for the extensive margin of exports. Aid for trade does not seem to be instrumental in boosting trade at the intensive margin within the continent. In summary, a 10% rise in total AfT flows seems to be raising exports on the extensive margin by around 2.32%. Among the sub-categories, aid for economic infrastructure appears to contribute positively to raising intra-African trade along the extensive margin but only by 0.68% against 2.87% and 2.55% concerning aid for productive capacity and trade facilitation, respectively. The coefficient for aid for trade policy, excluding the trade facilitation component is, however, negative.

Concerning the coefficients of the other variables, some notable differences in sign and significance are worth mentioning. Population does not seem to be instrumental in influencing exports within the continent at either margin since the coefficient is not significant. The border dummy is statistically significant at both margins, implying that SSA countries sharing the same border tend to trade more at the intensive and extensive margins, with the latter dominating. The colony dummy is unreasonably high but is not statistically significant. The dummy for GSP is also not significant, which is expected since the latter is granted by developed countries while here the sample is restricted to SSA. The formation of intra-African trade agreements appears to improve the export performance of member countries along both margins, in particular, the extensive margin.

Table 5.3: Effects of AfT on the Extensive and Intensive Margins of Intra-African Export Growth

	HK Extensive Margin					HK Intensive Margin				
	AfT_total	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*	*AfT_total*	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnGDP_exporter	0.948***	0.936***	0.934***	0.925***	0.901***	0.380***	0.386***	0.386***	0.384***	0.379***
	(0.065)	(0.068)	(0.064)	(0.068)	(0.066)	(0.048)	(0.047)	(0.048)	(0.046)	(0.047)
lnGDP_importer	0.122**	0.120**	0.122**	0.123**	0.130**	-0.180***	-0.182***	-0.180***	-0.182***	-0.180***
	(0.052)	(0.054)	(0.051)	(0.055)	(0.054)	(0.046)	(0.047)	(0.047)	(0.047)	(0.047)
lnPOP_exporter	-0.359***	-0.257***	-0.368***	-0.178***	-0.187***	-0.037	-0.022	-0.049	-0.013	-0.018
	(0.059)	(0.057)	(0.058)	(0.055)	(0.056)	(0.046)	(0.042)	(0.047)	(0.042)	(0.041)
lnPOP_importer	0.118**	0.122**	0.120**	0.121**	0.118**	0.007	0.006	0.007	0.006	0.005
	(0.057)	(0.060)	(0.057)	(0.060)	(0.059)	(0.040)	(0.041)	(0.040)	(0.041)	(0.041)
lnAfT (1yr lag)	**0.232*** **	**0.068*** **	**0.287*** **	**0.255*** **	**-0.100*** **	**0.040**	**-0.013**	**0.045**	**-0.188**	**0.024**
	(0.036)	(0.023)	(0.042)	(0.056)	(0.029)	(0.028)	(0.025)	(0.032)	(0.179)	(0.046)
$(1+\ln tariff_{ijt})$	1.168***	1.059***	1.174***	1.012***	0.929***	#	#	#	#	#
	(0.219)	(0.224)	(0.220)	(0.235)	(0.233)					
MRDIST	-1.154***	-1.162***	-1.157***	-1.163***	-1.168***	-0.249***	-0.252***	-0.253***	-0.252***	-0.250***
	(0.119)	(0.123)	(0.118)	(0.124)	(0.122)	(0.087)	(0.085)	(0.088)	(0.084)	(0.085)
MRBORDER	0.466***	0.494***	0.479***	0.514***	0.514***	0.248*	0.258*	0.246*	0.259*	0.257*
	(0.149)	(0.156)	(0.148)	(0.161)	(0.159)	(0.147)	(0.148)	(0.148)	(0.148)	(0.148)
MRLANG	0.962***	0.967***	0.969***	0.959***	0.971***	0.229***	0.229***	0.230***	0.228***	0.230***
	(0.111)	(0.114)	(0.111)	(0.116)	(0.115)	(0.080)	(0.081)	(0.080)	(0.081)	(0.080)
MRCOLONY	-111.239	-117.602	-108.519	-116.690	-111.170	44.345	46.971	45.981	45.982	47.460
	(13.803)	(14.498)	(13.680)	(14.854)	(14.653)	(15.328)	(15.452)	(15.299)	(15.078)	(15.096)
Landlocked	-0.099	-0.089	-0.118	-0.076	-0.087	0.108*	0.111*	0.104	0.114*	0.113*
	(0.078)	(0.081)	(0.078)	(0.082)	(0.081)	(0.065)	(0.066)	(0.066)	(0.066)	(0.065)
GSP	#	#	#	#	#	#	#	#	#	#
RTA	0.749***	0.780***	0.735***	0.773***	0.769***	0.212**	0.218**	0.207**	0.217**	0.214**
	(0.103)	(0.108)	(0.102)	(0.111)	(0.109)	(0.099)	(0.099)	(0.100)	(0.099)	(0.099)
Observations	26,709	26,709	26,709	26,709	26,709	26,709	26,709	26,709	26,709	26,709
R^2	0.62	0.61	0.63	0.60	0.61	0.58	0.58	0.58	0.58	0.58

Notes:
(a) Estimates are obtained using the Flex estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(f) # Variable dropped because inclusion prevented estimation from converging.

5.5.4 AfT and Extra-African Export Growth

The sensitivity of the baseline results is also analysed by restricting the analysis to a sample of SSA exporting countries with non-SSA importing countries. Table 5.4 provides the estimation results of the effect of AfT on extra-African export growth.

The AfT coefficients, in terms of their sign and statistically significance, are similar to what was obtained with the full sample. In particular, aid for trade facilitation appears to be exerting a stronger effect on exports along the extensive margin, followed by aid for productive capacity (0.262 versus 0.139). Aid for economic infrastructure seems to be exerting a positive effect on the intensive margin of trade but a reverse effect along the extensive margin. Aid for productive capacity tends to promote exports at the intensive margin as well. The only difference is on the magnitude of total aid for trade; the coefficient is larger along the intensive margin (0.131 versus 0.094) with the restricted sample.

Other interesting differences include the distance coefficient, which is now negative and significant by roughly the same magnitude along both margins. The coefficient for landlockedness is negative and significant, implying that landlockedness hinders SSA's export potential with the rest of the world. The border dummy coefficient is statistically insignificant since the data consists only of zero entries in this restricted sample. The coefficient for RTA is statistically significant at both margins, but the opposing sign is at odds with economic theory. This is explained by the presence of only zero entries in this variable on the restricted sample – as all the RTAs are within SSA countries. Hence, the RTA coefficient is not economically relevant.

Table 5.4: Effects of AfT on the Extensive and Intensive Margins of Extra-African Export Growth

	HK Extensive Margin					HK Intensive Margin				
	AfT_total	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*	*AfT_total*	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnGDP_exporter	0.983***	0.953***	0.972***	0.958***	0.928***	0.179***	0.197***	0.176***	0.187***	0.178***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
lnGDP_importer	0.604***	0.609***	0.601***	0.610***	0.607***	-0.138***	-0.135***	-0.140***	-0.135***	-0.136***
	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
lnPOP_exporter	-0.407***	-0.337***	-0.425***	-0.315***	-0.319***	0.108***	0.125***	0.107***	0.167***	0.164***
	(0.028)	(0.027)	(0.028)	(0.025)	(0.025)	(0.033)	(0.032)	(0.033)	(0.031)	(0.031)
lnPOP_importer	-0.168***	-0.170***	-0.166***	-0.172***	-0.169***	0.056**	0.054**	0.057**	0.053**	0.054**
	(0.032)	(0.032)	(0.031)	(0.033)	(0.032)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
lnAfT (1yr lag)	**0.094*** **	**-0.064*** **	**0.139*** **	**0.262*** **	**-0.053*** **	**0.131*** **	**0.081*** **	**0.136*** **	**0.029**	**-0.023**
	(0.017)	(0.011)	(0.020)	(0.026)	(0.014)	(0.020)	(0.019)	(0.023)	(0.157)	(0.046)
$(1+\ln tariff_{ijt})$	0.321*	0.210	0.354*	0.242	0.174	#	#	#	#	#
	(0.188)	(0.194)	(0.188)	(0.197)	(0.196)					
MRDIST	-0.428***	-0.419***	-0.436***	-0.419***	-0.442***	-0.482***	-0.478***	-0.477***	-0.478***	-0.479***
	(0.153)	(0.154)	(0.152)	(0.154)	(0.153)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)
MRBORDER	-0.344	-0.417	-0.331	-0.448	-0.372	0.860	0.875	0.838	0.794	0.813
	(0.739)	(0.745)	(0.727)	(0.750)	(0.735)	(0.723)	(0.721)	(0.727)	(0.755)	(0.746)
MRLANG	0.550***	0.550***	0.555***	0.543***	0.551***	0.250***	0.250***	0.248***	0.255***	0.252***
	(0.091)	(0.093)	(0.090)	(0.094)	(0.091)	(0.079)	(0.080)	(0.079)	(0.080)	(0.079)
MRCOLONY	0.991***	1.003***	0.986***	1.005***	1.000***	-0.577**	-0.596**	-0.565**	-0.582**	-0.574**
	(0.161)	(0.167)	(0.158)	(0.171)	(0.165)	(0.241)	(0.254)	(0.240)	(0.254)	(0.251)
Landlocked	-0.223***	-0.224***	-0.247***	-0.204***	-0.226***	-0.144***	-0.125**	-0.152***	-0.125**	-0.128**
	(0.048)	(0.050)	(0.048)	(0.050)	(0.049)	(0.051)	(0.052)	(0.051)	(0.052)	(0.052)
GSP	-0.001	-0.019	0.011	-0.033	-0.006	-0.299***	-0.309***	-0.295***	-0.315***	-0.308***
	(0.075)	(0.076)	(0.074)	(0.077)	(0.075)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)
RTA	0.349**	0.361**	0.355**	0.358**	0.335**	-0.580***	-0.615***	-0.581***	-0.623***	-0.622***
	(0.141)	(0.142)	(0.140)	(0.143)	(0.140)	(0.205)	(0.209)	(0.204)	(0.208)	(0.207)
Observations	88,738	88,738	88,738	88,738	88,738	88,738	88,738	88,738	88,738	88,738
R^2	0.63	0.63	0.64	0.62	0.63	0.22	0.21	0.21	0.20	0.21

Notes:
(a) Estimates are obtained using the Flex estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(f) # Variable dropped because inclusion prevented estimation from converging.

5.5.5 Robustness Checks

5.5.5.1 Use of an Alternative Export Margin Measure

The HK decomposition of exports of country *i* to *j* at time *t* along the extensive and intensive margins by adapting the methodology in Feenstra (1994) and appropriately weighting categories of goods by their overall importance in exports to a given country is well grounded in consumer price theory. However, it is worth analysing the sensitivity of the baseline results to the use of the conventional unweighted measure of trade margins. This methodology has been applied in previous studies such as that of Bernard et al. (2007), Dutt, Mihov, and Van Zandt (2013), Flam and Nordstrm (2006), and Nitsch and Pisu (2008).

$$EM_{ijt} = N_{ijt} \quad \ldots \quad (5.10) \qquad\qquad IM_{ijt} = \frac{X_{ijt}}{N_{ijt}} \quad \ldots \quad (5.11)$$

where N_{ijt} measures the number of products exported by country *i* to *j* at time *t* (extensive margin) and X_{ijt} denotes the value of total exports of country *i* to *j* at time *t*. The intensive margin, therefore, is the average value of exports per product traded by country *i* to *j* at time *t*.

Table 5.5 reports the estimation results with the unweighted trade margins as dependent variable in the specifications. The coefficients of the variable of interest, AfT in total and by sub-categories, obtain statistical significance except for aid for infrastructure along the extensive margin and aid for trade facilitation along the intensive margin. The sign and economic significance of the AfT coefficients along the extensive margin seem to be similar to the baseline results. A 10% rise in total aid for trade appears to have contributed to a 2.92% rise in product varieties exported by SSA recipient countries. Among the sub-categories, aid for trade facilitation seems to be driving the result, again followed by aid for productive capacity (0.398 versus 0.374). The coefficient for aid for trade policy, excluding trade facilitation, is however negative but small in magnitude.

Along the intensive margin, however, the results are in contrast with the baseline analysis. Negative coefficients are obtained for most of the AfT components, except for aid for trade policy, excluding trade facilitation. In total, aid for trade seems to have reduced the value of exports per product traded. This result can be interpreted in two ways: either AfT has not been effective in raising bilateral exports value in SSA (X_{ijt}) or it has been effective in raising the number of products exported (N_{ijt}). Since columns (1) to (5) confirm the latter, it can be deduced that the rise in the number of product varieties was not sufficiently high to raise the intensive margin as measured by Equation (5.11). There is a reason to believe this is the case in SSA given that diversification has been mainly in low-value added manufactures (AfDB 2017).

Nonetheless, one needs to be cautious in drawing any implications from the results using this intensive trade measure because many of the coefficients of the control variables are insignificant. This demonstrates the superiority of the HK decomposition over the unweighted, conventional trade margins used in this section.

5.5.5.2 Results with Extended AfT Lags

An analysis of whether time lags affect the relationship between AfT and the two export margins is also warranted. In previous estimations, AfT lagged by one year was used to minimise the risk of endogeneity coming from reverse causality, and to account for the fact that aid takes time to become effective. This may concern mainly aid given to consolidate the economy's hard infrastructure and build capacity (hard aid) as opposed to aid to support trade facilitation (soft aid). Table 5.6 gives the results of running the same regression specification with three-year lags in the AfT variable.

The significance and sign of the coefficient of all variables are similar to the baseline results, except for aid for trade facilitation as expected. The magnitude of the coefficient of the main variable of interest also differs, but is consistent with a priori expectations. A 10% increase in total AfT flows contributes to a 1.89% rise in the extensive margin of exports three years later compared to a 1.67% increase when only one-year lag is considered. Similarly, its contribution along the intensive margin is slightly higher when three-year lags are considered (1.06% versus 1.00%).

Table 5.5: Robustness Checks using the Count Measure of Export Margins

	Extensive Margin (Count)					Intensive Margin (Exports per product)				
	AfT_total	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*	*AfT_total*	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnGDP_exporter	1.279***	1.244***	1.245***	1.245***	1.172***	0.641***	0.721***	0.680***	0.735***	0.811***
	(0.043)	(0.043)	(0.042)	(0.044)	(0.043)	(0.063)	(0.076)	(0.065)	(0.080)	(0.083)
lnGDP_importer	0.348***	0.348***	0.345***	0.355***	0.349***	0.481***	0.463***	0.482***	0.457***	0.466***
	(0.033)	(0.035)	(0.032)	(0.035)	(0.034)	(0.060)	(0.061)	(0.060)	(0.061)	(0.061)
lnPOP_exporter	-0.656***	-0.511***	-0.678***	-0.426***	-0.415***	-0.116	-0.278***	-0.127	-0.418***	-0.418***
	(0.047)	(0.045)	(0.046)	(0.043)	(0.043)	(0.080)	(0.093)	(0.080)	(0.100)	(0.095)
lnPOP_importer	0.032	0.040	0.031	0.038	0.036	0.066	0.077	0.065	0.082	0.077
	(0.041)	(0.043)	(0.041)	(0.044)	(0.043)	(0.089)	(0.092)	(0.090)	(0.093)	(0.092)
lnAfT (1yr lag)	**0.292*** **	**0.011**	**0.374*** **	**0.398*** **	**-0.080*** **	**-0.252*** **	**-0.070* **	**-0.301*** **	**0.051**	**0.137* **
	(0.028)	(0.014)	(0.029)	(0.032)	(0.013)	(0.044)	(0.041)	(0.048)	(0.149)	(0.081)
$(1+\ln tariff_{ijt})$	0.005	-0.250	0.046	-0.357	-0.396	0.398	0.653	0.383	0.592	0.601
	(0.289)	(0.313)	(0.289)	(0.328)	(0.327)	(0.531)	(0.498)	(0.519)	(0.503)	(0.492)
MRDIST	-1.017***	-0.968***	-1.021***	-0.968***	-0.989***	-0.185	-0.191	-0.181	-0.189	-0.171
	(0.099)	(0.105)	(0.098)	(0.108)	(0.104)	(0.266)	(0.276)	(0.268)	(0.278)	(0.277)
MRBORDER	0.406**	0.442**	0.416**	0.450**	0.450**	0.254	0.312	0.271	0.343	0.262
	(0.202)	(0.213)	(0.199)	(0.216)	(0.208)	(0.466)	(0.486)	(0.465)	(0.503)	(0.480)
MRLANG	0.879***	0.875***	0.893***	0.867***	0.883***	-0.353	-0.360	-0.361	-0.378	-0.364
	(0.115)	(0.122)	(0.114)	(0.125)	(0.121)	(0.225)	(0.241)	(0.228)	(0.248)	(0.241)
MRCOLONY	0.541**	0.502**	0.548**	0.496*	0.519**	0.161	0.160	0.168	0.177	0.158
	(0.237)	(0.253)	(0.231)	(0.262)	(0.248)	(0.304)	(0.328)	(0.313)	(0.334)	(0.331)
Landlocked	0.189**	0.229***	0.147**	0.267***	0.216***	-0.122	-0.183	-0.082	-0.201	-0.158
	(0.074)	(0.078)	(0.073)	(0.079)	(0.077)	(0.172)	(0.169)	(0.172)	(0.174)	(0.171)
GSP	0.497***	0.441***	0.519***	0.417***	0.461***	-0.057	0.022	-0.060	0.052	0.002
	(0.091)	(0.095)	(0.091)	(0.095)	(0.094)	(0.178)	(0.184)	(0.180)	(0.186)	(0.184)
RTA	0.752***	0.797***	0.751***	0.793***	0.753***	-0.432*	-0.502**	-0.432*	-0.523**	-0.399
	(0.101)	(0.105)	(0.099)	(0.107)	(0.104)	(0.253)	(0.256)	(0.252)	(0.257)	(0.255)
Observations	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447
R^2	0.54	0.52	0.55	0.51	0.53	0.68	0.65	0.65	0.63	0.66

Notes:
(a) Estimates are obtained using the PPML estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Concerning the sub-components of AfT, the coefficient of aid for productive capacity building is positive and significant, but the magnitude is higher (0.261 versus 0.221 along the extensive margin and 0.119 versus 0.105 along the intensive margin). This supports the hypothesis that 'hard aid' takes time to be effective. The same findings apply to aid for economic infrastructure, but as was discussed in Section 5.5.2, the coefficient is negative when the extensive margin is considered. A 10% rise in aid for economic infrastructure seems to raise exports at the intensive margin by 0.55% with a lag of three years against 0.52% with a one-year lag, but it reduces export at the extensive margin by 0.34% instead of 0.27%.

The results for 'soft aid', i.e. aid for trade facilitation, are also plausible. Here the opposite effect is obtained; a 10% rise in such aid raises the extensive margin of exports by 3.09% when one-year lag is accounted for, but when three-year lags are considered, the sign changes from positive to negative and the magnitude decreases. This suggests that aid for trade facilitation has a relatively immediate positive effect on the extensive margin of exports while the effect fades out in the longer term.

Table 5.6: Robustness Checks Using Extended AfT Lags

	HK Extensive Margin					HK Intensive Margin				
	AfT_total	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*	*AfT_total*	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnGDP_exporter	1.096***	1.073***	1.073***	1.070***	1.032***	0.202***	0.217***	0.201***	0.214***	0.204***
	(0.031)	(0.032)	(0.031)	(0.032)	(0.031)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
lnGDP_importer	0.351***	0.362***	0.344***	0.369***	0.364***	-0.168***	-0.167***	-0.169***	-0.168***	-0.168***
	(0.029)	(0.030)	(0.029)	(0.031)	(0.030)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
lnPOP_exporter	-0.480***	-0.386***	-0.502***	-0.326***	-0.331***	0.086***	0.100***	0.082***	0.129***	0.128***
	(0.029)	(0.027)	(0.029)	(0.026)	(0.026)	(0.030)	(0.028)	(0.030)	(0.028)	(0.028)
lnPOP_importer	0.030	0.028	0.034	0.023	0.026	0.056***	0.055***	0.058***	0.055***	0.055***
	(0.029)	(0.030)	(0.028)	(0.030)	(0.030)	(0.020)	(0.020)	(0.020)	(0.021)	(0.020)
lnAfT (3yr lag)	**0.189*** **	**-0.034*** **	**0.261*** **	**-0.274*** **	**-0.069*** **	**0.106*** **	**0.055*** **	**0.119*** **	**-0.017**	**-0.032**
	(0.019)	(0.013)	(0.022)	(0.068)	(0.016)	(0.018)	(0.017)	(0.020)	(0.097)	(0.038)
$(1+\ln tariff_{ijt})$	0.303*	0.249	0.351**	0.228	0.192	#	#	#	#	#
	(0.169)	(0.174)	(0.169)	(0.181)	(0.178)					
MRDIST	-1.226***	-1.231***	-1.220***	-1.245***	-1.244***	-0.361***	-0.365***	-0.368***	-0.372***	-0.371***
	(0.068)	(0.072)	(0.067)	(0.075)	(0.073)	(0.058)	(0.055)	(0.060)	(0.055)	(0.055)
MRBORDER	0.548***	0.608***	0.537***	0.620***	0.613***	0.165	0.171	0.170	0.187	0.186
	(0.165)	(0.173)	(0.163)	(0.176)	(0.173)	(0.139)	(0.140)	(0.140)	(0.141)	(0.141)
MRLANG	0.739***	0.737***	0.749***	0.732***	0.742***	0.259***	0.258***	0.260***	0.260***	0.260***
	(0.080)	(0.083)	(0.079)	(0.085)	(0.083)	(0.058)	(0.059)	(0.059)	(0.060)	(0.060)
MRCOLONY	1.048***	1.100***	1.015***	1.137***	1.106***	-0.487**	-0.501**	-0.478**	-0.497**	-0.486**
	(0.253)	(0.256)	(0.250)	(0.261)	(0.258)	(0.201)	(0.210)	(0.202)	(0.216)	(0.212)
Landlocked	-0.068	-0.065	-0.092*	-0.040	-0.059	-0.046	-0.035	-0.053	-0.032	-0.035
	(0.053)	(0.055)	(0.051)	(0.057)	(0.055)	(0.044)	(0.044)	(0.045)	(0.044)	(0.044)
GSP	0.439***	0.412***	0.461***	0.394***	0.414***	-0.221***	-0.226***	-0.216***	-0.228***	-0.225***
	(0.067)	(0.070)	(0.066)	(0.071)	(0.070)	(0.080)	(0.081)	(0.081)	(0.081)	(0.081)
RTA	0.881***	0.924***	0.859***	0.914***	0.899***	0.029	0.029	0.021	0.022	0.018
	(0.092)	(0.094)	(0.089)	(0.097)	(0.096)	(0.087)	(0.087)	(0.088)	(0.088)	(0.087)
Observations	102,267	102,267	102,267	102,267	102,267	102,267	102,267	102,267	102,267	102,267
R^2	0.56	0.55	0.58	0.54	0.55	0.40	0.40	0.40	0.39	0.39

Notes:
(a) Estimates are obtained using the Flex estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(f) # Variable dropped because inclusion prevented estimation from converging.

5.5.5.3 Results with Alternative Estimators

Table 5.7 presents the results of estimating the AfT-augmented gravity model with some alternative estimation methods mentioned in the gravity trade literature. This is to ensure the baseline estimates and analyses do not depend heavily on the choice of the Flex estimator of Santos Silva, Tenreyro, and Wei (2014). For comparison's sake, the baseline results obtained from the Flex estimator are reproduced in columns (2) and (8).

Columns (1) and (7) report the estimates of the model when the traditional OLS method is used. Unlike previous estimations, the dependent variable is in logs, but one is added to all zero values before taking logs as the logarithm of zero is not defined and using the truncated approach, i.e. simply ignoring the zero flows, would entail the loss of information. The coefficient for total AfT is significant at the 1% level but negative in sign at both margins. This may suggest AfT is ineffective in boosting export performance, but the sign of most other control variables in the equation hold opposite signs and the R^2 has dropped significantly to 12.4%, which is below the reasonable level for such analyses (Dennis and Shepherd 2011). Thus, while the statistics demonstrate that the model has weak explanatory power and the sign coefficients of most regressors are at odds with economic theory, the empirical literature on gravity model estimation suggests that the use of OLS results in biased coefficients because of the sample selection bias caused by the improper treatment of zero trade flows (Westerlund and Wilhelmsson 2011). Also, as Santos Silva and Tenreyro (2006) point out, the use of log-linear OLS in the presence of heteroscedasticity changes the property of the error term, generates inefficient estimates, and the *t*-values cannot be trusted.

The recent literature on gravity estimation recommends the use of nonlinear methods. In particular, the PPML method, first suggested by Santos Silva and Tenreyro (2006), has become the workhorse estimation model in gravity trade studies. To generate the baseline estimation, the Flex estimator was employed. This is a variant of the PPML given the doubly-bounded nature of the dependent variable. In columns (3) and (9), the findings after applying PPML to the model are reported to gauge the sensitivity of the results. The Gamma Pseudo-Maximum Likelihood (GPML) is also used as an alternative estimator following Martínez-Zarzoso (2013) and Kang (2017). The results are shown in columns (4) and (10) for the extensive and intensive margins, respectively. Both the PPML and the GPML are similar in approach, with the exception that the latter assigns less weight to observations with a larger conditional mean and is thus less prone to measurement errors, while the former assigns the same weight to all observations. Interestingly, the results of running the gravity model using the PPML and the GPML estimators are identical. The coefficient's significance, sign and magnitude of the variable of interest are very similar to the baseline estimates. The results show that a 10% increase in the total AfT increases the extensive margin by 1.46% and the intensive margin by 1.01%, other things remaining equal.

As a further robustness check, a modified Poisson model, the zero-inflated PPML (ZIPPML) proposed by Burger, van Oort, and Linders (2009), is employed. The zero-inflated model considers two types of zero-trade flows: zeros that reflect countries that have never engaged in a trading relationship, and theoretical zeros representing countries that do not trade now but may trade in the future. This segregation is based on many trade influencing features of the dataset such as distance, language, and cultural proximity. The model also allows the possibility of decomposing the probability to trade from the volume of trade. The results obtained from the application of the ZIPPML to the data are provided in columns (5) and (6) for the extensive margin, and columns (11) and (12) for the intensive margin.

There are two columns of results in each margin when the ZIPPML is applied because the latter generates two sets of parameter estimates. The first one is for the logit model, where the impact of the regressors included in the gravity equation is identified on the probability of country pairs forming part of the never-trading group. The second set is for the Poisson part, which looks at the influence of the control variables on the expected volume of trade between country pairs having positive trade flows and those having, theoretically, zero-trade flows. The results imply that a 10% rise in total AfT reduces the probability of country pairs to never trade by 2.9% at the extensive margin. The coefficient along the intensive margin is also negative but does not obtain statistical significance. Concerning the expected volume of trade, the use of ZIPPML reassuringly generates results similar to the baseline; a 10% rise in total AfT increases the expected volume of trade at the extensive margin by 1.39% and the intensive margin by 1.00% when holding all other variables constant.

Table 5.7: Robustness Checks Using Alternative Estimators

	HK Extensive Margin						HK Intensive Margin					
	OLS	*Flex*	*PPML*	*GPML*	*ZIPPML*		*OLS*	*Flex*	*PPML*	*GPML*	*ZIPPML*	
					Logit	*Poisson*					*Logit*	*Poisson*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
lnGDP_exporter	0.061***	1.112***	0.882***	0.882***	0.151	0.877***	-0.152***	0.229***	0.219***	0.219***	-0.046***	0.223***
	(0.024)	(0.031)	(0.024)	(0.024)	(0.269)	(0.025)	(0.022)	(0.023)	(0.023)	(0.023)	(0.016)	(0.023)
lnGDP_importer	-0.355***	0.359***	0.251***	0.251***	-1.801***	0.247***	-0.660***	-0.163***	-0.166***	-0.166***	-0.061***	-0.160***
	(0.018)	(0.029)	(0.022)	(0.022)	(0.379)	(0.022)	(0.017)	(0.019)	(0.019)	(0.019)	(0.013)	(0.019)
lnPOP_exporter	-0.082***	-0.479***	-0.389***	-0.389***	0.604*	-0.378***	0.088***	0.069**	0.061**	0.061**	0.008	0.069**
	(0.022)	(0.029)	(0.029)	(0.029)	(0.343)	(0.028)	(0.022)	(0.029)	(0.027)	(0.027)	(0.017)	(0.028)
lnPOP_importer	0.015	0.026	0.049**	0.049**	2.876***	0.056**	0.056***	0.060***	0.057***	0.057***	-0.006	0.059***
	(0.018)	(0.029)	(0.024)	(0.024)	(0.489)	(0.024)	(0.017)	(0.020)	(0.019)	(0.019)	(0.013)	(0.019)
lnAfT_total (1yr lag)	**-0.206***	**0.167***	**0.146***	**0.146***	**-0.290***	**0.139***	**-0.183***	**0.100***	**0.101***	**0.101***	**-0.015**	**0.100***
	(0.014)	(0.018)	(0.019)	(0.019)	(0.101)	(0.019)	(0.014)	(0.018)	(0.017)	(0.017)	(0.011)	(0.017)
$(1+\ln tariff_{ijt})$	-4.436***	0.403**	0.550***	0.550***	#	#	-3.427***	#	1.283***	1.283***	#	#
	(0.226)	(0.164)	(0.138)	(0.138)			(0.211)		(0.123)	(0.123)		
MRDIST	0.454***	-1.244***	-0.886***	-0.886***	-1.011***	-0.876***	0.505***	-0.395***	-0.376***	-0.376***	0.138***	-0.392***
	(0.044)	(0.067)	(0.072)	(0.072)	(0.285)	(0.072)	(0.043)	(0.058)	(0.040)	(0.040)	(0.035)	(0.040)
MRBORDER	1.318***	0.558***	0.336***	0.336***	20.294***	0.378***	0.592***	0.141	0.143	0.143	-0.003	0.128
	(0.157)	(0.163)	(0.128)	(0.128)	(1.686)	(0.123)	(0.147)	(0.138)	(0.134)	(0.134)	(0.113)	(0.134)
MRLANG	-0.159***	0.763***	0.685***	0.685***	3.250***	0.684***	-0.440***	0.267***	0.256***	0.256***	-0.053	0.264***
	(0.058)	(0.081)	(0.079)	(0.079)	(0.530)	(0.079)	(0.056)	(0.058)	(0.055)	(0.055)	(0.044)	(0.056)
MRCOLONY	1.681***	1.068***	0.543**	0.543**	35.843***	0.708***	0.293	-0.502**	-0.469**	-0.469**	0.042	-0.497**
	(0.276)	(0.245)	(0.213)	(0.213)	(1.179)	(0.156)	(0.313)	(0.203)	(0.197)	(0.197)	(0.180)	(0.200)
Landlocked	0.076**	-0.055	0.002	0.002	-0.683**	-0.005	0.131***	-0.055	-0.056	-0.056	0.018	-0.056
	(0.037)	(0.052)	(0.042)	(0.042)	(0.299)	(0.041)	(0.034)	(0.043)	(0.040)	(0.040)	(0.028)	(0.040)
GSP	-0.374***	0.469***	0.475***	0.475***	-2.885***	0.463***	-1.202***	-0.229***	-0.222***	-0.222***	-0.029	-0.232***
	(0.068)	(0.068)	(0.059)	(0.059)	(0.428)	(0.060)	(0.073)	(0.079)	(0.078)	(0.078)	(0.040)	(0.078)
RTA	0.300***	0.886***	0.696***	0.696***	3.165***	0.693***	-0.284***	0.018	0.032	0.032	-0.015	0.017
	(0.090)	(0.092)	(0.074)	(0.074)	(0.466)	(0.075)	(0.085)	(0.085)	(0.082)	(0.082)	(0.062)	(0.082)
Observations	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447	115,447
R^2	0.124	0.562	0.430	0.430			0.343	0.410	0.420	0.420		

Notes:
(a) All specifications include time fixed effects.
(b) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(c) Heteroscedastic robust standard errors are in parentheses.
(d) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(e) # Variable dropped because inclusion prevented estimation from converging.

5.5.5.4 Results with Alternative AfT Data

The robustness of the baseline results obtained using an AfT data sample constructed using the methodology of Hühne, Meyer, and Nunnemkamp (2014b) is also checked. In particular, the specified model is run using AfT disbursements data obtained directly from the OECD-CRS database over the period 2002 to 2014. A smaller time frame is used here because AfT disbursement data is readily available only from the year 2002 on. The results are shown in Table 5.8.

Although the magnitudes may differ, the coefficients of the variable of interest remain mostly positive and statistically significant. Also, the pattern noted when analysing the baseline results recur in most cases. A 10% rise in total AfT has a bigger contribution to raising exports of SSA at the extensive margin than at the intensive margin (1.82% versus 0.58%). Aid for productive capacity seems to be the main driver of this result rather than aid for trade facilitation and aid for other trade policy and regulations at the extensive margin (0.265 versus 0.161 and 0.151, respectively). Aid for economic infrastructure, however, does not appear to be effective at the extensive margin because the coefficient is statistically insignificant.

The coefficient of aid for economic infrastructure is, however, positive at the intensive margin but the influence of aid for productive capacity dominates (0.092 versus 0.034). The impact of aid for trade facilitation is statistically insignificant, and this result corroborates the baseline results. Aid for other trade policy and regulations (excluding trade facilitation), however, has a positive impact on the intensive margin and is significant as opposed to the baseline findings where insignificant results were obtained.

Most other control variables have the same sign, significance and exhibit the same trend as the baseline results.

Table 5.8: Robustness Checks Using Alternative AfT Data Sample: AfT Disbursements, 2002-2014

	HK Extensive Margin					HK Intensive Margin				
	AfT_total	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*	*AfT_total*	*AfT_inf*	*AfT_prod*	*AfT_tf*	*AfT_pol*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnGDP_exporter	0.999***	1.009***	0.985***	0.959***	0.974***	0.193***	0.191***	0.190***	0.191***	0.184***
	(0.032)	(0.032)	(0.031)	(0.031)	(0.032)	(0.026)	(0.027)	(0.026)	(0.026)	(0.026)
lnGDP_importer	0.360***	0.371***	0.353***	0.364***	0.374***	-0.190***	-0.190***	-0.191***	-0.190***	-0.191***
	(0.031)	(0.032)	(0.030)	(0.030)	(0.031)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
lnPOP_exporter	-0.401***	-0.307***	-0.445***	-0.302***	-0.321***	0.084**	0.109***	0.065*	0.124***	0.101***
	(0.031)	(0.028)	(0.032)	(0.026)	(0.027)	(0.035)	(0.034)	(0.034)	(0.031)	(0.030)
lnPOP_importer	0.024	0.019	0.027	0.023	0.018	0.050**	0.049**	0.051**	0.049**	0.049**
	(0.030)	(0.031)	(0.030)	(0.030)	(0.031)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
lnAfT (1yr lag)	**0.182*** **	**0.020**	**0.265*** **	**0.161*** **	**0.151*** **	**0.058*** **	**0.034* **	**0.092*** **	**-0.067**	**0.072** **
	(0.022)	(0.016)	(0.025)	(0.027)	(0.029)	(0.022)	(0.018)	(0.024)	(0.078)	(0.031)
$(1+\ln tariff_{ijt})$	-0.054	0.107	-0.042	0.180	0.205	1.572***	1.609***	1.555***	1.640***	1.660***
	(0.227)	(0.230)	(0.223)	(0.227)	(0.229)	(0.262)	(0.257)	(0.268)	(0.254)	(0.259)
MRDIST	-1.185***	-1.204***	-1.180***	-1.215***	-1.211***	-0.340***	-0.342***	-0.342***	-0.342***	-0.348***
	(0.073)	(0.077)	(0.071)	(0.075)	(0.077)	(0.061)	(0.060)	(0.063)	(0.059)	(0.060)
MRBORDER	0.653***	0.696***	0.635***	0.699***	0.705***	0.190	0.193	0.188	0.199	0.206
	(0.181)	(0.190)	(0.178)	(0.184)	(0.189)	(0.151)	(0.152)	(0.151)	(0.150)	(0.152)
MRLANG	0.715***	0.708***	0.721***	0.721***	0.726***	0.244***	0.244***	0.245***	0.243***	0.248***
	(0.086)	(0.089)	(0.085)	(0.086)	(0.088)	(0.066)	(0.066)	(0.066)	(0.066)	(0.067)
MRCOLONY	1.044***	1.107***	1.010***	1.072***	1.095***	-0.477**	-0.489**	-0.469**	-0.477**	-0.470**
	(0.268)	(0.271)	(0.265)	(0.260)	(0.267)	(0.211)	(0.214)	(0.209)	(0.215)	(0.211)
Landlocked	-0.129**	-0.119**	-0.154***	-0.148**	-0.133**	-0.043	-0.037	-0.053	-0.039	-0.041
	(0.058)	(0.061)	(0.056)	(0.058)	(0.060)	(0.048)	(0.049)	(0.048)	(0.048)	(0.048)
GSP	0.305***	0.281***	0.322***	0.329***	0.285***	-0.157*	-0.161*	-0.153	-0.164*	-0.158*
	(0.070)	(0.072)	(0.068)	(0.069)	(0.071)	(0.094)	(0.094)	(0.093)	(0.094)	(0.094)
RTA	0.994***	1.013***	0.972***	0.953***	1.008***	0.143	0.148	0.138	0.140	0.134
	(0.097)	(0.100)	(0.095)	(0.097)	(0.099)	(0.097)	(0.097)	(0.097)	(0.097)	(0.098)
Observations	69,498	69,498	69,498	69,498	69,498	69,498	69,498	69,498	69,498	69,498
R^2	0.53	0.52	0.54	0.53	0.52	0.39	0.38	0.39	0.38	0.39

Notes:
(a) Estimates are obtained using the Flex estimator.
(b) All specifications include time fixed effects.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

5.5.5.5 Results with Additional Control Variables

Last, the robustness of the previous results is analysed by including additional control variables in the baseline model specification to capture some further time-variant exporter and importer characteristics that influence the intensity of trade between country pairs. These include proxy indices for the quality of physical infrastructure (PI), Information and Communication Technologies (ICT), the state of the business regulatory environment (BREV), and the efficiency of border and transport procedures (BTE). These indicators are constructed following the methodology of Portugal-Perez and Wilson (2012)[22]. Kalirajan (2009) argues that the non-inclusion of these country-specific characteristics from the specified model can lead to biased estimates, particularly if the omitted variables are correlated with the included explanatory variables.

Table 5.9 shows the results of alternative specifications of the model with additional controls. For each trade margin, these additional controls are introduced one at a time before including all in one specification, and in each case the sensitivity of the coefficient of the variable of interest is noted. In addition, the economic and statistical significance of the coefficients accompanying the additional controls are compared with those obtained in previous studies. It is noteworthy that data availability considerations pertaining to the additional control variables limit the sample for this analysis to 20 SSA countries with data spanning the period 2002 to 2014.

The results are reassuring and robust to the inclusion of most of the additional controls. Although the total AfT coefficient in each specification is slightly less, they remain positive and significant, except when BREV and BTE are included in isolation in the specification (8) and (9). However, that may be due to the exclusion of importer BREV and BTE in those specifications following errors of convergence and preventing the estimation to run. Interestingly, the coefficients of the additional controls are in most cases consistent with a priori expectations, as well as the findings of previous studies in terms of their economic and statistical significance. This confirms the appropriateness of the model specification.

[22] See Appendix 3.1A for more details on the construction of the PI, ICT, BREV, and BTE indicators.

The quality of the physical infrastructure is an important determinant of trade as an improvement in physical infrastructure facilitates the international trade process by reducing transport and handling costs of merchandise (Iwanow and Kirpatrick 2007; Limão and Venables 2001; Portugal-Perez and Wilson 2012). This is confirmed by the positive coefficient for PI at both margins, the exception being that the importer's PI does not appear to contribute positively to the intensive export margin. The ICT quality level also matters as it determines communication costs between traders (Lin 2015). Improvements in the state of the exporter's and importer's ICT contribute positively to improving export performance at the extensive margin. At the intensive margin, exporter ICT is not statistically significant while improvements in importer ICT do not appear to benefit exports at the intensive margin.

The business regulatory environment, a proxy for institutional quality, has also been identified as a determinant of trade flows in the literature. Better institutions reduce the uncertainty and transaction costs associated with trade contracts and thus promote trade (Dutt and Traca 2010; Francois and Manchin 2013; Hoekman and Nicita 2011). This is confirmed by the empirical findings; the coefficient for BREV is positive and significant at both margins. Finally, an efficient border and transport system reduces the number of days and the number of documents needed to export goods offshore. The less time it takes to export, the lower will be the border-related costs and the greater will be the country's participation in world trade. The positive and significant coefficients obtained for BTE at both margins confirm the findings of previous studies such as that of Niru (2014) and Freund and Rocha (2011). The magnitude of the BTE coefficient is also higher than the other control variables, indicating the potential of border trade facilitation through the simplification and harmonisation of customs procedures to improve export performance, particularly at the extensive margin.

When all the four additional control variables are included in the estimating equation (columns (5) and (10)), except for importer ICT the coefficients decrease but remain positive and statistically significant at the extensive margin. The results are not convincing at the intensive margin as the coefficients lose statistical significance when included together in the specification model, except for exporter PI where the coefficient stays positive and significant. However, this does not disturb the main contention of the present study; that the coefficient for AfT is positive and significant.

Table 5.9: Robustness Checks Using Additional Control Variables

	HK Extensive Margin					HK Intensive Margin				
	phys_inf.	*ICT*	*Reg_Env.*	*Border Eff.*	*ALL*	*phys_inf.*	*ICT*	*Reg_Env.*	*Border Eff.*	*ALL*
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnGDP_exporter	0.995***	1.006***	1.056***	1.105***	0.944***	-0.013	0.012	0.092**	0.088**	-0.008
	(0.051)	(0.056)	(0.046)	(0.050)	(0.055)	(0.061)	(0.062)	(0.039)	(0.039)	(0.060)
lnGDP_importer	0.279***	0.386***	0.290***	0.419***	0.262***	-0.221***	-0.209***	-0.230***	-0.220***	-0.177***
	(0.053)	(0.050)	(0.047)	(0.048)	(0.054)	(0.040)	(0.040)	(0.035)	(0.033)	(0.050)
lnPOP_exporter	-0.514***	-0.525***	-0.515***	-0.529***	-0.389***	0.241***	0.204**	0.244***	0.264***	0.202**
	(0.052)	(0.057)	(0.048)	(0.053)	(0.058)	(0.084)	(0.081)	(0.070)	(0.071)	(0.092)
lnPOP_importer	0.132***	0.045	0.154***	0.032	0.172***	-0.035	-0.026	0.046	0.036	-0.078
	(0.041)	(0.037)	(0.037)	(0.035)	(0.041)	(0.046)	(0.044)	(0.032)	(0.032)	(0.060)
lnAfT (1yr lag)	**0.122*** **	**0.127*** **	**0.111*** **	**0.107*** **	**0.069** **	**0.088* **	**0.104** **	**0.034**	**0.010**	**0.110** **
	(0.029)	(0.032)	(0.029)	(0.032)	(0.029)	(0.052)	(0.043)	(0.038)	(0.040)	(0.050)
lnPhysical Infrastructure_exp	0.565***				0.206**	0.178***				0.199**
	(0.090)				(0.096)	(0.061)				(0.096)
lnPhysical Infrastructure_imp	0.726***				0.544***	-0.268***				-0.111
	(0.139)				(0.150)	(0.077)				(0.069)
lnICT_exp		0.562***			0.231***		0.104			-0.035
		(0.094)			(0.082)		(0.068)			(0.101)
lnICT_imp		0.344***			-0.220**		-0.212***			-0.055
		(0.088)			(0.094)		(0.076)			(0.077)
lnBusiness Regulatory Env._exp			0.457***		0.240***			0.170**		0.075
			(0.057)		(0.063)			(0.067)		(0.093)
lnBusiness Regulatory Env._imp			0.542***		0.349***			#		-0.160**
			(0.070)		(0.082)					(0.075)
lnBorder Transport Efficiency_exp				0.874***	0.362***				0.407***	-0.236
				(0.130)	(0.123)				(0.120)	(0.173)
lnBorder Transport Efficiency_imp				0.520***	0.142*				#	-0.158
				(0.125)	(0.077)					(0.098)
Observations	16,992	16,992	16,992	16,992	16,992	16,992	16,992	28,224	28,224	16,992
R^2	0.74	0.72	0.73	0.72	0.74	0.59	0.57	0.43	0.43	0.62

Notes: (a) Estimates are obtained using the Flex estimator.
(b) All specifications include MR controls, tariff, RTA dummy, and time fixed effects but are not reported due to space considerations.
(c) The models include non-AFT dummies to deal with zero AFT flows, but the coefficients are not reported as they are not of direct interest.
(d) Heteroscedastic robust standard errors are in parentheses.
(e) Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.
(f) # Variable dropped because inclusion prevented estimation from converging.

5.6 Conclusion

This study considers the effectiveness of the AfT initiative in achieving export growth in SSA decomposed into the intensive and extensive margin. Using HS 6-digit product disaggregated trade data from the BACI database over the period 1995 to 2014, the two export margins are constructed using the Hummels-Klenow's (2005) methodology. The gravity model, augmented with AfT data, is then employed for the analysis and estimated using the Flex method of Santos Silva, Tenreyro, and Wei (2014) after controlling for MR terms. The estimation results obtained are mostly robust to the use of alternative estimation methods, different export margin measures, AfT disbursements data over a different time frame, and the inclusion of additional control variables.

The extensive export margin elasticity to total AfT is positive and ranges between 1.4% and 1.8% in the preferred non-linear estimations for the full sample. This elasticity is larger when the estimation is restricted to trade within SSA. The sign of the intensive export margin elasticity to total AfT is also positive, but the magnitude is lower and varies between 0.6% and 1.0% when the whole sample is used. It is larger, however, when the analysis is limited to SSA exporting and non-SSA importing countries.

With respect to which type of AfT is driving the results and is working better in delivering the positive outcomes, the estimations indicate that this varies across the two margins. At the extensive export margin, aid for trade facilitation is more effective while aid for productive capacity appears to be having a bigger impact along the intensive export margin. In most of the specifications, however, aid for economic infrastructure is serving to promote exports only at the intensive margin, while a negative or a statistically insignificant coefficient is observed along the extensive margin. This finding suggests that aid for economic infrastructure is flowing towards existing (primary) export sectors and is only helping to diversify the share of products that are already being exported to the rest of the world. The exception is when the sample is restricted to include only SSA importing countries, where the impact of aid for economic infrastructure is statistically significant and positive only along the extensive margin, implying that such aid is helping to diversify the share of new products in the intra-African export portfolio.

The study findings, therefore, suggest that the AfT initiative has contributed to export diversification in SSA, with the combined effect being more pronounced along the extensive margin than on the intensive margin. Such results are encouraging given the continent's longstanding overconcentration on a few unprocessed primary exports and the potential for export product diversification to boost economic growth (Lin, Weldemicael, and Wang 2016). Increasing AfT funds by the donor community to promote further export product diversification is thus implied. This, in turn, can contribute to putting SSA economies on a sustainable development path. Although it is total AfT that ultimately matters when capturing its impact on export diversification, it is worth highlighting the effectiveness of the smallest AfT category (aid for trade facilitation) in promoting exports, particularly at the extensive margin.

CHAPTER 6

CONCLUSIONS

6.1 Overview

The research objectives of this study are three-fold: firstly, to investigate empirically the sources of trade costs, secondly to assess the effectiveness of AfT in reducing trade costs, and thirdly, to analyse the theoretical links between AfT, trade costs, and export diversification and to conduct an empirical investigation of the influence of AfT on export diversification in SSA. After a background chapter on the economic performance of SSA, and an analysis of its merchandise export performance, trade costs and AfT disbursements, this thesis has three chapters that discuss the empirical research. Chapter 3 provides an empirical analysis of the policy-induced and non-policy factors that are behind SSA's high trade costs. A trade cost equation is estimated using a panel dataset consisting of 20 SSA countries over the period 2004 to 2012 using Pooled OLS, Random Effects Model (REM), and the Fixed Effects Model (FEM). The empirical results obtained from the FEM, which controls for partner-year fixed effects and year fixed effects are, however, considered for the discussion of findings.

Chapter 4 assesses the effectiveness of AfT received by SSA countries in reducing the cost of trading regionally and internationally. A panel dataset consisting of 47 SSA countries examined over the period 1995 to 2014 is employed for the empirical analysis that is based on a fixed effects framework controlling for country-pair and time fixed effects. Chapter 5 develops the conceptual model to analyse the impacts of AfT on export diversification at the intensive and extensive margins. It then explains an empirical gravity trade model used to investigate the effectiveness of AfT on the two margins of export diversification using a sample of 42 SSA countries studied over the period 1995 to 2014. The Flex estimating technique developed by Santos Silva, Tenreyro, and Wei (2014) is favoured over alternative specification models for this analysis.

The remainder of this final chapter is organised as follows. Section 6.2 summarises the major findings of the three empirical chapters of the thesis. Section 6.3 discusses the policy implications of these findings. Section 6.4 identifies the limitations of the study and concludes with some suggestions for future research.

6.2 Major Findings of the Study

The results discussed in Chapter 3 confirm that non-policy factors cited in the literature such as the geographical distance between trading partners, the state of being landlocked, language dissimilarities, and border differences act as trade barriers and partially account for the high trade costs faced by SSA. Moreover, policy-induced factors such as the quality of the physical and communications infrastructure, the efficiency of customs procedures in terms of the number of documents required and the time taken to process the export and import of goods, tariff rates applied by trading countries, and their participation in Regional Trade Agreements (RTAs) are statistically significant determinants of trade costs faced by SSA.

While the sign of the coefficients obtained for the variables mentioned above is consistent with theory, their importance for intra-African and extra-African trade costs differs. The quality of the physical infrastructure (roads, railroads, seaports, and airports) is found to be a more substantial determinant of intra-African trade costs, followed by the efficiency of the information and communication technologies (ICT) infrastructure. Customs efficiency does not seem to be a source of intra-African trade costs. In contrast, the empirical analysis reveals that trade facilitation in terms of streamlining customs procedures and cutting red tape will contribute more to reducing extra-African trade costs than an upgrade of the quality of ICT and physical infrastructure. Further reduction in tariffs and participation in RTAs would also significantly reduce trade costs faced when trading regionally and with the outer world.

The empirical results discussed in Chapter 4 suggest that the AfT initiative is helping to reduce the costs of trading in goods within SSA, and between SSA countries and the rest of the world. In most of the specifications, *aid for economic infrastructure* and *aid for productive capacity* exert a reducing effect on bilateral trade costs between SSA and trading partners. The influence of *aid for trade facilitation* on trade costs is observed to be relatively larger and significant in the baseline regression and with the inclusion of additional covariates in the trade cost equation with the full sample. However, it loses significance when the sample is restricted to include only SSA partner countries, implying that efforts to design trade facilitation projects should be geared towards the simplification and harmonisation of import and export procedures between SSA and the rest of the world.

The results discussed in Chapter 5 reveal that the extensive margin diversification effects are larger than the intensive diversification effects in most of the specifications. The extensive export margin elasticity to total AfT is positive and ranges between 1.4% and 1.8% over the whole sample. This elasticity is larger when the estimation is run on intra-African trade. The sign of the intensive export margin elasticity to total AfT is also positive, but the magnitude is lower and varies between 0.6% and 1.0% when the whole sample is used. The intensive margin effect is larger, however, when the analysis is limited to extra-African trade. The results, therefore, suggest that the AfT initiative is contributing to promote export diversification in SSA along both margins. Nevertheless, AfT is serving better to diversify the share of new export products traded within SSA while its contribution to diversifying the share of existing export products when trading with the rest of the world is stronger. These findings are robust to the use of alternative estimation methods, a different export margin measure, the use of another AfT data sample, and the inclusion of additional control variables.

This study also investigates which category of AfT is more effective in promoting export diversification. The results indicate that this varies across the two export margins. At the extensive export margin, *aid for trade facilitation* is more effective while *aid for productive capacity* has a bigger impact along the intensive export margin. In most of the specifications, however, *aid for economic infrastructure* is serving to promote exports only at the intensive margin, while a negative or a statistically insignificant coefficient is observed along the extensive margin. This result suggests that *aid for economic infrastructure* is flowing towards existing (primary) export sectors and is only helping to diversify the share of products that are already being exported to the rest of the world. The exception is when the sample is restricted to include only SSA importing countries; then the impact of *aid for economic infrastructure* is statistically significant and positive only along the extensive margin.

This result implies that *aid for economic infrastructure* is only helping to diversify the share of new products in the intra-African export portfolio.

6.3 Policy Implications

The findings of the study provide important policy insights for both African governments and the donor community. The study reveals that among the unilateral reforms, *trade facilitation*, defined in terms of the simplification and harmonisation of customs and border procedures, can bring more substantial reductions in trade costs than will an upgrade of the transport and communications infrastructure. Although it is crucial for SSA to tackle its infrastructure deficiencies, the findings of the study reveal there is more to gain in the short term from trade facilitation measures that require relatively less financing. The empirical findings on the effectiveness of AfT lend support to this claim.

Aid for trade facilitation, which currently represents only around 1.2% total AfT disbursed to SSA, is associated with more substantial reductions in trade costs and greater export diversification effects, particularly at the extensive margin. While *aid for productive capacity* and *aid for economic infrastructure* are also contributing to reduce trade costs and achieve export diversification, such aid-financed projects require large upfront investments and have a longer gestation period compared to trade facilitation initiatives (OECD 2012).

Sub-Saharan African countries, therefore, stand to gain significantly from the implementation of the Trade Facilitation Agreement (TFA) that came into force in 2017. The findings suggest that African policymakers should take greater advantage of the AfT initiative by demanding additional AfT funds from donors to implement the TFA measures. Along with the ratification of the planned Continental Free Trade Area (CFTA), implementing the TFA measures is expected to significantly reduce trade costs and contribute to putting SSA on a sustainable growth path through export diversification. In addition, a key policy implication for the donor community is that providing new and additional resources to trade facilitation could deliver the highest returns in terms of aid effectiveness.

On the whole, however, the empirical findings on the combined effects of the AfT initiative clearly show the success of this approach in contributing to a shift in SSA's exports from the intensive margin to the extensive margin. Such export diversification is much desired in SSA given the continent long-standing over-reliance on a few unprocessed primary commodities. The AfT initiative is, therefore, helping SSA leverage its growth potential through trade by contributing to reduce trade costs and spur export diversification.

6.4 Limitations and Suggestions for Future Research

Despite the theoretical and empirical contributions of this study, it has some limitations that should be discussed to develop potential areas for future research.

This study employs standard panel estimators to investigate the sources of trade costs and to assess the effectiveness of AfT in reducing trade costs in SSA. These estimators, however, assume cross-sectional independence, i.e. there is no correlation across panel members arising from the occurrence of common shocks such as a recession or commodity price fluctuations during the period of study. Nevertheless, if neglected, cross-sectional dependence can lead to imprecise estimates and, at worst, to a serious identification problem. The literature on panel time-series modelling recommends the use of heterogeneous panel estimators, such as the Common Correlated Effects Mean Group (CCEMG) of Pesaran (2006) and the Augmented Mean Group (AMG) estimators of Eberhardt and Teal (2010), to account for cross-sectional dependence (CSD) in the dataset. These panel estimators are, however, more appropriate for macro panels with long time series (Eberhardt 2011; Salim, Hassan, and Shafiei 2014). The data available to run the empirical analysis described in Chapter 3 and Chapter 4 is, at best, an unbalanced micro panel. For this reason, more appropriate estimators such as CCEMG or AMG estimators could not be employed in the present study. With more data available in the future, this could be a fruitful avenue of research.

The current study is also based on an analysis of the sources of trade costs in goods and the effectiveness of AfT in reducing costs involved in the trade of agricultural and manufactured goods. It does not analyse the sources of costs of trading in services or the potential of AfT to reduce trade costs in services or the promotion of exports in services. The main reason for not accounting for trade costs in services is the lack of data, particularly in SSA. Miroudot, Sauvage, and Shepherd (2013) employed Novy's (2013) methodology to estimate a comprehensive measure of the cost of international trade in services, but the dataset is limited and excludes SSA countries. Services, however, serve as inputs to the production and export of goods, and the services sector is the second largest sector by employment in SSA. An investigation of the role AfT can play in reducing the costs of international trade in services and in promoting growth through increased trade in services can be a fruitful avenue of future research when relevant data is available.

Another area for future research could be to investigate the role of AfT in helping SSA countries tap into high-value Global Value Chains (GVCs) and global production networks. Limited supply capacity and high trade costs are mainly to be blamed for the continent's low integration in GVCs, although increased participation in GVCs offers promising growth prospects for SSA economies (AfDB 2014; IMF 2015; OECD/WTO 2013). The effectiveness of AfT as a development assistance tool to increase SSA's participation in GVCs could, therefore, be investigated.

Despite these limitations, this present study has important implications for African policymakers and the donor community. This study is the first to empirically investigate the impact of AfT on export diversification along the intensive and extensive margins in SSA. The findings of this research can guide policymakers as they consider AfT as an effective future financing option to stimulate export diversification. Importantly, a knowledge of which category of AfT is most effective helps in the design of appropriate AfT-financed projects. This study also offers insightful directions to the donor community who seeks to optimise the allocation of foreign aid. Moreover, the conceptual model developed to analyse the causality links between AfT, trade costs, and export diversification along the two margins, and the augmented-gravity model formulated for the empirical analysis can be replicated in other AfT-recipient developing regions. This would be of particular interest to donors given their concern about the effectiveness of aid.

APPENDIX TO CHAPTER 2

Table A2.1: Classification of Sub-Saharan African countries

Country	Collier (2008) classification	World Bank (2018)[a]	UNDP (2018)[b]
Angola	Resource rich	Lower middle income	Medium Human Development
Benin	Coastal	Low income	Low Human Development
Botswana	Resource rich	Upper middle income	High Human Development
Burkina Faso	Landlocked	Low income	Low Human Development
Burundi	Landlocked	Low income	Low Human Development
Cabo Verde	Coastal	Lower middle income	Medium Human Development
Cameroon	Coastal	Lower middle income	Medium Human Development
Central African Republic	Landlocked	Low income	Low Human Development
Chad	Landlocked	Low income	Low Human Development
Comoros	Coastal	Low income	Low Human Development
Congo, Dem. Rep.	Resource rich	Low income	Low Human Development
Congo, Rep.	Resource rich	Lower middle income	Medium Human Development
Cote d'Ivoire	Coastal	Lower middle income	Medium Human Development
Equatorial Guinea	Resource rich	Upper middle income	Low Human Development
Eritrea	na.	Low income	Low Human Development
Ethiopia	Landlocked	Low income	Low Human Development
Gabon	Resource rich	Upper middle income	High Human Development
Gambia, The	Coastal	Low income	Low Human Development
Ghana	Coastal	Lower middle income	Medium Human Development
Guinea	Resource rich	Low income	Low Human Development
Guinea-Bissau	Coastal	Low income	Low Human Development
Kenya	Coastal	Lower middle income	Medium Human Development
Lesotho	na.	Lower middle income	Low Human Development
Liberia	Coastal	Low income	Low Human Development
Madagascar	Coastal	Low income	Low Human Development
Malawi	Landlocked	Low income	Low Human Development
Mali	Landlocked	Low income	Low Human Development
Mauritania	Newly resource rich	Lower middle income	Low Human Development
Mauritius	Coastal	Upper middle income	High Human Development
Mozambique	Newly resource rich	Low income	Low Human Development
Namibia	Coastal	Upper middle income	Medium Human Development
Niger	Landlocked	Low income	Low Human Development
Nigeria	Resource rich	Lower middle income	Low Human Development
Rwanda	Landlocked	Low income	Low Human Development
Sao Tome and Principe	na.	Lower middle income	Medium Human Development
Senegal	Coastal	Low income	Low Human Development
Seychelles	na.	High income	High Human Development
Sierra Leone	Coastal	Low income	Low Human Development
Somalia	na.	Low income	na.
South Africa	Coastal	Upper middle income	Medium Human Development
South Sudan	Resource rich	Low income	Low Human Development
Sudan	Newly resource rich	Lower middle income	Low Human Development
Tanzania	Coastal	Low income	Low Human Development
Togo	Coastal	Low income	Low Human Development
Uganda	Landlocked	Low income	Low Human Development
Zambia	Resource rich	Lower middle income	Medium Human Development
Zimbabwe	Landlocked	Low income	Low Human Development

a Countries are classified according to the 2017 gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, $995 or less; lower middle income, $996–$3,895; upper middle income, $3,896–$12,055; and high income, $12,056 or more.

b Countries are classified on the basis of their Human Development Index (HDI) score, calculated using 2017 data. The HDI is a composite index measuring average achievement in three basic dimensions of human development: a long and healthy life, knowledge and a decent living standard. The HDI categories are: 0.800-1.000 (very high), 0.700-0.799 (high), 0.555-0.699 (medium), 0.350-0.554 (low).

APPENDIX TO CHAPTER 3

Table A3.1: Summary of Empirical Evidence on Sources of Trade Costs

Study	Dataset	Methodology	Main Trade Cost Proxy Variable(s)	Summary of Findings
Limão and Venables (2001)	Cross section: 103 countries; 1990	Gravity model; Censored Tobit	Quality of infrastructure	Poor infrastructure impedes trade, and this effect is stronger in SSA. In particular, they find that if a country improves its infrastructure from the median to the 75th percentile, trade would increase by 28%.
Anderson and Marcouiller (2002)	Cross section: 48 countries; 1996	Import demand model; Ordinary Least Squares (OLS)	Institutional quality	They find that a 10% rise in a country's index of transparency and impartiality leads to a 5% increase in import volumes, other things equal.
Wilson, Mann and Otsuki (2003)	Panel: Asia Pacific Economic Cooperation (APEC) members; 1989-2000	Gravity model; Fixed Effects Estimation (FEE)	Port efficiency, customs environment, regulatory environment, e-business usage	Improved port efficiency has the greatest impact on trade flows, followed by fewer regulatory barriers. Greater use of e-business and a better customs environment also promote trade but to a lesser extent than improvements in ports or regulations.
Nordås and Piermartini (2004)	Cross section: 138 countries; 2000	Gravity model; OLS, FEE	Quality of infrastructure	The quality of infrastructure is an important determinant of trade performance, particularly port efficiency.
Freund and Weinhold (2004)	Panel: 56 countries; 1995-1999	Gravity model; FEE, Helpman-Melitz-Rubinstein (HMR), Poisson Pseudo-Maximum Likelihood (PPML), system-GMM estimation	Internet	A 10% point growth in the number of web hosts contributes to a 0.2% point increase in export growth in the following year.

Wilson, Mann and Otsuki (2005)	Panel: 75 countries; 2000-2001	Gravity model; FEE	Port efficiency, customs environment, regulatory environment, service sector infrastructure	An improvement in service sector infrastructure is expected to bring more trade gains than improvement in port infrastructure, regulatory environment, and in the customs environment.
Fink, Mattoo, and Neagu (2005)	Cross section: 1999	Gravity model; FEE	Communication costs	Halving the importer's calling prices (a proxy for communication costs) would boost aggregate trade by 42.5%. Moreover, the authors deduce that communication is more important for trade in differentiated goods as opposed to homogeneous goods.
Clarke and Wallsten (2006)	Cross section: 98 countries; 2001	Gravity model: OLS, two-stage least sqaures (2SLS)	Internet	A 1% increase in the number of Internet hosts per 100 people would increase exports of developing countries to developed countries by 0.08%.
Ranjan and Lee (2007)	Cross section: 1992	Gravity model; Random Effects Estimation (REE)	Institutional quality	They conclude that contract enforcement affects the volume of trade for both types of goods, but the impact is larger for differentiated goods. They also note that measures of contract enforcement in exporting countries have a larger impact on bilateral trade than in importing countries.
Blonigen and Wilson (2008)	Panel: 40 countries; 1991-1999	Gravity model; FEE	Port efficiency	A 1% improvement in port efficiency is expected to result in a 0.4% increase in trade flows. Thus, improving ocean ports is central to trade facilitation.
Disdier and Head (2008)	1467 distance estimates obtained from 103 papers	Meta analysis	Distance	They find that, on average, a 10% increase in distance lowers bilateral trade by 9%. This result is robust to the use of different samples and estimation methods. They also find that the negative impact of distance on trade rose around the middle of the 20th century and has remained persistently high since then.

Zaki (2008)	Cross section: 175 countries; 2006	Gravity model: PPML	Time to trade, number of documents needed, internet	Transaction time for imports and number of documents for exports have a negative impact on trade. Also, the impact of trade facilitation on sectoral trade reveals that some perishable (food and beverages), seasonal (wearing apparels) and high-value added products are more sensitive to import time than other products. Hard industries are sensitive to export documents.
Iwanow and Kirpatrick (2007)	Panel: 78 countries; 2000-2004	Gravity model; HMR, Generalised Least Squares (GLS)	Regulatory environment, infrastructure, on-the-border trade facilitation index	An improvement of 10 percent in trade facilitation brings about a 5 percent rise in exports. However, the same proportionate improvement in regulatory and infrastructure is accompanied by a larger rise in export performance; 9% to 11% and 8%, respectively.
Djankov, Freund and Pham (2010)	Cross section: 98 countries; 2005	Difference gravity model; OLS	Time delays	Each additional day a product is delayed prior to being transited abroad reduces trade by about 1 %. Also, time delays have a bigger impact on the export of time-sensitive goods and on the export of landlocked countries.
Dutt and Traca (2010)	Panel: 122 countries; 1989–2001	Gravity model; FEE, HMR estimation	Corruption	They find that in the majority of the cases, there is support for the trade-taxing extortion effect of corruption. Only in 5% to 10% of observations does corruption enhances trade and that occurs when tariffs are very high.
Hoekman and Nicita (2011)	Cross section: 105 countries; 2006	Gravity model; PPML estimation	Tariff and Non-tariff Barriers (NTBs), Behind-the-border costs (logistics performance index)	Unilateral trade facilitation efforts in terms of reducing behind-the-border trade costs can have a comparable effect in boosting trade as further regional or multilateral trade liberalization, i.e. reduction of tariff and non-tariff barriers, would have.
Freund and Rocha (2011)	Cross section: 45 SSA countries; 2007	Gravity model; OLS & Tobit censored regression	Domestic export delays: transit time, documentation, port handling and customs clearance	Transit delays have the most economically and statistically significant impact on exports in Africa compared to delays caused by documentation, port handling and customs clearance. In particular, a one day increase in inland transit time reduces exports by 7% on average.
Portugal-Perez and Wilson (2012)	Panel: 100 developing countries; 2004-2007	Gravity model; HMR estimation, OLS, PPML	Physical infrastructure, ICT, Border & Transport Efficiency, Business & Regulatory Environment	The coefficients for the four aggregated indicators of trade facilitation are positive but the coefficient for physical infrastructure is largest, followed by the business and regulatory environment, border and transport efficiency and lastly, ICT.

Felipe and Kumar (2012)	Cross section: 140 countries in Central Asia; 2005	Gravity model; Heckman estimation	Overall LPI & LPI individual components: customs, infrastructure, international shipments, competence, tracking, timeliness	Improvements in the exporter overall LPI enhances trade more than the importer LPI. Among the different components of the LPI, improvements in infrastructure appear to have the largest impact on trade flows, followed by logistics and customs efficiency on the exporter side. However, customs efficiency is more significant on the importer side.
Egger and Lassman (2012)	701 language coefficients from 81 articles published in 24 refereed journals; 1970-2011	Meta analysis	Language	They find that, on average, a common language (official or spoken) increases trade flows directly by 44%. The authors also point that the estimated direct effect of common language on bilateral trade is sensitive to the sample period and control variables used in the gravity estimations.
Francois and Manchin (2013)	Panel: 146 reporter countries and 102 partner countries; 1990, 1995, 2000, 2001, 2002, 2003	Gravity model; PPML & HMR estimation	Infrastructure, Institutional quality	Low infrastructure and institutional quality in both the exporting and importing country affects trade performance, albeit the impact is slightly larger in the exporting country. Also, this limits the access of developed countries' exports into developing countries.
Briggs (2013)	Cross section: 2010	Gravity model; HMR estimation	Institutional quality	Improvements in foreign institutions encourage new firms to enter export markets (extensive margin of trade) but has no effect on the volume of exports of existing firms (intensive margin of trade).
Shepherd (2013)	Cross section: 11 industries, 85 developing countries	Fractional logit model	Trade times	Border clearance times influence both export volume and choice of export mode. Also, higher import licensing time reduces the proportion of imported intermediate inputs used in production.
Behar, Manners, and Nelson (2013)	Cross section: 88 low and middle-income exporters, 116 importers; 2007	Gravity model; HMR estimation	International Logistics Index (ILI) - a variant of the LPI	A one standard-deviation improvement in the ILI increases exports for a small country by around 8%. They also estimate this is equivalent to a 14% reduction in distance.

Moïsé and Sorescu (2013)	Panel: 107 countries; 2002-2010	Gravity model; FEE	16 trade facilitation indicators corresponding to the current negotiations under the WTO/OECD Trade Facilitation Indicators (TFIs)	Trade facilitation efforts should be directed towards the availability of trade-related information, the simplification and harmonization of documents, the streamlining of procedures, the use of automated processes and good governance and impartiality. Moreover, they find that that the combined effect of improvements in these TFIs is larger than their individual effects on trade flows and trade costs.
Martí, Puertas and García (2014a)	Cross section: 67 emerging countries having a maritime boundary; 2005 and 2008	Gravity model; OLS	Exporter and Importer Logistics Performance Index (LPI)	Both the exporter and importer LPI coefficients are positive but the magnitude of the latter is lower. Also, the more difficult a good is to transport, the more important the country's logistics performance becomes.
Niru (2014)	Panel: 77 countries; 2004-2007	Gravity model; OLS, PPML, Heckman, & HMR estimation	Physical infrastructure, ICT, Border & Transport Efficiency, Business & Regulatory Environment	The findings indicate that trade facilitation efforts stimulate parts and components trade more than final goods trade. Also, the importer's trade facilitation measure, particularly with regards to border efficiency, is found to have the larger effect. The results imply that border/customs reforms are important for countries that are engaged in assembly of imported components.
Saslavsky and Shepherd (2014)	Cross section: 228 exporters and importers; 2007	Gravity model; OLS, PPML, Gamma Pseudo-Maximum Likelihood, Heckman estimation	Exporter and Importer Logistics Performance Index (LPI)	Trade in parts and components is markedly more sensitive to the importer's trade logistics compared to trade in final goods – a difference of about 45% in the semi-trade elasticity of the LPI. Moreover, there is evidence to suggest that trade logistics is more important for South-South trade compared to South-North trade.
Martí, Puertas and García (2014b)	Cross section: emerging countries with a maritime boundary; 2007 and 2012	Gravity model; Heckman estimation, OLS, Tobit	LPI individual components: customs, infrastructure, international shipments, competence, tracking, timeliness	Countries have made some progress to improve their logistics performance, particularly in Africa, South America and Eastern Europe. All individual components are also positive and statistically significant with respect to trade flows.

Lin (2015)	Panel: 200 countries; 1990-2006	Gravity model; FEE, HMR, PPML, System-GMM	Internet	A 10% growth of the internet usage intensity results in a 0.2–0.4% increase in international trade.
Porto, Canuto, and Morini (2015)	Panel: 72 countries; 2011-2012	Gravity model; OLS, FEE, REE, PPML	Dummies for the existence of Authorized Economic Operator (AEO) program, Single Window (SW) program, and Mutual Recognition Arrangements (MRA) - trade facilitation proxies	The presence of an AEO program and the SW program improve countries' trade performance. By contrast, the existence of MRA does not necessarily improve countries' trade performance.

Table A3.2: List of SSA and Partner Countries in the Sample.

SSA Countries	Partner Countries		
Benin	Albania	Ghana	Nicaragua
Botswana	Algeria	Greece	Nigeria
Cameroon	Argentina	Guatemala	Norway
Chad	Armenia	Guyana	Pakistan
Ethiopia	Australia	Honduras	Panama
Gambia, The	Austria	Hong Kong, China	Paraguay
Ghana	Azerbaijan	Hungary	Peru
Kenya	Bahrain	Iceland	Philippines
Madagascar	Bangladesh	India	Poland
Malawi	Belgium	Indonesia	Portugal
Mali	Bolivia	Ireland	Qatar
Mauritius	Bosnia and Herzegovina	Israel	Romania
Mozambique	Brazil	Italy	Russian Federation
Namibia	Bulgaria	Jamaica	Singapore
Nigeria	Cambodia	Japan	Slovak Republic
South Africa	Cameroon	Jordan	Slovenia
Tanzania	Canada	Kazakhstan	South Africa
Uganda	Chad	Kenya	Spain
Zambia	Chile	Korea, Rep.	Sri Lanka
Zimbabwe	China	Kuwait	Sweden
	Colombia	Kyrgyz Republic	Switzerland
	Costa Rica	Latvia	Tanzania
	Croatia	Lithuania	Thailand
	Czech Republic	Luxembourg	Trinidad and Tobago
	Denmark	Madagascar	Turkey
	Dominican Republic	Malawi	Uganda
	Ecuador	Malaysia	Ukraine
	Egypt, Arab Rep.	Mali	United Arab Emirates
	El Salvador	Mauritius	United Kingdom
	Estonia	Mexico	United States
	Ethiopia	Mongolia	Uruguay
	Finland	Morocco	Venezuela
	France	Mozambique	Vietnam
	Gambia, The	Namibia	Zambia
	Georgia	Netherlands	Zimbabwe
	Germany	New Zealand	

Country pairs formed from the selected sample of countries are represented only once in the dataset. This is because the trade cost variable used in the study is a bilateral geometric average figure and including bi-directional country pairs would generate repeated values for the same variable. This differs from the usual gravity approach whereby direction matters.

Appendix 3.1A: Construction of Trade Facilitation Indicators

The methodology of Portugal-Perez and Wilson (2012) is adapted to construct the four trade facilitation indicators. This uses factor analysis as a data reducing technique to obtain a smaller number of trade facilitation indicators from a larger set of primary variables collected from different sources.

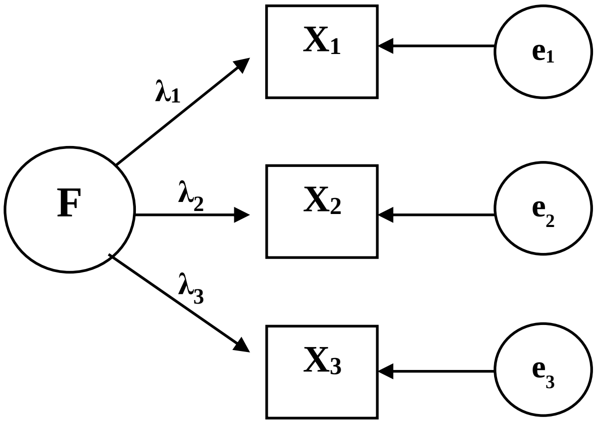
In particular, the factor analysis technique postulates that a set of observable random variables $X_1, X_2, \ldots, X_p$ is linearly correlated with a few unobservable random variables $F_1, F_2, \ldots, F_m$, called common factors, and p additional sources of variation $e_1, e_2, \ldots, e_p$, called errors or unique factors (Johnson and Wichern 2007). The factor model is outlined below:

$$
\begin{aligned}
(1) \qquad X_1 &= \lambda_{11}F_1 + \lambda_{12}F_2 + \ldots + \lambda_{1m}F_m + e_1 \\
X_2 &= \lambda_{21}F_1 + \lambda_{22}F_2 + \ldots + \lambda_{2m}F_m + e_2 \\
&\vdots \\
X_p &== \lambda_{p1}F_1 + \lambda_{p2}F_2 + \ldots + \lambda_{pm}F_m + e_p
\end{aligned}
$$

The coefficient λ_{ij} is the factor loading of the ith variable on the jth factor. It provides information on the weight and correlation between each observed variable and the common factor(s). In this way, factor loadings reflect the relevance of the observed primary variable in explaining the common factor. It is noteworthy that the ith specific factor e_i is associated with the ith response X_i only.

In the event of a single common factor (F) and three observed primary variables (X_1, X_2, X_3), the factor analysis process can be depicted below:

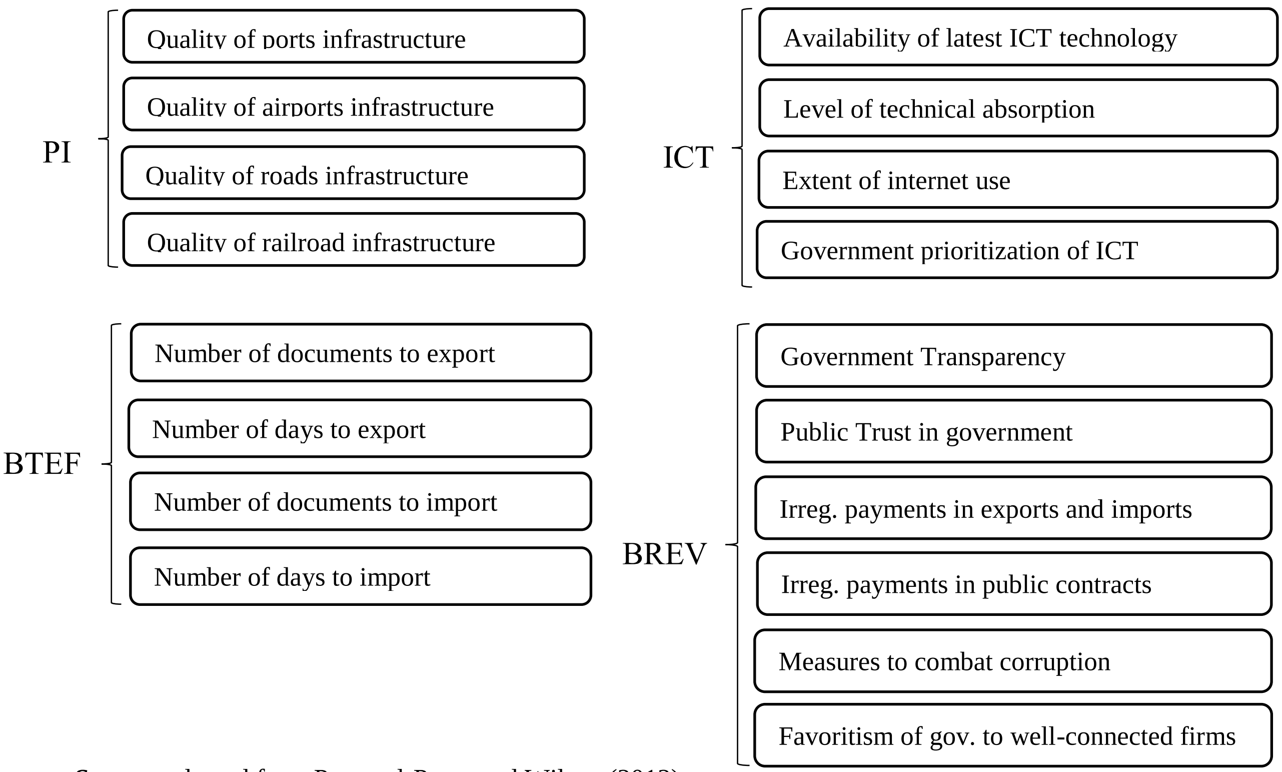
Figure A3.1: The Factor Analysis Process



Source: adapted from Portugal-Perez and Wilson (2012)

The factor analysis output of Portugal-Perez and Wilson (2012) identifies four factors that represent trade facilitation: *Physical Infrastructure (PI), Information and Communication Technologies (ICT), Border and Transport Efficiency (BTEF),* and *Business and Regulatory Environment (BREV).* Data needed to develop a comprehensive index for each of the four factors were obtained from the following sub-group of primary variables:

Figure A3.2: Construction of the Trade Facilitation Proxy Variables



Source: adapted from Portugal-Perez and Wilson (2012)

The pool of 18 sub-indicator primary variables was collected from different sources: World Economic Forum (WEF), Doing Business (DB), and Transparency International (TI). Each variable was standardised to values that range from 0 to 1 to facilitate comparison. The higher the value obtained, the better the performance of the country along the corresponding trade facilitation dimension. Also, the maximum value per indicator during the whole period was used to rescale the indicators to preserve year variability.

The standardised values were then subject to a two-step factor analysis procedure. The first step contributes to the identification of the sub-group of variables to be considered for each aggregate indicator as depicted above, while the second step generates the factor scores for each of the four aggregate trade facilitation indicators from the sub-group of indicators.

Table A3.3 presents the summary statistics for values of the trade facilitation indices and the primary indicators used for the period 2008 to 2012 along with their respective sources.

Table A3.3: Summary Statistics of the Trade Facilitation Indicators

Trade Facilitation Index	Primary Variables	Source	Mean	Std. Dev.	Min	Max
Physical Infrastructure (PI)			0.52	0.22	0.008	1
	Quality of roads	WEF	0.53	0.23	0.07	1
	Quality of railroads	WEF	0.38	0.26	0.003	1
	Quality of ports	WEF	0.56	0.20	0.07	1
	Quality of airports	WEF	0.63	0.18	0.20	1
Information & Communication Technology (ICT)			0.58	0.21	0.009	1
	Availability of latest technologies	WEF	0.68	0.16	0.29	1
	Firm-level technology absorption	WEF	0.70	0.13	0.37	1
	Extent of business internet use	WEF	0.68	0.15	0.20	1
	Govt. prioritization of ICT	WEF	0.66	0.15	0.27	1
Border & Transport Efficiency (BTEF)			0.75	0.18	0.01	1

	Number of documents to export	DB	0.73	0.15	0.07	1
	Number of days to export	DB	0.83	0.16	0.01	1
	Number of documents to import	DB	0.70	0.16	0.06	1
	Number of days to import	DB	0.82	0.17	0.01	1
Business Regulatory Environment (BREV)			0.39	0.25	0.016	1
	Corruption Perception Index	TI	0.43	0.26	0.07	1
	Diversion of public funds	WEF	0.48	0.23	0.10	1
	Public trust in politicians	WEF	0.36	0.22	0.05	1
	Irregular payments in exports and imports	WEF	0.58	0.21	0.16	1
	Favouritism in decisions of govt. officials	WEF	0.45	0.19	0.14	1

The primary data collected and standardised for each of the four dimensions of trade facilitation were factor analysed separately. In each case, only the factor that was accounting for most of the variance in the dataset was retained. Table A3.4 below shows the variance and the relative weight of each factor in the total variance (proportion):

Table A3.4: Variance and the Relative Weight of Each Factor Retained

Common Variance

Factor	**Variance**	**Proportion**
Physical Infrastructure	2.52	0.89
Information & Communication Technology	2.54	0.84
Border & Transport Efficiency	3.07	0.92
Business & Regulatory Environment	4.40	0.97

As can be observed, each factor accounts for more than 80% of the total variance present in the dataset.

Table A3.5: Factor Loadings of Each Primary Variable

Variable	Loadings	Uniqueness
Quality of roads	0.83	0.18
Quality of railroads	0.66	0.41
Quality of ports	0.84	0.17
Quality of airports	0.84	0.23
Availability of latest technologies	0.91	0.06
Firm-level technology absorption	0.84	0.07
Extent of business internet use	0.86	0.22
Govt. prioritization of ICT	0.51	0.52
Number of documents to export	0.83	0.32
Number of days to export	0.92	0.16
Number of documents to import	0.85	0.28
Number of days to import	0.91	0.17
Corruption Perception Index	0.93	0.14
Diversion of public funds	0.98	0.04
Public trust in politicians	0.90	0.18
Irregular payments in exports and imports	0.93	0.14
Favouritism in decisions of government officials	0.95	0.10

Table A3.5 shows the factor loadings and uniqueness of each primary variable. Factor loadings are the weights and correlations between each variable and the factor. The higher the load, the more relevant the variable is in defining the factor's dimensionality (Pallant 2011). Most of the variables have a factor loading above +0.8, indicating a high correlation. Its uniqueness corresponds to the variance that is 'unique' to the variable and not shared with other variables. Lower 'uniqueness' values imply the variable is more relevant in the factor analysis model.

The results of the factor model were rotated using the Varimax method to get a clearer pattern (Kaiser 1958). Varimax produces orthogonal factors, i.e. factors that are not correlated to each other, and attempts to minimise the number of variables that have high loadings on each factor. Based on the Varimax rotated factors, factor scores were then generated using the regression scoring method (Burns and Burns 2008).

Table A3.6: Summary Statistics of Variables used in Chapter 3 Estimation

Variables	Obs.	Mean	Std. Dev.	Min	Max
Bilateral Trade Costs	11,662	323.6	166.1	11.83	2,299
PI	17,715	0.350	0.155	0.00116	0.738
ICT	17,715	0.356	0.147	0.00913	0.744
BREV	17,715	0.268	0.136	0.0223	0.638
BTEF	17,715	0.546	0.158	0.134	0.904
Tariff	17,715	1.052	0.0548	1	2.016
Distance (km)	17,715	7,755	3,171	105.2	17,591
Regional Trade Agreement	17,715	0.0593	0.236	0	1
Common border	17,715	0.0127	0.112	0	1
Common language (official)	17,715	0.199	0.399	0	1
Common language (ethnographic)	17,715	0.186	0.389	0	1
Colony	17,715	0.0107	0.103	0	1
Common coloniser	17,715	0.133	0.339	0	1
Same country	17,715	0.00305	0.0551	0	1
Landlocked	17,715	0.0670	0.250	0	1

Appendix 3.2A: Discussion of Diagnostic Tests

Model Specification Tests

A simple test for the presence of heterogeneity in the dataset is the F test (Baltagi 2008; Kunst 2009). It compares the efficiency of the pooled OLS to the fixed effects model specification. Formally, the null $\mu_i = 0$ is tested against the alternative $\mu_i \neq 0$ using the following F statistic:

$$(2) \qquad F = \frac{(ESS_R - ESS_U)/(N-1)}{ESS_U/((T-1)N-K)}$$

ESS_R denotes the residual sum of squares under the null hypothesis, ESS_U the residual sum of squares under the alternative. Under H_0, the F statistic is distributed as F with $(N-1,(T-1)N-K)$ degrees of freedom. Table A3.7 reports the calculated F values. They are statistically significant, indicating the presence of heterogeneity in the data. Hence, the pooled OLS is rejected in favour of the fixed effects model.

To determine the efficiency of the pooled OLS over the random effects specification model, Breusch and Pagan (1980) have devised a Lagrange multiplier (LM) test to assess the presence of random unobserved effects in the panel setting. The null and alternative hypotheses can be stated as follows:

$$(3) \qquad \begin{aligned} H_0 &: \sigma_\mu^2 = 0 \\ H_1 &: \sigma_\mu^2 \neq 0 \end{aligned}$$

σ_μ^2 represents the variance of the individual unobserved effects. If the test statistics reject the null hypothesis, one can conclude there is random heterogeneity to account for in the panel model. The test statistics (LM) is based on the OLS residuals, $\hat{\varepsilon}_{it} = y_{it} - \hat{\alpha} - \hat{\beta}x_{it}$, and is calculated as follows:

$$(4) \qquad LM = \frac{NT}{2(T-1)} \left\{ \frac{\sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{\varepsilon}_{it} \right)^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{\varepsilon}_{it}^2} - 1 \right\}$$

Under the null hypothesis, LM follows a chi-square distribution with one degree of freedom, i.e. $LM \sim \chi^2_{(1)}$. The LM calculated values reported in Table A3.7 are statistically significant suggesting the presence of random heterogeneity. The random effects model performs better than the pooled OLS.

If there exists unobserved effects to be accounted for, the researcher would then be concerned about which unobserved effects model to employ that would yield the most efficient estimate of β. The choice is between the fixed effects and the random effects model.

As argued earlier, the GLS estimator of β under the random effects model relies on the assumption of no correlation between the unobserved effects and the explanatory variable, i.e. $E(X_{it}u_{it}) = 0$, or more precisely, $E(X_{it}\mu_i) = 0$ and $E(X_{it}\lambda_t) = 0$. If these do not hold, $\hat{\beta}_{RE}$ (estimate of β under the random effects model) is biased and inconsistent. On the other hand, the Within estimator of β under the fixed effects model allows for *arbitrary* correlation between the unobserved effects and the explanatory variable, thereby making $\hat{\beta}_{FE}$ (estimate of β under the fixed effects model) unbiased and consistent.

To compare the efficiencies of $\hat{\beta}_{RE}$ and $\hat{\beta}_{FE}$, Hausman (1978) suggests a test with the following null and alternative hypotheses:

$$(5) \qquad \begin{aligned} H_0 &: E\left(X_{it}u_{it}\right) = 0 \\ H_1 &: E\left(X_{it}u_{it}\right) \neq 0 \end{aligned}$$

The Hausman test statistics, which follows a chi-square distribution, can be calculated as follows:

$$(6) \qquad t = \frac{\hat{\beta}_{FE} - \hat{\beta}_{RE}}{\left[\widehat{var}\,(\hat{\beta}_{FE}) - \widehat{var}\,(\hat{\beta}_{RE})\right]^{1/2}}$$

The null hypothesis suggests there is no correlation between the unobserved effects and the explanatory variable, in which case both $\hat{\beta}_{RE}$ and $\hat{\beta}_{FE}$ would be consistent. Thus if the test statistics fails to reject the null hypothesis, it would imply that both the fixed and random effects model yield consistent estimates. However, if the null hypothesis is rejected by the test statistics, $\hat{\beta}_{FE}$ would remain consistent while $\hat{\beta}_{RE}$ would be inconsistent, in which case the researcher would be in favour of the fixed effects model estimates.

The Hausman test statistics are statistically significant as observed from Table A3.7. This leads to the rejection of the null hypothesis, and the fixed effects model is favoured over the random effects model.

Heteroscedasticity

Panel data estimation methods are no different to other estimation techniques. They also assume the disturbance term is homoscedastic with the same variance across time and individuals when estimating β. However, this may not hold in a panel that consists of different cross-sectional units. Although the coefficient estimates would still be consistent in the presence of heteroscedasticity, they would not be efficient. Also, the standard errors of the estimates would be biased.

The Modified Wald test, developed by Greene (2003), is used to test for group-wise heteroscedasticity under the fixed effects model. The hypotheses are:

$$(7) \qquad \begin{aligned} H_0 &: \sigma_i^2 = \sigma^2 \\ H_1 &: \sigma_i^2 \neq \sigma^2 \end{aligned}$$

The modified Wald test statistic is defined as:

$$(8) \qquad W = \sum_{i=1}^{N} \frac{\left(\hat{\sigma}_i^2 - \hat{\sigma}^2\right)^2}{V_i}$$

where, $\hat{\sigma}_i^2 = \frac{1}{T}\sum_{t=1}^{T} e_{it}^2$ represents the estimator of the i^{th} cross-sectional unit error variance computed from the residuals e_{it} for each unit. V_i is the estimated variance of $\hat{\sigma}_i^2$ and is obtained from $V_i = \frac{1}{T}\frac{1}{T-1}\sum_{t=1}^{T}\left(e_{it}^2 - \hat{\sigma}_i^2\right)^2$. $\hat{\sigma}^2$ is the disturbance variance estimator that is generated from the pooled OLS model.

The test statistic follows a chi-square distribution with N degrees of freedom. Rejection of the null hypothesis would imply that there is heteroscedasticity. The calculated modified Wald statistic is statistically significant, suggesting the presence of heteroscedasticity in the estimation model.

Serial Correlation

The presence of serial correlation in the idiosyncratic error terms in the panel data model would also lead to biased standard errors and make the estimation results inefficient. While there exists several tests for serial correlation such as the Modified Durbin-Watson test by Bhargava, Franzini and Narendranathan (1982) and the Baltagi-Wu test derived in Baltagi and Wu (1999) among others, the Wooldridge test (Wooldridge 2010) is used. This is because it relies on fewer assumptions and is more robust (Drukker 2003).

The Wooldridge test employs the residuals of a regression in first-differences. Let $y_{it} = \alpha + \mathbf{X}_{it}\beta_1 + \mu_i + \varepsilon_{it}$ and $y_{it-1} = \alpha + \mathbf{X}_{it-1}\beta_1 + \mu_i + \varepsilon_{it-1}$. Taking the first differences of these two regression models yields $y_{it} - y_{it-1} = (\mathbf{X}_{it} - \mathbf{X}_{it-1})\beta_1 + (\varepsilon_{it} - \varepsilon_{it-1})$, i.e. $\Delta y_{it} = \Delta\mathbf{X}_{it}\beta_1 + \Delta\varepsilon_{it}$. The residuals $\Delta\varepsilon_{it}$ are then used as dependent variables in another regression model with their lagged values $\Delta\varepsilon_{it-1}$ as independent variables.

$$(9) \qquad \begin{aligned} &\Delta\varepsilon_{it} = \hat{\rho}_1\Delta\varepsilon_{it-1} + error_{it} \\ &t = 3, 4, \ldots, T \\ &i = 1, 2, \ldots, N \end{aligned}$$

Following Wooldridge's procedure, there is a case of no serial correlation if the lagged residuals of Equation (7) are equal to -0.5. This represents the null hypothesis, which is tested against the alternative hypothesis that $\hat{\rho}_1 \neq -0.5$. Table A3.7 reports the calculated test statistics for the Wooldridge test. Since these are statistically significant, the null hypothesis is rejected, indicating the presence of serial correlation in the estimations.

Table A3.7: Diagnostic Tests for Chapter 3 Estimation

	Fixed Effects Model		Random Effects Model
DV: Trade Costs, Total			
Specification Tests			
Poolability test (F test)	24.66***		
Breusch and Pagan LM test			25489.12***
Hausman test		206.49***	
Heteroscedasticity			
Modified Wald test	1.2e+59***		
Serial Correlation			
Wooldridge test	265.454***		
DV: Trade Costs, Manufactured Goods			
Specification Tests			
Poolability test (F test)	19.68***		
Breusch and Pagan LM test			17625.48***
Hausman test		131.47***	
Heteroscedasticity			
Modified Wald test	2.4e+59***		
Serial Correlation			
Wooldridge test	183.668***		
DV: Trade Costs, Agricultural Goods			
Specification Tests			
Poolability test (F test)	22.30***		
Breusch and Pagan LM test			10493.44***
Hausman test		57.96***	
Heteroscedasticity			
Modified Wald test	2.2e+59***		
Serial Correlation			
Wooldridge test	140.359***		

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

APPENDIX TO CHAPTER 4

Table A4.1: List of SSA countries used in the Baseline Estimation

Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Cote d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Table A4.2: Summary Statistics of Variables used in Chapter 4 Estimation

Variables	Obs.	Mean	Std. Dev.	Min	Max
TC *(All goods)*	49,778	324.1	160.2	11.24	2,299
TC *(Manufactured goods)*	40,973	299.5	147.8	8.486	1,397
TC *(Agricultural goods)*	20,647	360.5	172.4	18.24	1,969
AfT^{total} (US$m)	192,700	17.88	35.37	0	325.6
AfT^{TPR} (US$m)	192,700	26.82	39.81	0	283.8
AfT^{INF} (US$m)	192,700	0.915	3.225	0	39.45
AfT^{PC} (US$m)	192,700	0.296	2.026	0	34.60
AfT^{TF} (US$m)	192,700	45.62	69.62	0	546.2

Note: The summary statistics are conditional on AfT being non-negative. Net AfT flows which are negative following the repayment of ODA loans are removed.

Table A4.3: Diagnostic Tests for Chapter 4 Estimation

	Fixed Effects Model		Random Effects Model
DV: Trade Costs, Total			
Specification Tests			
Poolability test (F test)	35.86***		
Breusch and Pagan LM test			2.1e+05***
Hausman test		55.36***	
Heteroscedasticity			
Modified Wald test	5.8e+32***		
Serial Correlation			
Wooldridge test	1482.521***		
DV: Trade Costs, Manufactured Goods			
Specification Tests			
Poolability test (F test)	28.61***		
Breusch and Pagan LM test			1.6e+05***
Hausman test		71.67***	
Heteroscedasticity			
Modified Wald test	2.1e+35***		
Serial Correlation			
Wooldridge test	1242.689***		
DV: Trade Costs, Agricultural Goods			
Specification Tests			
Poolability test (F test)	8.26***		
Breusch and Pagan LM test			79081.06***
Hausman test		37.70***	
Heteroscedasticity			
Modified Wald test	1.2e+32***		
Serial Correlation			
Wooldridge test	690.232***		

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

APPENDIX TO CHAPTER 5

Table A5.1: Summary Statistics of Variables used in Chapter 5 Estimation

Variables	Obs.	Mean	Standard Deviation	Min	Max
Extensive margin (count)	186,480	19.78	126.7	0	3,825
Intensive margin (exports per product)	186,480	542.0	7,709	0	879,276
HK extensive margin	186,480	0.0212	0.0778	0	1
HK imtensive margin	186,480	0.0257	0.116	0	1
Aft_infrastructure (US$m)	166,320	19.30	37.03	0	325.6
Aft_productive capacity (US$m)	166,320	29.15	41.41	0	283.8
Aft_trade facilitation (US$m)	166,320	0.324	2.141	0	34.60
Aft_total (US$m)	166,320	49.45	72.51	0	546.2
Aft_other trade policy (US$m)	166,320	0.683	2.377	0	36.22
GDP_exporter (US$)	176,046	1.824e+10	5.621e+10	7.223e+07	5.685e+11
GDP_importer (US$)	158,424	2.599e+11	1.117e+12	1.103e+07	1.739e+13
POP_exporter	185,814	1.613e+07	2.475e+07	75,304	1.765e+08
POP_importer	171,108	3.180e+07	1.244e+08	9,230	1.364e+09
Distance (km)	173,880	7,672	4,334	8.023	19,904
Tariff	53,741	12.59	16.61	0	1,593
Common Border	173,880	0.0175	0.131	0	1
Common Official Language	173,880	0.256	0.436	0	1
Common Colony	173,880	0.00541	0.0733	0	1
Landlockedness	173,880	0.440	0.579	0	2
Regional Trade Agreement	159,600	0.0731	0.260	0	1
GSP	140,598	0.144	0.351	0	1

Note: The summary statistics are conditional on AfT being non-negative. Net AfT flows which are negative following the repayment of ODA loans are removed.

Table A5.2: SSA Country list

Benin	Gambia	Sao Tome and Principe
Burkina Faso	Ghana	Senegal
Burundi	Guinea	Seychelles
Cabo Verde	Guinea-Bissau	Sierra Leone
Cameroon	Kenya	Somalia
Central African Rep.	Liberia	South Africa
Chad	Madagascar	Sudan
Comoros	Malawi	Togo
Congo	Mali	Uganda
Côte d’Ivoire	Mauritania	United Rep. of Tanzania
Djibouti	Mauritius	Zambia
Equatorial Guinea	Mozambique	Zimbabwe
Eritrea	Niger	
Ethiopia	Nigeria	
Gabon	Rwanda	

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