THE IMPORTANCE OF BILATERAL AGREEMENTS ON TRADE FLOWS: A CASE OF THE TRADE DEVELOPMENT AND COOPERATION AGREEMENT (EU-SA TDCA)

by

GEORGES BUKASA KABAMBA

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SUPERVISOR: Professor Aregbeshola R. Adewale

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DECLARATION

Name: GB KABAMBA

Student number: 43506712

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ABSTRACT

This study analysed the intricacies of trade flows imbibed in the EU-SA TDCA. It assessed the trade creation and trade diversion effects of this bilateral trade agreement – using the top 10 selected commodity exports. This follows the report on the Harmonised System (HS) at the 2-digit codes. A Gravity Model Approach on bilateral trade flows is grounded on panel data models for the period 2000-2017 between South Africa as exporter country and the twenty EU countries (EU-20) as importer country-block out of the twenty-eight countries (EU-28).

The study reports that the EU-SA TDCA enhanced significant trade expansion and trade creation effects. Mixed results for GDPs and GDPPKs for both South Africa and the EU countries were reported, but the overall results showed that the bilateral agreement do affect South African commodity exports more negatively, albeit with few positive effects from the EU countries in particular. Besides, ICTSA does have a negative effect on commodity exports, while the South African REER has the positive effect on export models. Lastly, the distance as a proxy of transportation costs negatively affects South Africa's exports, while common colonial relationship and English as common official language have both a positive effect on exports. The findings imply that trade policies should focus on adequate telecommunication tools, alongside fair trade practices allowing South Africa to integrate with the global market, promote economic growth as well as enhance competitive advantage in most sectoral trades.

Keywords: Commodity exports, bilateral trade agreement, trade creation, trade diversion, gravity model, panel data estimation, ICT, fixed effect model.

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ABBREVIATIONS AND ACRONYMS DEFINITIONS

ACP	African, Caribbean and Pacific
ADF	Augmented Dickey-Fuller
AGADIR	FTA between Egypt, Jordan, Morocco and Tunisia
AMU	Agreement for Algeria, Libya, Morocco, and Tunisia
ASEAN	Association of Southeast Asian Nations
BTFs	Bilateral Trade Flows
CEEC	Central and Eastern European Countries
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CGE	Computable General Equilibrium
CIA	Central Intelligence Agency
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
EC	European Community
EPA	Economic Partnership Agreements
EU	European Union
FEM	Fixed Effect Model
FTA	Free Trade Agreements
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GDPPK	Gross Domestic Product per capita
GMM	Generalized Method of Moment
GSP	Generalized System of Preferences
HS	Harmonized System
HT	Hausman Taylor
IPS	Im, Pesaran and Shin
IV	Instrumental Variable
LLC	Levin, Lin and Chu
MERCOSUR	Southern Common Market
MFN	Most Favored Nation
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
POLS	Pooled Ordinary Least Squares
PPML	Poisson Pseudo Maximum-Likelihood
PTA	Preferential Trade Agreements
REER	Real Effective Exchange Rate
REM	Random Effect Model
RTA	Regional Trade Agreements
SA	South Africa
SACU	Southern African Customs Union
SADC	Southern African Development Community
TDCA	Trade, Development and Co-operation Agreement
TRQ	Tariff Rate Quotas
UNComtrade	United Nations Commodity Trade
UNCTAD	United Nations Conference on Trade and Development
WDI	World Development Indicators
WTO	World Trade Organization

CHAPTER ONE
INTRODUCTION AND BACKGROUND

1.1. Background

In the genesis, the Trade Development and Co-operation Agreement (TDCA) is a bilateral agreement that covers trade relations, development cooperation, economic cooperation and other various fields including socio-cultural co-operation and political dialogue between the Republic of South Africa and fifteen Member States of the European Union (EU-15) namely Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom (OJ L 311 1999:3).

According to DIRCO (2009), the TDCA of October 1999 was signed after five years of rigorous multilateral negotiations between EU-15, South Africa, and southern African Customs Union (SACU) members. The agreed trade instrument provisionally and partially came into effect from 1 January 2000. After the dry-run period, it was fully implemented from the 1st of May 2004; after signature endorsement by all the parties. This further resulted in the establishment of Preferential Trade Arrangements (PTA) between the European Union (EU) and South Africa (SA), with the continuous systematic introduction of a Free Trade Area (FTA). The major aim of the EU-SA FTA was to improve access to the EU market for South Africa and access to the South African market for the EU. Thus, the EU-SA FTA economically acts as a very significant integrator of South Africa’s agribusiness into the global marketplace. The major strategic importance of the agreement lies in its trade openness approach, essentially in agricultural produce. Accruing to the agreement, the enabling instrument liberates 95% of trade for the EU's imports from South Africa within ten years and 86% of South Africa's imports from the EU within twelve year (Deeplal 2016). Certain products were excluded from the FTA, while admittance of other products was limited as a safety measure. The excluded or classified products included agricultural products for EU and industrial products for South Africa such as motor vehicle products as well as certain textile and clothing products (OJ L 311 1999:6-12).

With the implementation of the agreement, South Africa stands as one of Europe’s 15th largest trading partners. Record suggests that there was a remarkable increase in trade between 2000 and 2007 with the original 15 EU Member States (EU-15) as agreed upon in

the TDCA with SA in 1999. During this period, trade between these parties accumulated to R240 billion from R140 billion in 2000 (European Commission 2019:3). During the same period, exports escalated to R124 billion from R66.1 billion while imports increased from R74.5 billion to R180 billion. Bilateral trade between South Africa and the new EU member states is also increasing rapidly. For example and according to the European Commission (2019a:3), between 2000 and 2004 total trade with the new EU Member states increased by 234% (DIRCO 2009).

In 2004, the South African Department of International Relations and Cooperation (DIRCO) realised the need to update TDCA and pioneered its review. The Department of International Relations and Cooperation led to the formal TDCA revision negotiation which was launched on 27 March 2007 (DIRCO 2010). There were thirty-five new and revised articles that were initialled by the chief negotiators on 10 October 2007 and Minister Nkoana-Mashabane assented to the amending agreements during the 2nd SA-EU Summit on 11 September 2009 (PMG 2010). In 2007, the European Union increased its membership to 27 sovereign Member States (EU-27). The enlargement protocol legally assists the EU to extend the TDCA to all Member States and ensures that all of them benefit from the following trade implications (PMG 2015):

- An application of EU's Common External Tariff on exports to new member states;
- A column for EU in SA Customs & Excise Act to be applicable to imports from new member states; and a reduction in tariff duties will result over time in Government forfeiting revenues collected from import trade;
- The enlargement provides South Africa with market access to 27 countries compared to the original EU-15 in 1999, later EU-25 in 2004. Thus, South African products have increased in the larger external market than prior to the enlargement.

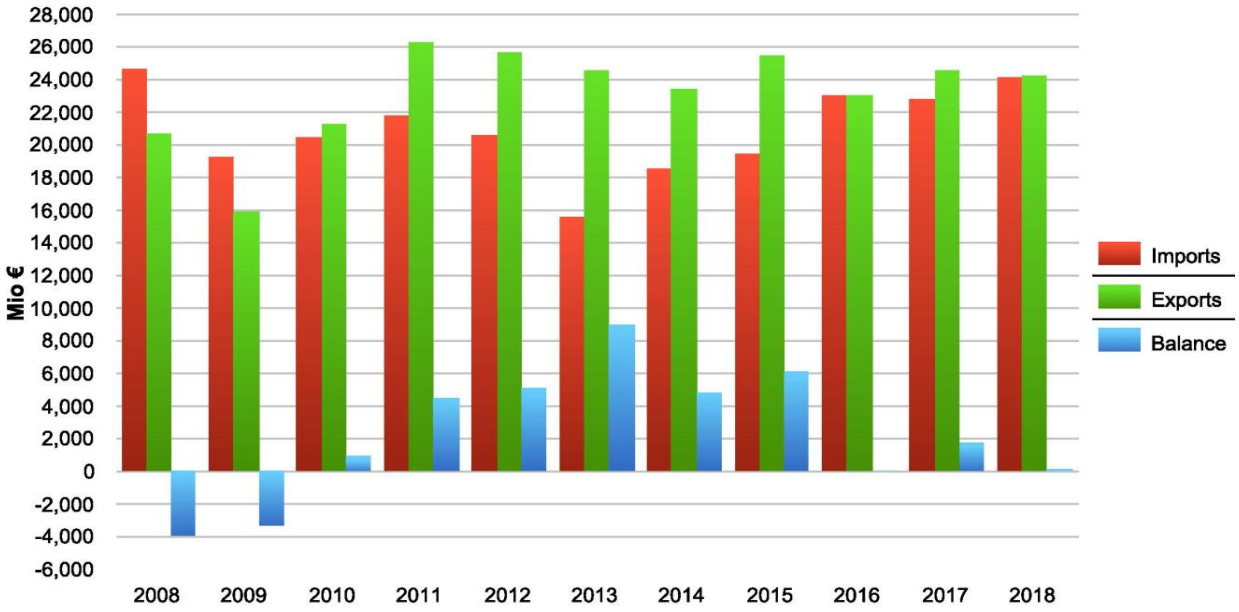
According to van Heerden (2008:10) the evolution of the trade balance from the point at which the TDCA was implemented to the present time must be considered when reflecting on the impact of the TDCA on South Africa-EU trade relations following the trade balance which is the "value of the EU exports to SA" minus the "value of the EU imports from SA." The EU trade values in international trade in goods with SA are reported in Table 1.1 and Figure 1.1 below.

Table 1.1 EU-28'strade with South Africa 2008-2018 (Million euros)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
South Africa											
Exports	20,594	15,860	21,287	26,232	25,580	24,481	23,331	25,455	22,995	24,447	24,177
Imports	24,618	19,252	20,422	21,760	20,514	15,560	18,538	19,399	22,970	22,722	24,072
Balance	-4,024	-3,391	865	4,472	5,067	8,921	4,794	6,056	25	1,725	104
% Growth											
Exports	-	-23.0	34.2	23.2	-2.5	-4.3	-4.7	9.1	-9.7	6.3	-1.1
Imports	-	-21.8	6.1	6.6	-5.7	-24.2	19.1	4.6	18.4	-1.1	5.9
% Extra-EU											
Exports	1.6%	1.4%	1.6%	1.7%	1.5%	1.4%	1.4%	1.4%	1.3%	1.3%	1.2%
Imports	1.6%	1.6%	1.3%	1.3%	1.1%	0.9%	1.1%	1.1%	1.3%	1.2%	1.2%

% Growth: relative variation between the current and previous period
% Extra-EU: imports/exports as % of all EU partners, i.e. excluding trade between EU Member States
Source: European Commission (2019:3)

Figure 1.1 EU-28's trade with South Africa 2008-2018 (Million euros)



Source: European Commission (2019:3).

Table 1.1 and Figure 1.1 above indicate that after the decline in the EU-28 trade with South African goods observed in 2008, exports to South Africa became healthier and realised 26.2 million euros in 2011, while imports from South Africa grew more slowly to reach 21.7 million euros in the same year, which is still below the peak of 24.6 million euros in 2008. In general, there was a surplus in trade between the EU-28 and South Africa, where South Africa recorded a surplus with the highest of 8.9 million euros in 2013, compared with +5.0 million euros in 2012 and +6.0 million euros in 2015. Table 1.1 and Figure 1.1 also reveal that the European Union's exports to South Africa have a slight increase as a result of the implementation of the EU-SA TDCA. From Figure 1.1, export reached its peak 2011 at a

value of roughly 27 billion euro, closely followed by values around 22 billion euro in 2012 and 2015. From the Figure, it is evident that the EU have benefitted extensively from a far larger export to South Africa than the other way round. One may thus be tempted to suggest that EU has been the largest beneficiary of this arrangement at the expense of South African exporters.

Table 1.2 SA's trade with EU-28 and its top 10 trading partners in 2018 (Million euros)

	Imports (Millions €)				Exports (Millions €)		
	Partners	**Value Mio €**	**% World**		**Partners**	**Value Mio €**	**% World**
	World	83,527	100.0		**World**	79,871	100.0
1	**EU 28**	24,243	29.0	**1**	**EU 28**	18,665	23.4
2	**China**	15,549	18.6	**2**	**China**	7,403	9.3
3	**USA**	4,978	6.0	**3**	**USA**	5,393	6.8
4	**Saudi Arabia**	4,813	5.8	**4**	**Japan**	3,803	4.8
5	**India**	3,430	4.1	**5**	**India**	3,773	4.7
6	**Nigeria**	3,393	4.1	**6**	**Botswana**	3,474	4.4
7	**Thailand**	2,594	3.1	**7**	**Namibia**	3,046	3.8
8	**Japan**	2,536	3.0	**8**	**Mozambique**	2,766	3.5
9	**Brazil**	1,345	1.6	**9**	**Zambia**	2,067	2.6
10	**United Arab Em.**	1,208	1.4	**10**	**Zimbabwe**	1,995	2.5
	EU-28	24,243	29.0		**EU-28**	18,665	23.4

Source: European Commission (2019:8)

Besides, Table 1.2 above shows South Africa's 2018 trade relations with its top 10 partners in the world with EU-28, China and USA as the top 3. This is supported by the cumulative share percentages of the EU-28, China and the USA, which accumulated to 53.6% imports to South Africa and 39.5% exports to the three in 2018. The same lopsided experience continues with Japan and India with 7.1% imports from South Africa and 9.5% exports to South Africa. In other words, the EU-28, China, USA, Japan and India accounted for over half of South Africa's trade in 2018. Southern Africa countries such as Botswana, Namibia, Mozambique, Zambia and Zimbabwe represent 16.8% of all South African exports in 2018. This suggests that the EU-SA TDCA leads South Africa to create trade with the Western and Asian countries and divert trade from the SADC countries.

As shown in Table 1.1 and Figure 1.1 related to the EU-28 in international trade in goods with South Africa (Million euros), SA was predicted to benefit from the EU-SA TDCA (Lee 2002), but the experience thus far has been contrary (Lewis, Robinson & Thierfelder 2002). On the one hand, while the trading growth rates for SA and EU individually reveal that the EU's exports and SA's imports were beneficial for both traders. Seemingly, SA also slightly

gained from the export side than import essentially in 2008/2009. In addition, the trade balance shows that EU benefited more over the past decade, except for 2008 and 2009 in which EU registered a negative balance of -4.029 and -3391 respectively. These negative values could be attributed to the global financial crisis 2007-2009. Finally, theEU-28 is exporting excessively to SA while SA is importing much from EU from 2010 to 2018 in Table 1.1.On the other hand, it also crucial to look at the magnitude of the overall commodity trade flows between EU and South Africa. Table 1.3 below indicates the commodity trade flows between the traders referred from 2015 to 2018.

Table 1.3 EU trade flows with South Africa by HS Section 2015-2018

		Imports (Millions €)				**Exports** (Millions €)			
	HS Sections	**2015**	**2016**	**2017**	**2018**	**2015**	**2016**	**2017**	**2018**
	TOTAL	**19,399**	**22,970**	**22,722**	**24,072**	**25,455**	**22,995**	**24,447**	**24,177**
I	Live animals; animal products	204	241	247	296	389	390	318	274
II	Vegetable products	1,733	1,808	1,932	2,092	275	257	339	299
III	Animals and vegetable fats and oils	12	17	19	22	165	235	196	180
IV	Foodstuffs, beverages, tobacco	607	593	648	681	822	787	885	915
V	Mineral products	2,453	1,844	2,211	2,095	944	506	917	1,004
VI	Products of the chemical or allied industries	602	552	661	865	3,522	3,095	3,389	3,531
VII	Plastics, rubber and articles thereof	167	176	193	206	1,234	1,202	1,307	1,365
VIII	Raw hides and skins, and saddlery	156	147	153	141	38	34	36	35
IX	Wood, charcoal and articles thereof	35	47	38	49	79	69	78	71
X	Pulp of wood, paper and paperboard	201	168	171	153	580	531	497	550
XI	Textiles and textiles articles	122	148	178	193	278	257	251	250
XII	Footwear, hats and other headgear	6	6	6	7	52	51	52	54
XIII	Articles of stone, glass and ceramics	79	87	87	84	349	306	329	331
XIV	Pearls, precious metals and articles thereof	5,821	9,535	7,520	8,013	190	349	210	331
XV	Base metals and articles thereof	1,698	1,354	1,952	1,924	1,241	1,091	1,210	1,211
XVI	Machinery and appliances	1,641	1,345	1,351	1,348	8,046	7,408	7,576	7,382
XVII	Transport equipment	3,113	3,976	4,280	5,235	5,333	4,553	4,952	4,548
XVIII	Optical and photographic instruments, etc.	80	71	78	99	1,075	1,043	1,124	1,138
XIX	Arms and ammunition	2	2	1	4	26	19	24	23
XX	Miscellaneous manufactured articles	88	71	76	72	347	347	377	379
XXI	Works of art and antiques	25	28	24	26	8	6	10	6
XXII	Other	554	755	896	466	463	460	373	300

Source: European Commission (2019:7)

Table 1.4 EU trade flows with South Africa by HS Section 2015-2018 (continued)

	Imports (Millions €)				**Exports** (Millions €)			
HS Sections	**2015**	**2016**	**2017**	**2018**	**2015**	**2016**	**2017**	**2018**
TOTAL	**19,399**	**22,970**	**22,722**	**24,072**	**25,455**	**22,995**	**24,447**	**24,177**
Agricultural products (WTO AoA)	*2,438*	*2,498*	*2,705*	*2,902*	*1,697*	*1,710*	*1,780*	*1,707*
Fishery products	*219*	*271*	*267*	*329*	*9*	*9*	*9*	*12*
Industrial products	*16,742*	*20,201*	*19,750*	*20,842*	*23,749*	*21,276*	*22,658*	*22,458*

Source: European Commission (2019:7)

Table 1.3 above reports the EU commodity trade (imports and exports) with SA by commodity groups for the period 2015-2018 following HS (Harmonized System) sections as follows: the EU registered an increase in exports of agricultural (1,707 million euros) and fishery (12 million euros) commodities in 2018, compared with 1,697 million euros and 9 million euros respectively in 2015. The imports from South Africa of these commodities also have slightly increased in the same period, but still less than EU's rate of exports. In 2015, South Africa was recorded with 23,749 million euros in exports of industrial commodities which still are the highest compared with its values from 2016 to 2018, while their imports from the EU also have increased slowly to 19,750 million euros and 20,842 million euros respectively in 2017 and 2018, but they remained the lowest with 16,742 million euros in 2015.

As a result of the foregoing, following the expected evidence of creation more trade between the EU and South Africa (Jordaan & Kanda 2011), the implementation of the EU-SA TDCA has controversially impacted on bilateral trade flows as well as commodity trade flows in terms of its unexpected outcomes (Draper, Engel, Krogman, Ngarachu & Wentworth 2018; Dirkes 2019). For instance, the market's share of SA exports into EU recorded a decrease from 1.45% to 1.3% in 2003 and 2016 respectively within more than 10 years of the implementation of the EU-SA TDCA (Czermińska & Garlińska-Bielawska 2018). In light of this, investigating the importance of bilateral trade flows between EU and SA is considered imperative, using a quantitative approach such as gravity model of the bilateral trade flows to estimate the effects of the EU-SA TDCA on commodity exports at the sectoral level in South Africa. Therefore, the problem statement is articulated hereunder.

1.2. Problem statement

To investigate the trade effects, the international trade literature provides the theories on determinants of trade and the economic models of trade over time which may be applied to

both importing and exporting countries. Among other theories contributing to the explanation of trade gains and/or loses through bilateral and multilateral agreements are referred as the country-based theories: mercantilism, absolute advantage, comparative advantage and Heckscher-Ohlin (Mason & Sanjyot 2012). These theories are explained in details in the next chapter 2, section 2.2.

Besides, since 1960s the basic form of the gravity model of bilateral trade is also used by several researchers in international trade to explain the relationship between economic size of two countries and economic distance between them through (regional) trade agreements where member countries are in different levels of development (Jordaan & Kanda 2011). Nowadays trade scholars started applying more an augmented gravity equation by adding other variables regarded as relevant factors of international trade, either as control, dummy or exogenous variables (Baier, Yotov & Zylkin 2019). Most importantly, the gravity model is appropriate for ex-post trade analysis, i.e. trade analysis conducted after trade agreement took place between two countries (Kabir, Salim & Al-Mawali 2017), for instance, in this case study of trade flows between the EU and South Africa (EU-SA TDCA) from 2000 to 2017.

On the one, literature on the analysis of trade flows refers to gravity models is in most cases about the keys factors or determinants of trade flows within a context of the trade agreement between a single country and its trading partners over a given period. There are several studies attempted to explain empirically the major trade (export) determinants, such as gross domestic product (GDP), distance (Dist), gross domestic product per capita (GDPPK) and real effective exchange rate (REER) (Eita 2008; Hatab, Romstad & Huo 2010; Serrano & Pinilla 2012; Khan, ul Haq & Khan 2013; Kahouli & Maktouf 2015; Kahouli 2016; Irshad, Xin & Arshad 2018; Balogh & Leitão 2019; Shahriar, Qian & Kea 2019). Some studies focused on the deterministic nexus between trade openness and economic growth(Cavallo & Frankel 2008; Mele & Baistrocchi 2012; Ramanayake & Lee 2015; Iyke 2017), while other studies have attempted to determine the trade effects of other key factors such as trade policies, regional trade agreement, common language, common borders and colonial relationship (Eita & Jordaan 2007a; Egger, Larch, Staub & Winkelmann 2011; Jordan & Eita 2011; Dal Bianco, Boatto, Caracciolo & Santeramo 2015; Steiner 2015; Karamuriro & Karukuza 2015; Dlamini, Edriss, Phiri & Masuku 2016). All these studies to some extent have found most of the above major determinants to be significantly affecting the trade

(export) flows of both member and non-member countries at the bilateral and multilateral levels.

On the other hand, there also is literature carried out in this case study of trade flows between the EU and South Africa that analysed the importance of the EU-SA TDCA and its determinants with particular attention on the South African export. Interestingly, some researchers (Jordaan & Eita 2012; Jordaan 2014; Kapuya 2015) have applied the gravity approach on the bilateral trade flows on South African exports to SADC and EU. As a whole, their findings revealed that SA's GDP, the importer's GDP, the REER and regional (free) trade agreement have been found significantly positive and they are major determinants of South African commodity exports such as leather and orange to the EU and some African countries. Other researchers (Jordaan & Kanda 2011; Jordaan & Eita 2011; Potelwa, Lubinga & Ntshangase 2016) have also applied the gravity approach to the EU-SA TDCA, particularly to capture the importance of that free trade agreement in terms of its impacts on bilateral trade flows. Their results are similar as indicated by the previous studies. Also, these authors reported that the EU-SA TDCA has a significant trade creation and trade expansion impacts on South Africa's exports for wood and agricultural products. Furthermore, Jordaan & Kanda (2011) found that South African population as a determinant, negatively impacted on the South African exports, while Potelwa *et al*. (2016) revealed that the importers' population positively impacted on it.

However, little has been done in the literature to analyse the trade creation and trade diversion effects of the EU-SA TDCA (Kanda & Jordaan 2010; Jordaan & Kanda 2011). These studies found that TDCA notably has trade expansion impacts. They also recommended that a review of the South African trade policies should be more directed to improve the multilateral liberalisation in general and to support regional trade integration initiatives as part of economic stability and development in the region. However, the end of the EU-SA TDCA was in 2016, at the same time the EU entered into the Economic Partnership Agreement (EPA) with SADC countries [EU-SADC EPA] for its replacement (Gammage 2017).

Over a decade, definitively the EU-SADC EPA marked the termination of the EU-SA TDCA along with some outcomes as seen in Table 1.1, figure 1.1, Table 1.2 and Table 1.3 in the above (background) section 1.1, which are unexpected in relation to the a priori expectations

of generic trade arrangements. This is also in contrary to the findings from a few gravity models of the EU-SA TDCA as documented in a few literatures mentioned above, and documented further in the next chapter. In many studies, most of the above standard determinants of international trade such as gross domestic products, per capita gross domestic products and real effective exchange rate have been linked to the EU and SA and they are important, of course, but they are not able yet to capture the ambiguity in outcomes of the trade (export) effects through augmented gravity model of bilateral trade agreement– the EU-SA TDCA– precisely. This means that there is still a need to conduct another trade investigation of both member countries throughout a more robust engagement with dataset and methodological improvement.

Given the above background, this study looks at the statistical significance and importance of the relationship between trade flows (among the standard determinants that are analysed) together with the Information and Communication Technology (ICT) as key factors that act as important stimulant (Tay 2017). Indeed, the ICT linked to trade in goods and services has been the main driver of recent marketing and organisational innovations, and it has pioneered a process that exerts notable deterministic influence on trade and investment. This variable has also acted as a source of comparative advantage that of course drives trade among developed and developing countries (Patrick & Ralph 2009).

In some of the recent economic literature, studies that attempted to analyse econometrically the cross-sectional determinants of the EU-SA TDCA implying notably the ICT service exports, which include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions) has been limited (WDI 2018). However, barely a documented study was identified that focussed exclusively on the comparative analysis of the effects of the ICT on trade flows among the BRICS countries (Brazil, Russia, India, China and South Africa) of which South Africa is a member (Wang & Choi 2019). The study deployed a panel data approach, spanning the period between 2000 and 2016. Although, the study adopted a standard gravity model framework, the major weakness was its lack of specific focus on bilateral trade arrangement, rather than a multilateral trade relationship.

In the light of the background and problem statement described above, the research question arises thereof.

1.2.1 Research question

Closely viewing the importance of the bilateral trade flows to the trading countries, the export orientation can lead acountry to integrate into the world market, compete globally by using ICT, and reduce the impact of external shocks on the domestic market. At the same time, it allows domestic firms to achieve high levels of demand (economies of scale) as it creates employment that is needed to sustain economic growth and decrease overall poverty, concomitantly (Patrick & Ralph 2009; Jordaan & Eita 2012). Thus, interests arise to explore the importance of the EU-SA TDCA on bilateral trade flows in order to measure its possible effects on commodity trade flows between the EU countries and SA. Therefore, the main question being investigated in this study is: 'what have been the effects of the EU-SA TDCA on South Africa's trade flows (especially export flows) of selected top 10 commodities according to the Harmonized System at the 2-digit level (HS-2) as reported from 2000 to 2017?' At this point, it is of paramount importance to postulate some hypotheses which will help to answer this main study question.

1.2.2 Study hypotheses

According to Vilakazi (2016) a research hypothesis is simply an educated-and testable-guess of the answer to a research question. It is often described as an attempt by the researcher to explain a phenomenon of interest. It is further suggested in literature that all hypotheses are characterised by having no predetermined outcome; hence hypotheses are the researcher's attempt to explain the phenomenon being studied (Hancock & Algozzine 2017). A useful hypothesis is a testable statement which may include a prediction (Dick, Alexander, Jeschke, Ricciardi, MacIsaac, Robinson, Kumschick, Weyl, Dunn, Hatcher & Paterson 2014). The predictions are then tested by collecting, gathering, analysing and interpreting it. The hypothesis can either be proved or disproved, based on the results or the outcome (Marczyk, DeMatteo & Festinger 2005; Dick *et al*. 2014).

The hypotheses in this study are broadly designed on the trade agreement theories related to the significance of the EU-SA TDCA. This also applies to the effects of bilateral trade flows between SA and the EU as they are more likely motivated to trade their commodities within the free trade agreement. This allows each participating country to have free access to its partner's markets while maintaining sovereign trade policy towards non-participants. Thus, the study hypotheses are as follows:

Hypothesis I*:*

Within the EU-SA TDCA, more bilateral trade flows would take place especially in top 10 selected commodities at the HS-2 between South Africa and the European Union. This could be achieved as a result of a compound of some major trade determinants together with ICT-related service exports as an important determinant for South Africa. It follows that, amongst other trade benefits, the importance of commodity exports and ICT adoption is considered a priori determinant (Tay 2017).

Hypothesis II:

Following the expected evidence of creation more bilateral trade flows between the European Union and South Africa (Jordaan & Kanda 2011), *the EU-SA TDCA would divert its trade flows in top 10 selected commodities at the HS-2 from the rest of world at large, to its European trading partners.*

However, what then is the study aim and specific objectives for exploring the importance of the EU-SA TDCA on commodity trade flows?

1.3. Aim of the study and specific objectives

The broad aim of this study is to analyse the importance of the EU-SA TDCA on top 10 selected commodities at the HS-2digit. This is achieved by investigating commodity export flows between the European Union trading partners and South Africa by applying a panel data estimation of the augmented gravity model of bilateral trade from 2000 to 2017.

This study argues that the importance of this bilateral trade agreement on the selected top 10 commodities from South Africa into EU is, in terms of trade effects, already solely visible. Thus, the specific objectives of the study are as follows:

- To investigate the statistical behaviour of some trade determinants, such as gross domestic product, distance, gross domestic product per capita and real effective exchange rate that affect South Africa's commodity export flows. The study also consider it important to include ICT measurable indicators to gauge the extent to which ICT adoption affects the possible benefits derivable from this bilateral trade arrangement. The dataset spans a period between 2000 and 20017. This study is motivated by its methodological novelty, in that most of the previous studies cited in the previous

paragraphs only adopted qualitative approaches, which limits the generalisation of the studies and also limits their predictive capability;

- To examine whether the EU-SA TDCA has trade creation or diversion effects on exports of the top 10 commodities at the HS-2 between the EU countries and SA over a period from 2000 to 2017.

1.4. Outline of the study

This chapter one has introduced the research topic, background and the problem statement. The remainder of the dissertation is structured as follows:

Chapter two presents a review of literature on country-based theories on international trade, Regional Trade Agreements, Free trade Agreements, the Trade Development and Cooperation Agreement and the gravity model of bilateral trade agreements. Chapter three provides the research methodology, starting with the research design, and after this, the econometric model specification of the gravity equation of bilateral trade adopted for the study. Chapter four presents the data as collected and the analysis of results from panel approach. Chapter five provides the conclusions from the analysed results, policy recommendations and suggestions on areas for further research.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

This chapter presents literature on the Trade, Development and Co-operation Agreement (TDCA). The TDCA is a trade agreement in this case drawn between European Union (EU) and South Africa (SA) as a free bilateral trade agreement, within the purview of realism that EU is a regional multilateral agreement among its Member States. According to Schmeiser (2014) and Gida (2018), the major objective of the TDCA is to cover development and economic cooperation and trade relations. It provides for some more fields including socio-cultural cooperation and political dialogue amid South Africa with fifteen EU Member States. For detailed analysis of this agreement, this chapter takes into account an overview of the international trade country-based theories and the Regional Trade Agreements (RTAs) in sections 2.2 and 2.3 respectively. Further, section 2.4 presents the patterns of the Free Trade Areas (FTAs). Also, section 2.5 discusses the TDCA while section 2.6 reviews the gravity model of bilateral trade flows. A conclusion is provided in section 2.7.

2.2. Brief overview of the international trade country-based theories

Trade is the notion of exchanging goods and services between two populations or institutions; as such, international trade is the notion of the exchange between populations or institutions in two different nations (Mason & Sanjyot 2012:56). Thus, international trade enables populations to increase their markets for both commodities and services that else may not have been accessible to them. It also encourages higher competition in the market and therefore more competitive prices, which bring a low-priced commodity home to the buyer. A product that is sold to the global market is an export, and a product that is bought from the global market is an import (Gawai & Wakode 2012).

Besides, to get a good understanding on how modern world trade has developed gradually, it is crucial to understand how nations exchanged with one another. Through time, scholars in economics have elaborated theories to give an explanation to the processes of international trade. The major theories are also named classical theories and they refer to the perspective of a country, that is, they are country-based. Among others, these theories are mercantilism, absolute advantage, comparative advantage, and Heckscher-Ohlin (Mason & Sanjyot 2012).

2.2.1 Mercantilism

Broadly, mercantilism presumes that a nation should increase its resources of gold and silver by enhancing exports and preventing imports. In other words, if population in other nations buy more (import) than they sell (export), then, they must pay the difference in gold and silver. The purpose of each nation is to have a trade surplus or a position in which the export value is higher than the import values, and to avoid a trade deficit or a position in which the import values is higher than the export values (Mason & Sanjyot 2012). This is achieved through government trade policy as the mercantilists advocated for economic nationalism. Given the mercantilist constant view of global resources accumulation, international trade can be perceived as a 'zero-sum' game in which exporter’s economic gain was at the expense of importer country (Georgiou 2016).

However, the veracity of the mercantilism theory was debunked by Adam Smith with the publication of "The Wealth of Nations" in 1776, which was based on what he named "absolute advantage". He argued that the mercantilism was completely misplaced on the function of State (government) in the economy and that the concept of wealth was misunderstood (Smith 2017).

2.2.2 Absolute advantage

In 1776, Adam Smith called in question the ruling mercantile theory of the timeline in The Wealth of Nations and suggested a new trade theory called "absolute advantage", which the focal point is the capacity of a nation to manufacture a single commodity more efficiently than another nation. He stated that trade among nations should not be ruled or limited by State (government) policy or interference. Preferably, trade should flow simply in line with market forces (Cuervo-Cazurra, Luo, Ramamurti & Ang 2018).

In a hypothetical two-nation world, if Nation A produces a commodity cheaper or/and faster than Nation B, then Nation A has the advantage and should focus on specialising in producing that commodity. Similarly, if Nation B is better at producing another commodity, it should also focus on specialising in that commodity. By means of specialisation, nations would produce efficiencies because their human resource (workforce) would become further experienced by doing the same duties repeatedly (Seretis & Tsaliki 2016). Production would furthermore become more efficient because there would be an incentive for specialisation,

which may lead to quicker and superior production techniques that would ameliorate low productivity.

Smith's theory presumes that with enhanced efficiencies, population in both nations would gain, as a result, international trade should be promoted. Besides, Adam Smith theory argues that a country's wealth should not be assessed by quantity of its resources in gold and silver, in contrast, by the living standards of its population (Mason & Sanjyot 2012). Moreover, the absolute advantage was disputed in another way by David Ricardo who presented "The Comparative Advantage theory" in 1817.

2.2.3 Comparative advantage

The dispute to the absolute advantage theory is that some nations are likely well at producing the two kinds of commodities and, thus, have an advantage in various sectors. In contrast, another may not have any beneficial absolute advantage. To find solution to this dispute, David Ricardo, an English economist, presented the theory of comparative advantage in 1817. He well thought out that even if nation A has the absolute advantage in the production of both commodities, specialisation and trade could yet take place amidst the two nations (Mason & Sanjyot 2012; Georgiou 2016).

Comparative advantage happens when a nation cannot turn out a commodity as efficiently as the other nation but it can turn out that commodity better and more efficiently than it does other commodities. The distinction among these two theories is slight. Comparative advantage bases on the relative productivity differences, while absolute advantage supposes the absolute productivity. The productivity differences could last over many years, which is equal to stating that the absolute advantage in production does not alter into comparative advantage (Seretis & Tsaliki 2016). However recently, some trade models, such as the Swedish award by Heckscher and Ohlin, improved the standard form of the trade model of Ricardo by providing further factors of production and differences in the endowments between nations and capital/labour ratios between commodities (Jones 2017).

2.2.4 Heckscher-Ohlin theory (Factor proportions theory)

The international trade theories presented by both Smith and Ricardo did not support nations to come to a decision in which commodities would be seen as a source of competitive advantage. Both theories suppose that free and open markets would direct nations and

producers to decide on which commodities they could manufacture more efficiently. Thus, Swedish economists Eli Heckscher and Bertil Ohlin, in the beginning 1900s centred their thoughts on how a nation could gain comparative advantage by manufacturing commodities that use factors that were in surplus in the nation (Bernhofen & Brown 2018).

Heckscher and Ohlin (H-O) theory is focused on a nation's production factors – land, labour, and capital, which generate the funds for investment in machinery and equipment. They resolutely pointed out that the cost of any factor or resource was a function of supply and demand. Factors of production that were in large supply relative to demand would be low-priced; factors in large demand relative to supply would be more high-priced (Mason & Sanjyot 2012; Hausmann, Hidalgo, Stock & Yildirim 2019). The H-O theory is further called the factor proportions theory which suggested that nations would produce and export commodities that required factors that were in large supply and, therefore, low-priced production factors. Alternatively, nations would import commodities that required factors that were in short supply but higher demand (Feenstra 2015).

In a nutshell, it is clear that international trade is complex and it is affected by several and frequently-changing factors. It cannot be studied systematically by one particular theory, and more importantly, the knowledge of international trade theories keeps on developing gradually (Mason & Sanjyot 2012). However, the analysis of international trade theory is consistent within Regional Trade Agreements (RTAs) – a context where trade unions and trade liberalisation occur between countries worldwide. Therefore, RTAs are introduced in the next section (section 2.3) below.

2.3. Introducing the Regional Trade Agreements

RTAs have a normal and a particular sense at the same time. Leal-Arcas (2013:365) posits that they are either decisions among countries that certainly belong to the identical geographic region or they are opportunities that are provided for countries to conduct trade among World Trade Organisation (WTO) signatory members. Based on their magnitude of trade integration, there are five general categories of RTAs which are: Preferential Trade Agreements (PTAs), Free Trade Agreements (FTAs), Customs Unions (CUs), Common Markets, and Economic Unions (Virág-Neumann 2009:382-383). Member countries related to the WTO do have a predisposition of concluding bilateral FTAs than multilateral FTAs or CUs. This is likely because bilateral FTAs are much more straightforward to conclude than

other forms of RTAs. The WTO (2019a) notifies that in September 2019 from 480 notifications from its members, which separately include goods, services, and accessions, 302 RTAs were in force. As a whole, FTAs, Economic Integration, Partial Scope Agreements, and CUs account, respectively for 260, 160, 30, and 30 notifications (WTO 2019a).

In spite of the removal of tariffs between Member States as a result of RTAs, tariffs were maintained against non-Member States within the trade region. Countries prefer to form an RTA as a preventive measure from increasing the tariff barriers to the outsider countries (Feenstra & Taylor 2011:365). However, the authors reveal that the two primary forms of RTAs - which are FTAs and CUs, treat the Member countries fairly since they maintain zero tariffs within the regional arrangement, as opposed to the non-Member countries. Thus, RTAs break the rule of the Most Favoured Nation (MFN) principle, which postulates that all countries that belong to the GATT (General Agreement on Tariffs and Trade)/ and by extension, the WTO, should benefit the same set of trade treatment equally. Accordingly, RTAs are called preferential trade agreements (PTAs) sometimes to describe the trade discrimination against other countries excluded from the agreement. Even though RTAs violated the MFN principle, the ratification of RTAs is still ongoing. This is based on the fact that they expand trade flows of the groups of countries towards freer trade by removing various vestiges of trade restrictions.

However, there are various reasons for the proliferation of signing an RTA between countries, and it always drives by some specific economic or political motives. Leal-Arcas (2013:370-373) argued that it is often for both economic and political motives countries that countries sign an RTA. One of the economic motives is the fact that countries affianced in fierce competition to have permanent admission to other larger markets because of the tension depicted by trade liberalisation regionally. Contrarily, a political motive for countries in concluding an RTA is to sustain or promote political support as well as regional cooperation between with allies in terms of geopolitical and security interests.

Concerning the economic motives of RTAs, the implementation of RTA aluminates the trade among signatories in two ways: creation and diversion of trade. The trade creation occurs when, within the same trade region, one importer country buys (imports) at a higher quantity of a product at lower prices which it previously was self-manufactured from another trading partner as an exporter country, and the latter increases its sales. Subsequently, trade creation

gives rise to economic welfare for the importing and exporting countries. In contrast, trade diversion arises once an importing country as a member country imports a good from an exporting country as another member country of RTA that it was previously imported outside the regional trade area newly formed (Feenstra & Taylor 2011:367). As previously pointed out, FTAs and CUs are the two primary forms of RTAs because they treat Member countries better since they maintain zero tariffs between them than the non-Member countries within the WTO. Therefore, the next section (section 2.4) focuses only on some significant patterns of FTAs following the study purpose (i.e. the EU-SA TDCA as an FTA).

2.4. Patterns of FTAs

FTA forms part of the large group of trade arrangements under which each member country applies its instruments of trade restrictions, such as trade tariffs to the other countries which are not part of the trade consensus. In the same vein, statutory consents are enacted to remove both tariff and non-tariff restrictions on traded goods for all the Member countries within the FTA over a fixed term (Brack 2013:7). In addition, the member countries of an FTA generally consent to rules of origin that determine the origin (national) source of each manufactured good within the FTA in order to secure free import duties and trade policy measures such as preferential trade treatment. The rules of origin are used to hamper goods produced in non-member countries from entering the FTA market across the lowest tariff barriers. In numerous instances, an FTA also encompasses operating procedures of implementing the border controls on trade namely good safety certification and phytosanitary verification (Cooper 2012:35-36).

2.4.1 Main forms of FTA and overview of some criticisms of FTA

In most cases, FTAs are considered to be recommendable for countries which are in pursuit of maximising their exports. In previous decades, two forms of FTAs emerged. The first form refers to the bilateral FTA which is ratified by the governments of the countries that are part of the agreement. The bilateral trade agreement may cover supplied goods and services between the countries and is based on tradable goods of some economic sectors of all countries. Under other conditions, the regional multilateral agreement is the second form of FTA. For instance, except labour force, the defunct North American Free Trade Agreement (NAFTA) created a single market in 1994 with Mexico which was included in the existing free trade between the USA and Canada (Villareal & Fergusson 2017). Under this

multilateral agreement, trade was free between the three countries. Similarly, the European Union (EU) is a multilateral FTA representing a single economic market for all the Member countries and allowing goods, services and labour to freely move among them.

However, since many countries supported the RTAs in the form of an FTA, it has been debated whether FTA is a good thing or not from both supporters and opponents. For instance, Peloso (2005:5-6) states that a high number of Economists suggest that FTA raises the quality of living through economies of scale and comparative advantage that offers cheaper but efficient substitute products. Smith, El-Anis and Farrands (2011:109), however, argue that FTA enables most of developed countries to benefit from less developed and developing countries, pulling down domestic industries in the less privileged communities, while avoiding to improve the standards of social life and labour force.

Conversely, some authors opposed this proposition by suggesting that FTA damages the local economy of the developed countries. The argument is premised on the reality that because of the high labour costs in these countries, many jobs move abroad to other countries where cost of labour is low (Smith *et al.* 2011:109). These authors further point out that several scholars see FTAs as destroying the development of the economy of the poorest countries by reducing import tariff walls, as a consequence, local industries which are to some extent uncompetitive and inefficient at the international level will probably shut down. For this reason, North Korea took remedial trade policies to reinforce import barriers for the intention of protecting local industries.

Besides, the actual application of FTA has been found deficient by the proponents. On the one side, one objection is that developed countries are inclined to demand that third countries open their markets to manufactured and agricultural commodities from developed countries, and on the other side, these countries themselves still deny giving access to their markets for agricultural commodities from the third world countries (Irwin 2015). An active way of thinking in opposition to FTA is that barriers of the trade such as agricultural allowances and quotas intercept farmers in the developing countries from being competitive in domestic markets as well as export markets. As a result, it is generating poverty in the less developed and underdeveloped countries. Also, although FTA provides for the free movement of commodities and business owners which is in favour of developed countries, but there is no

free migration of workers (i.e. labour force) which would also be favourable to the populations of the Third World (Peloso 2005:6).

Other criticisms of FTAs include the fact that they support the non-interference and removal of governance of the economic sector. Multinational Corporations (MNCs) can pursue their activities without the barriers hitherto erected to curb opportunistic excesses of the global conglomerates. In some states such as the United Kingdom, governmental laws stipulate issues like minimum wage, the right of association in unions, and working conditions (Smith *et al.* 2011). However, in many developing countries, such regulations do not exist, and national governments are unwilling to discourage MNCs from doing business in their countries. Indeed, the modern liberal economic system necessarily entails a race to the bottom as governments seek to offer the most favourable terms to MNCs and foreign capital as an enticement to invest in their economies.

Critics of FTAs claim that these agreements only encourage the process of exploitative practices. According to these authors, exploitation of labour and the environment are seen as negative results of FTAs. Whether FTAs are seen as economically and morally desirable or not ultimately has little impact on the adversity it has drawn from a community of scholars. Irrespective of the criticisms levied against it, FTAs have fast increased in number, and the liberalisation of world trade has resulted in greatly expanding levels of this type of exchange (Smith *et al*. 2011). Despite the productiveness of free trade, a step in that direction rarely exists, even though it automatically improves the efficiency of the economy. The improvement of the welfare or economic efficiency of a country by PTA is not guaranteed by implications of trade diversion against trade creation (Suranovic 2012:580-581).

2.4.2 The major economic effects of FTAs

Cooper (2012:40-41; 2014) revealed that the major economic effects of FTAs as analysed by various Economists are based on the concepts of trade creation and trade diversion. The author informs that trade is created when a member of an FTA replaces the domestic production of a commodity with imports of the goods from another member of the FTA because the formation of the FTA has made imports far much cheaper than producing domestically. The creation of trade is alleged to enhance economic welfare within the group. This is for the reason that resources are being diverted to more efficient uses. Trade diversion

takes place when a member of an FTA changes the import of a commodity from an efficient non-member to a less efficient member (Krueger 2012). This can be as a result of the removal of tariffs within the group. Further, the extension of tariffs on imports makes the products more affordable, and rational consumers would prefer cheaper substitutes.

Trade diversion is said to scale down economic welfare due to resources being diverted from an efficient producer to a less efficient producer (Cooper 2014). It seems, FTAs are central to both trade diversion and creation where the net effects are determined by the structure of the FTA. Hence, our focus is directed to the postulation that the movement of two or more countries to freer trade among themselves in an FTA could place those countries and the world as a whole at a disadvantage (Hoffmann & Kumar 2013), especially if the FTA diverts more trade than it creates. More so, trade policy analysts (Aniche 2014; Aregbeshola 2017) encounter circumstances that are much more complex than what are depicted in economic theory. These authors suggest that various functioning and propounded FTAs incorporate more than two countries and involve a variety of products. These are for both goods and services. The authors therefore argue that it makes it much more difficult to assess their effects on the economy. By providing a framework of analysis, assumptions presuming that an FTA would generate more trade than it averts was proposed by Aniche (2014).

On one hand, Cooper (2012:42) indicates that trade policy-makers postulate that trade creation is likely to exceed trade diversion when larger tariffs or other trade barriers are eliminated among members before the FTA is formed. In addition, the lower the tariffs and other barriers in trade with non-members, the larger the number of countries embodied in the FTA. Further, it occurs that the strength of existing competitiveness or less complementary the economies joining the FTA are, and the state of the economic relationship among the members before the FTA was formed, the more trades are created. On the other hand, Economists have also resolved that within the purview of immediate and static effects of trade diversion and creation, FTAs generate long-term dynamic effects such as increased efficiency of production (Aregbeshola 2017).

This is envisaged as producers face heighted competition with the removal of trade barriers. To stay competitive, it becomes apparent to attain economies of scale. That is, decreased unit costs of production as producers can have larger production runs since the markets for their goods have enlarged and there is a manageable increase in foreign investment from outside

the FTA as firms seek to locate operations within the borders of the FTA to take advantage of preferential trade arrangements (Cooper 2012:42). It thus begets the reality that the aggregate effects of welfare of FTA on signatory countries are not known since markets are opened through FTAs (Villareal & Fergusson 2017). These authors suggest that not only one market or country is affected when a free trade area is formed but many. Therefore, it is vital to sum up the combined effects of an FTA, in order to analyse their effects across markets and countries. Ordinarily, this could be achieved by allowing a country entering into FTA to have some import markets to enhance trade creation and trade diversion (Suranovic 2012; Villareal & Fergusson 2017).

Therefore, the markets with trade creation would certainly generate national welfare gains, while the markets that have trade diversion may produce national welfare losses (Kitwiwattanachai, Nelson & Reed 2010). Hence and universally, Economists have stated that national welfare would be improved if the positive effects of trade creation are greater than the negative effects of trade diversion (Yang & Martinez-Zarzoso 2014). However, Krueger (2012) found that the right expression would be an FTS would be welfare improving if it causes more trade creation than trade diversion. Nonetheless, Dai, Yotov and Zylkin (2014) contrarily indicate that an FTA would be welfare reducing for member states if it causes more trade diversion than trade creation. The impression created by this author is that if free trade is undertaken, a group of countries may actually reduce the national welfare of the involved countries. According to Suranovic (2012:589), the assertion is that a movement towards a more-efficient free trade policy may not enhance the efficiency of the economy.

Having looked at the theoretical and practical application of FTAs, the study now proceeds to the practical application of trade instruments in some leading FTAs. That discussion is presented in section 2.5 of this chapter.

2.5. Trade Development and Cooperation Agreement

As indicated in chapter one, in the genesis, the Trade Development and Cooperation Agreement (TDCA) is a bilateral trade agreement between South Africa and the EU-15. Thus, this section presents the EU Member States and its main enlargements over time in subsection 2.5.1, while subsection 2.5.2 provides the EU-SA TDCA implementation along with its features, and lastly, subsection 2.5.3 is about its reviews and termination.

2.5.1 European Union Member States

The European Union, formerly the European Communities (EC) according to Phinnemore and McGowan (2013) is a name that was recognised globally and officially by the WTO in 2009 and it has legal membership among the 29 WTO member countries. Further, it is a one policy tariff arrangement (Moeller 2017). The EC represents the EU as an executive arm during the WTO meetings (WTO 2019b). The EU membership and its main enlargements over time are as follows:

- EU-15 was formed in 1995 with the founders such as Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom.
- In 2004, EU-15 became EU-25 with the ascension of 9 other Member States (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic, Slovenia).
- Bulgaria and Romania joined in 2007, taking the tally to EU-27.
- Finally Croatia also became an EU Member State in 2013 to make EU-28 (WTO 2019b; WTO 2019c).

According to Bagwell, Bown and Staigner (2016), EU was originally designed to liberalise customs on behalf of Member States. Originally, operating as a single umbrella under the General Agreement on Tariffs and Trade (GATT) and then the World Trade Organisation (WTO), the agreement was meant to abolish barriers to customs while promoting trade for the Member States. At first, the principles of trade were inspiring for EU, but this soon decapitated with a series of crises that pervaded the lopsidedness of trade benefits among member nations. It must be admitted however, that the strength of the single EU market has made the EU to become the main enabler of trade between nations (Stone & Brunell 2013). At the inception, the Union had the vision to ensure a fair access to the global market for all member nations. However, this was not realised as complexities in implementing the strategy beclouded the reality of purpose (European Parliament 2015).

2.5.2 The EU-SA TDCA: from Lomé convention to FTA negotiations and its features

Frankel (2018) reveals that South Africa encountered some challenges preceding the 1994 democratic elections. Despite the escalating population growth, the country suffered a dwindling economy, increased unemployment, poverty, unfair income distribution and

racism. This resulted in a series of boycotts and trade-related sanctions that eventually plummeted the country's economy. In more specific terms, the country experienced a decline of shares in the world market, which was marked by loss of reputation in the international markets for South Africa (Keegan 2017). The ruling party, African National Congress (ANC) became committed to a social-welfare-oriented policy in the guise of the Reconstruction and Development Programme (RDP). Hence, South Africa became a member of the Lomé Convention.

2.5.2.1 The Lomé Convention

The Lomé agreement was held in 1975 in Lomé, Togo (Farrell 2010). This convention was between the EU and 46 African, Caribbean and Pacific countries. Previously, South Africa was not allowed to enter into any trade agreements with the European Union or any other sovereign state (Hill, Smith & Vanhoonacker 2017). Therefore, South Africa was advised to become a signatory of the Lomé Convention in order to gain admission into the other trade arrangements (Ron Sandrey 2014). Hence, South Africa became a signatory of the Lomé Convention, which granted the country unrestricted access to the EU export markets. However, the negotiated market entry for goods and services excluded beef. An immediate realism was that the SA government realised that the Lomé agreement was not only beneficial for SA but the neighbouring countries too as volume of trade relations between South Africa (and by extension, SADC Member States) and the EU improved noticeably (Stevens 2006).

When SA applied for membership with Lomé, the EU frowned at the ANC government's request to be allowed to join as a developing country (Nunn & Price 2005). More so, the EU predicted that South Africa would become a threat as its economy would rise quickly and possibly create some competitive challenge for the EU member states. Therefore, the ACP members were concerned that SA would forgo the rights to technical aid programmes provided by the Lomé agreement and settle for qualified membership of the convention. Hence, a consensus was reached that meaningful trade agreement to SA would be through a free trade agreement. The agreement however, limited SA's access to some sectors of the EU economy, and it was agreed that the country would be assisted financially (if so necessary) outside the Lomé agreement. In response to that, the EU rejected to offer SA the opportunity for a free trade area because of some similar products produced in both regions such as

agricultural products like fruits and wine. SA raised concerns that the country was in serious economic crisis (Barrientos & Visser 2013). However, the EU invited SA for further trade negotiations leading gradually to a free trade agreement area with the EU (Lister 2016). This allowed SA to accept with discretion to some trade aspects of the FTA (Guei, Mugano & le Roux 2017). Then SA entered into the EU-SA TDCA.

2.5.2.2 Negotiations and main features of the EU-SA TDCA

South Africa and the European Union entered into negotiations which according to Lee (2002) were lastly summarised in January 1997. The government of the Republic of South Africa offered a working describing the country's view in establishing the EU-SA TDCA. The TDCA establishes PTA between EU and SA, with the gradual implementation of an FTA. The objective of the FTA is to give the best access to the European countries for South African domestic market and vice versa (Osman 2015). Therefore, it plays a very important function to integrate SA into the global economy (EUR-Lex 2018). To realise this trade goal, TDCA was formulated as an FTA under the general rules of the GATT, Article XXIV. This entails that TDCA would conform to the GATT rules and obligations (Thomashausen 2011).

According to research (Assarson 2005) the EU-SA TDCA agreement has two components:

1) the trade component which encompassed the FTA between SA and the EU with the purpose of creating more trade between the two partners;
2) the financial component called European Program for Reconstruction and Development (EPRD) concerned with the EU's financial aid to some sectors covering South Africa's concerns (for instance, regional integration on private sector development) as summarised by Qhobela (2014).

However, the expanse of the EU-SA TDCA suggested a provision for some product vulnerabilities that both parties needed to address. This necessitated the partial liberalisation adopted at the inception of the arrangement (Smis & Kingah 2014). Agricultural products were the main products of strong concern for the EU, while South Africa was concerned with motor vehicle parts and textile products (EUR-Lex 2018). Some main patterns of the EU-SA TDCA are as follows: it liberates 95% of trade for the EU's imports from South Africa within ten years and 86% of South Africa's imports from the EU within twelve year (Laaksonen 2008; Deeplal 2016). It aimed to encourage regional cooperation and economic integration in Southern Africa. This included integrating South Africa into the world economy by

promoting cooperation between the EU and South Africa (van Heerden 2008:6). Although it was an agreement between the EU and the SA, in reality, it also applied to Botswana, Lesotho, Namibia and Swaziland (BLNS). This happened by default given that the BLNS States are in the SACU with SA. Therefore, with regard to imports from the EU, failure to fulfil an obligation has resulted in the BLNS countries becoming a party to the EU-SA TDCA. This makes BLNS countries obligatory members of the EU-SA TDCA.

Additionally, an important feature of the EU-SA TDCA is the implicit asymmetry of trade liberalization between the EU and the BLNS countries. Even though the EU-SA TDCA effectively grants the EU free access to the markets of the BLNS countries, it does not grant the BLNS countries reciprocal access to the markets of the EU (Tsolo, Mogotsi & Motlaleng 2010). SA is a Member State of both SACU and SADC. Thus, the TDCA trade policy and implications to some extent were applicable to the SADC as a third party in the EU-SA TDCA, and this has placed a strong negative impact on SACU. However, the UNCTAD (2006) argues that most African countries seek a close relationship with South Africa as both an outlet and a source of materials products. Predominantly so, those on the southern tip of the region.

2.5.3 The EU-SA TDCA – TDCA review and termination towards the EU-SADC EPA

Despite the benefits enjoyed by the EU-SA traders, complexities persisted (Mthembu 2017). These were arising from other arrangements that concurrently grew with trade relationships within the region (for instance, everything-but-arms, Cotonou Agreement). These impeded the secondment of the review of the TDCA and the emergence of the Economic Partnership Agreement (EPA) (Osman 2015). The objective was to inform and opportune the trading members to a singular regime inclusive of the SADC EPA member countries and the EU.

According to DIRCO (2009), the TDCA was reviewed in 2004 under Articles 18 and 103 of the EU-SA TDCA. These articles provided for the five-year term review of the TDCA from the date of the TDCA inception. Therefore, 2007 marked new negotiations between the EU and SA. The negotiations focused on political, economic and development cooperation (DIRCO 2010). This obviously carried financial connotations that were to be incorporated into the agreement. Hence, the TDCA was revised officially on the 29th of March 2007 in Pretoria, RSA. This was followed by an initiation and revision of 35 additional articles. The

decision reached by the trade agreement members contributed to the de-alignment from the TDCA to the inception and implementation of the SADC EPA (Viljoen 2017; Gillespie 2018).

The new trade agreements offered contentment and promised to be effectively implemented by the trading member countries in SADC region and the EU (Murray-Evans 2015). Seemingly, the EU had meaningful interests (Stoler 2011). These followed negotiations preceding the EPA of 2002, which saw the 28 EU countries together with 49 ACP countries with over 999 million population drawn from the continents concluding the provisions of the EPA. Hence, the RSA ratified the provisions of the EU-SADC EPA in June 2016. Emphatically, on the 10th of June, the EU entered into Economic Partnership Agreement with SADC members. However, other SADC countries were at first incorporated into the trade negotiations (Gammage 2017). Thus, the non-Member countries have intentions to become part of the deal in the long run. Negotiations are still under way for the other non-member countries from the SADC region to incorporate into the trade agreements.

2.6. Bilateral trade agreements using the gravity model estimation

The gravity model has long been the workhorse model used to explain bilateral trade (Yamarik & Ghosh 2005:84; Baier & Bergstrand 2006; 2007; Chikangaidze 2011:18). Baier & Bergstrand (2006:1) states that based on Newton's Law of Gravitation, the gravity model predicts that the volume of trade between two economies should increase with their size (proxy by real GDP) and decrease with transactions cost (measured as bilateral distance). Researches (Yamarik & Ghosh 2005; Yotov, Piermartini, Monteiro & Larch 2016) reveal that the popularity of the gravity model is four-fold. The four reasons are:

1) the current theories of international trade that are based on differentiated goods provide and enhanced the foundation of the theories of the gravity model;
2) the gravity equation has demonstrated a success in analysing the bilateral trade;
3) there has been a raised interest in empirically assessing the bilateral trade impacts of the RTAs and,
4) Economists have found interest in the relationship between geography and trade nexus (Gómez-Herrera 2013).

Similarly, authors observe that the gravity equation has been used to explain international trade for over the past 40 years (Baier & Bergstrand 2007; Akhter & Ghani 2010). This has

assisted researchers to unveil the ex-post effects of free trade agreements and customs unions on bilateral merchandise trade flows (Baier & Bergstrand 2007) for Member and non-Member countries (Akhter & Ghani 2010). For instance, in a study conducted by Hatab, Romstad and Huo (2010) on 'the determinants of Egyptian Agricultural exports from 1994 to 2008,' the researchers revealed that Egypt's gross domestic product alongside the exchange rate volatility have positively and significantly impacted on agricultural exports. However, in the same study, between Egypt and its trading partners, the gross domestic product per capita and the geographical distance steered the decrease in agricultural exports.

Khan, ul Haq and Khan (2013) explored the bilateral trade between Pakistan and its major country partners through a panel data to extract trade policy implications for Pakistan from 1990-2010 through the gravity model approach. Using the gravity approach, the findings revealed that Pakistan's GDP and GDP per capita has significantly and positively affecting export flows while Pakistan's bilateral trade flows were negatively correlated with distance and culture. In another study, Nuroglu and Dreca (2011) extended the basic form of the gravity equation to analyse the gross trade between Bosnia and Herzegovina's (BiH) and the main European partners from 2005 to 2009. The report was that export and import flows for Bosnia are positively depends on the market size and the population of the EU traders. Comparable gross domestic products are found to be positive on their trade volume. Further, the distance is an important determinant that negatively influences the trade flow of Bosnia while an increase in gross domestic product per capita of Bosnia and Herzegovina seems to significantly expand the export flow of Bosnia (Portugal-Perez & Wilson 2012; Fracasso, Sartori & Schiavo 2016).

In a study conducted by Karamuriro and Karukuza (2015), panel data was used for the period 1980-2012 to estimate an augmented gravity equation of Uganda's exports. The findings indicated that among other factors of the performance of the exports for Uganda, its GDP, contiguity, official common language as well as importer's gross domestic product per capita are statistically significant. Yet, Uganda's GDP per capita and geographical distance negatively correlate with export flows (Ariu, Docquier & Squicciarini 2016). In addition, the findings in support of Saurombe (2012) indicated that the regional trade membership countries had significantly and positively affected Uganda's exports. In the same vein, Dlamini, Edriss, Phiri and Masuku (2016) applied the gravity approach in examining the sugar exports from Swaziland to its trading partners. This was through a panel dataset for the

period 2001-2013 (Tu & Giang 2018; Bekele & Mersha 2019). More so, they reported that the major determinants of sugar exports of Swaziland, which are official common language, importers landlocked, the gross domestic products of the importer's countries. It must be noted that Swaziland showed a positive and significant effect on the volume of sugar exports (Bekele & Mersha 2019). The results of this study also reported that the COMESA and EU trading groups had positively and significantly generated trade creation effects on Swaziland's sugar exports.

In the study of Karemera, Koo, Smalls and Whiteside (2015), and as supported by Sultan and Munir (2015), a modified gravity equation was applied on the bovine and swine meat trade flows amongst the Common Market of the South (MERCOSUR), Association of Southeast Nations (ASEAN), European Union (EU) and North American Free Trade Agreement (NAFTA) from 1986 to 2009. In the separate studies, it was found that the gross domestic product per capita, capacity productivity, the volatility of exchange rates and distance are major determinants that impact meat trade flows. In the same way, Shahriar, Qian and Kea (2019) analysed the major determinants of meat export flows in China with its thirty-one country partners through extended gravity equation for the period of 1997-2016, and found that among others GDPs, GDPs per capita and exchange rate are significant factors impacting China's meat industry in the case of pork exports.

Apart from these previous studies that looked at the GDP, Dist, GDPPPK, REER, and RTA dummy variables as key factors of bilateral or multilateral trade flows, other empirical studies had attempted to analyse a two way-link between trade flows and the Information and Communication Technology (ICT) determinant that act as an important stimulant (Tay 2017). Indeed, the ICT linked to trade in goods and services has been the main driver of recent marketing and organisational innovations, and it has been documented as one of strong determinants of trade and investment, while also acting as a source of comparative advantage that of course drives trade among developed and developing countries (Patrick & Ralph 2009).

Some empirical studies in the international trade literature have supported a comprehensive inclusion of ICT in their augmented gravity equations in estimating trade (export) flows between countries. For instance, Keita (2015) used an augmented gravity model to analyse the effects of ICT on international trade costs from 2000 to 2012 among 2827 country-pairs.

The study reported that the higher level in communication network between countries has significantly reduced the bilateral trade costs. Tay (2017) investigated the impact of ICT from 2000 to 2013 on the bilateral trade flows in goods between The United States and 34 trading countries, and the study found that ICT determinant as well as other trade determinants have a significant impact on American commodity exports. Furthermore, the study revealed that the United States are dependent considerably on ICT for its commodity exports than imports. In a similar study through extended gravity equation, Ozcan (2016) examined the effects of ICT on Turkish bilateral trade flows in commodities with its 35 importer countries and 34 exporter countries using panel data models for the period 2000-2014. The study results showed that trade volumes for both Turkish import and export commodities were positively and significantly impacted by ICT.

Regarding an extended gravity model analysis within a panel data for the period 2001-2017 between the ASEAN (Association of Southeast Asian Nations) and a single country, researchers such as Wardani, Azizurrohman and Tanthowy (2019) and, Chu and Guo (2019) analysed the ICT effects on bilateral trade relations for Indonesia and China respectively. They found that ICT have positively and significantly impacted on Indonesian and Chinese export (trade) flows respectively. However in the case of China, it has been reported that the internet as a component of ICT contributed more to trade flows with ASEAN countries.

2.6.1 Gravity model of bilateral trade flows between the EU and other countries

Concerning panel data approach between the EU and a single country in the presence of bilateral trade relations, researchers (Antonucci & Manzocchi 2006; Akan & Balin 2016; Dincer, Tekin-Koru & Yaşar 2018) analysed the case of bilateral trade between the EU and Turkey over different periods ranging from 1967 to 2013. The studies revealed that by using the Hausman test (HT), the choice of the Fixed Effects Model (FEM) is supported by data rather than Random Effects Model (REM). One of their main findings from the gravity equation of the trade flows for Turkey lacked evidence to prove that the bilateral trade has created more trade than it diverted. Nguyen (2016) estimated gravity model of the bilateral trade between the EU-23 and Vietnam. The findings indicated that by all three methods (pooled model, REM and FEM) and panel data from 2006 to 2015, these three methods are consistent with the estimated coefficients as expected for all variables between Vietnam and its EU trading partners. In contrast, Binh, Duong and Cuong (2011) used pooled model and

REM to determine factors affecting bilateral trade flows. This was utilised for countries worldwide and Vietnam. Particularly so, in the EU, Africa and Western Asia regions and they applied a panel data from 2000 to 2010. According to the purpose of their study, they made choice on the gravity equation for REM alongside other econometric approaches. This was followed by an application of the Breusch-Pagan LM test to choose the REM for the interpretation of the findings, rather than FEM plus pooled models. They found that distance, culture, Vietnam's economic size, importer's economic size are strongly significant and positively affect Vietnam's bilateral trade with its 60 trading partners. They also revealed that Vietnam has a trade potential, particularly in Africa and Western Asia regions as they do have some new emerging markets.

Similarly, based on an extended gravity equation, these authors estimated panel data on Cameroon's bilateral trade flows with EU-28 countries, following ordinary least squares (OLS), FEM and REM from 2008 to 2012 (Doumbe & Belinga 2015). They applied the HT for FEM, rather than REM. Then, they also performed the Breusch-Pagan LM test for REM versus OLS and chosen REM. The report indicated that gross domestic product and per capita gross domestic product were significantly positive affecting Cameroon-EU FTA and the distance has a negative impact on Cameroon's bilateral trade flows.

Regarding the effects of the EU trading with other regional blocks in the world, Kahouli and Maktouf (2015) applied the gravity equation to analyse trade creation and the expansion impacts in the European Union-Mediterranean region with 27 countries, including the EU-15 countries. They argued that the estimated coefficients for all the regional blocks, usually, at the 1% level of significance, were found to have positively affected exports. Hence, being part of the European Union-15 exerted more influence on the orientation of export flows, compared to being a member of the AGADIR (FTA between Egypt, Jordan, Morocco and Tunisia) or AMU (Algeria, Libya, Morocco, and Tunisia) agreement. Besides, the FTAs in the EU-Mediterranean region had not only taken part in the creation of trade but have led to the diversion of trade as well. Similarly, Kahouli (2016) used a static and dynamic gravity equation during the period 1980-2011 to 40 countries, which are members of six different RTAs: MERCOSUR, ASEAN, NAFTA and EU-15. Static results reported that the RTA affected the creation and diversion of trade on export flows with the EU-15 trading partners. Furthermore, estimations that investigate the impact of RTAs between the EU-15, NAFTA,

ASEAN and MERCOSUR by these authors yielded strong positive effects on the EU trade creation.

2.6.2 Some empirical studies signifying TDCA between the EU-SA in Southern Africa

As pointed out previously, this study aims to assess the importance of the EU-SA TDCA through the application of the gravity model for bilateral trade flows (Jordaan & Kanda 2011; Jordaan & Eita 2011; Potelwa *et al.* 2016). Many studies (Mokoena 2011; Kwaramba, Kwenda-Magejo & Rankin 2015) have been conducted to investigate the effects of the EU-SA TDCA on SA including its European trading partners and selected Southern African countries. However, literature on the EU-SA TDCA is rather scarce compared to the literature on the international (regional) trade agreement between WTO members. For example, Holden and Tang (2016) and, Soko and Qobo (2017) explored the impacts of the EU-SA FTA and concluded that on one hand, South Africa has experienced an improvement of its trade.

On the other hand, the EU-SA FTA had negatively impacted on South Africa's trade along with some countries in the Southern African region. However, it has been difficult to infer if the outcomes of the studies could be attributed to the agreement. Besides, results revealed that the EU-SA FTA positively impacted the world trade. Hurt (2012) studied the experience of South Africa and the TDCA with the EU commencing 1995 and ending 2005 and noted that the TDCA was in fact successfully negotiated by South Africa by showing an upsurge in trade flows with South Africa amongst the top 20 EU trading partners with the EU being the leading trade partner for South Africa. It also has been concluded that the TDCA did manage to achieve most of the trade objectives as it set out to attain although some challenges remain.

Researchers (Hurt 2012; Walaza 2013; Soko & Qobo 2017) analysed the TDCA between South Africa and the European Union. The findings reveal that the significance of bilateral free trade between EU and SA proves to be complex, pertaining to the trade picture as a whole during the beginning of the twenty-first century. According to these authors, the findings were due to the various changes in the business environment and the economic emergence of Asia as well as the increase in raw material and energy prices. In spite of the changing global economic environment in the past decade, there has been an increase in the South African market share for the EU. Nonetheless, Czermińska (2018) study suggested that

the EU-SA FTA should be considered like an exemplar to other potential FTAs that may be considered in the Southern Africa region.

Contrarily, the prediction by Lewis, Robinson and Thierfelder (2002), which postulated that the EU-SA FTA would precipitate more trade creation from FTA partners than trade diversion from non-FTA partners is to some extent currently evident. In such a way, Sandey (2010) assessed the impact of the TDCA on exports on agricultural products from SA to the EU over the period of 2000-2009 and noted that the TDCA has been a factor in promoting agricultural exports to EU, and regional integration with the EU. In a similar study, Potelwa *et al.* (2016) explored within the gravity model, the factors influencing the growth of agricultural export in SA through African Growth Opportunity Act (AGOA) and TDCA trade agreements between 2001 and 2014. The findings indicated that the EU-SA TDCA has positively affected the growth in (South African) export performance.

A research conducted by Tsolo, Mogotsi and Motlaleng (2010) reflecting on the outcome of the EU-SA TDCA between South Africa and some of her neighbouring countries such as Botswana, Lesotho, Namibia and Swaziland. The researchers suggested that through the EU-SA TDCA, BNLS countries import foods from SA. This saw the volume of exports and imports increasing for both SA and BLNS after the implementation of the agreement (Guei *et al.* 2017). In another study, Kapuya (2015) revealed that the GDPs for SADC and EU countries have been found significant in explaining South Africa's orange (citrus fruit) exports. Jordaan and Kanda (2011) found that both creation and expansion of bilateral trade effects were not only between the EU-SA country signatories, but a worldwide concern. However, this was with a cautionary remark that the EU-SA restricts that the non-Member countries could benefit from trade with European Union trading countries.

2.7. Chapter summary

This chapter presented a literature review on the Trade, Development and Co-operation Agreement (TDCA). It revealed that TDCA allowed international trade to take place in order to facilitate member countries to expand their markets for goods, services, and investment capital. Particular attention was paid to FTAs which are straightforward to conclude than other forms of RTAs. This was due to a beneficial treatment in trade that was offered to signatory members than to the rest of the WTO members. An overview of the international

trade country-based theories and the Regional Trade Agreements (RTAs) were presented in sections 2.2 and 2.3 respectively.

Furthermore, section 2.3 also furnished some major economic effects that FTA could have on member countries through the concepts of trade diversion and trade creation section 2.4 presented the patterns of the FTAs. Section 2.5 discussed the TDCA while section 2.6 reviewed the gravity model of bilateral trade using a gravity model approach in two particular ways: empirical studies on relationships in trade amid the EU and a single country as well as empirical studies about the importance of the EU-SA TDCA in Southern Africa. A conclusion was provided in section 2.7. The chapter that followed (chapter 3) provides a research methodology: research design and econometric approach.

CHAPTER THREE
RESEARCH METHODOLOGY: RESEARCH DESIGN AND ECONOMETRIC APPROACH

3.1. Introduction

This chapter provides a research design in relation to an augmented gravity equation chosen for this study in section 3.2, which also indicates sample size, data collection and sources for all variables used in the augmented gravity equation. Section 3.3 contains research methodology, which begins by presenting an overview of the basics of the gravity equation for bilateral trade flows. This section also provides the econometric approach in relation to augmented gravity equation for the EU-SATDCA based on empirical literature on trade agreements. The bilateral trade referred to as the EU-SA TDCA focuses on sectoral exports of top 10 selected commodities in relation to the 2-digit level in Harmonized System (HS). Section 3.4 discusses the econometric model specification adopted for the EU-SA TDCA specifying an augmented gravity equation split into two steps: step 1 for fixed effects estimation and step 2 for trade creation and trade diversion estimation. The chapter is summarised in section 3.5.

3.2. Research design

Research designs are the specific procedures involved in the research process: data collection, data analysis, and report writing (Creswell 2012:20). It is the conceptual structure within which research is conducted (Pandey & Pandey 2015:14). Following the research question as addressed in the subsection 1.2.1 in chapter one, the research design in this study was carefully built on an appropriate quantitative structure to obtain dependable and valid answer to the research questions from different theories that exist in explaining the international trade.

Over time, economists have developed theories to explain the mechanisms of international trade on how countries traded with one another historically. Several international trade theories are referred as the country-based theories, amongst others, mercantilism, absolute advantage, comparative advantage and Heckscher-Ohlin (Mason & Sanjyot 2012). In addition to these theories, the gravity equation is nowadays considered by most of the scholars of empirical international trade as the workhorse in studying the ex-post effects of FTAs and Custom Unions on trade flows (Brodzicki 2015; Koçaslan 2017). It is only that

trade scholars started applying more an augmented gravity equation by adding other variables regarded as relevant factors of international trade, either as control, dummy or exogenous variables, this study adopted gravity equation of bilateral trade flows as econometrical analysis tool of export flows linking SA and the EU countries through the TDCA. It is appropriate for analysis done after trade has taken place between two countries (Cipollina, De Benedictis, Salvatici & Vicarelli 2016), for instance, the case of the EU-SA TDCA.

Besides, as pointed above that the objective of this study is also to examine the trade flows of the EU-SA TDCA in terms of the trade creation and trade diversion effects of this bilateral trade agreement on the selected commodity exports in South Africa. Thus for this purpose, the research design relates to a panel data estimation of the augmented gravity model of bilateral trade from 2000 to 2017 is well suited for this study. This is done by analysing the relationship between trade (export) flows (dependent variable) of the top 10 selected commodities at the HS-2 and its main determinants (independent variables) as well as to understand the functional nature of that relationship in explaining the trade effects between South Africa and the EU countries following a statistical analysis with a level of significance.

3.2.1 Population and sample

A population is a group of individuals who have the same characteristic that the researcher can identify and study. Within this target population, researcher then select a sample for study which is a subgroup of the target population that the researcher plans to study for generalizing about the target population (Creswell 2012: 142).Thus, the population in this study includes only South Africa as exporter country and the twenty-eight EU Member States (EU-28) as importer country-block. Therefore, no sample has to be chosen for the study.

3.2.2 Data collection and sources

Our bilateral trade analysis for the EU-SATDCA ranges from 2000 to 2017 between South Africa as exporter country and the EU Member States (EU-28) as importer country-block. Through this period, the study found that more than 65% of commodity data in the panel dataset are missing or not available for the following 08 EU countries: Estonia, Hungary, Latvia, Lithuania, Malta, Slovak Republic, Slovenia and Croatia (Ranilović 2017). Thus, these EU countries have been dropped from sample data in order to preserve chronological continuity in panel data. In this way, the panel dataset is strongly balanced with large N

(groups or entities) = 20 (i.e. EU-20) and small *T* (period) = 18 (i.e. 2000-2017) to obtain 360 observations over the study period. The study uses different data sources related to its variables on trade flows (bilateral) amid SA and its EU traders.

First, commodity exports are selected from the British Department for Business Innovation and Skills (BIS) database which proposes a list of products and commodity exports and imports flows among countries in the world subsequently, for example the Harmonized Commodity Description and Coding Systems (HS) at the 2-digit rank as adopted in this study. The BIS has ranked every single commodity from the higher level to lower level as compared to their respective share in world trade over time as well as according to their preferential/regional trade agreements at the bilateral and multilateral levels. The top 10 HS 2-digit selected commodities as imported by EU-28 from SA between 2000 and 2017. These products are as follows: HS08 (Edible fruit and nuts; peel of citrus fruit or melons), HS22 (Beverages, spirits and vinegar), HS26 (Ores, slag and ash), HS27 (Mineral fuels, mineral oils and products of their distillation, etc.), HS71 (Pearls, precious stones and metals, coins, etc), HS72 (Iron and steel), HS76 (Aluminium and articles thereof), HS84 (Nuclear reactors, boilers, machinery, etc.), HS85 (Electrical, electronic equipment), HS87 (Vehicles other than railway or tramway). However, commodity data with the monetary value of the volumes of exports in US dollars are taken from UNComtrade (United Nations Commodity Trade Statistics Database) by using the HS at the 2-digit level as "reported".

Second, data on GDPs, GDPPKs, ICT and REER for both countries come mainly from the database of the World Bank Development Indicators (WDI). Third, data on common colonial history and common language come from the Central Intelligence Agency (CIA) World Fact book, which is accessible at the online database. Fourth, data on distance between SA and each EU trader in kilometres are from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Data are annual, and all regressions to estimate the gravity model using STATA 14 are run by the author.

3.3. Research methodology: the gravity equation adopted for the study

This study applies the gravity equation approach as the theoretical and econometric frameworks in analysing and assessing the bilateral export commodities between South Africa and the EU countries through the EU-SA TDCA, as done in many previous studies of international trade flows. As a result, an augmented gravity equation as adopted for the EU-

SATDCA is specified in order to explain their trade patterns from the basic form of the gravity equation.

3.3.1 Overview of the equation for bilateral flows in trade

Based on Newtonian theory of gravitation (Brodzicki 2015; Koçaslan 2017), since time immemorial, the equation of gravity has been functional to analyse bilateral trade flows (BTFs). The law of gravity predicts that trade volume amid any two nations should rise alongside the size of the economies per se. This is as calculated by gross domestic products and go down with the transaction costs (Ghosh & Yamarik 2004:372). One reason that the gravity equation is nowadays considered by most of the scholars of empirical international trade as the workhorse in studying the ex-post effects of preferential trade agreements (such as FTAs and Custom Unions) on trade flows (bilateral), is because the approach has high power properties with either panel or ordinary least squares (Buongiomo 2015; Baltagi & Egger 2016; Kabir, Salim & Al-Mawali 2017). According to van Bergeijk and Brakman (2010:5), the gravity equation can be expressed in its basic form of the bilateral trade flows as follows:

$$T_{ij} = \frac{GDP_i^{\alpha} GDP_j^{\beta}}{DP_{ij}^{\theta}} \qquad \textbf{(1)}$$

The formula is interpreted as below:

T_{ij} denotes BTFs between countries *i*, and *j*; $GDP_i(_j)$ (gross domestic product) represents the size of the economy of *i*(*j*); DP_{ij} is the distance between country *i* and *j*. Coefficients $\propto$, β, and θ, in many cases, are approximated in logarithm linear equation specification. This gravity equation, in its general formulation, gives about 70-80% explanation of the BTFs which are determined by economic size and distance. By implication, a country with bigger economic size amid the two countries would enjoy the bigger bilateral trade. Furthermore, the longer the bilateral distance between the two country traders, the smaller the bilateral trade flows.

Moreover, to obtain the estimate form of the gravity model, generally in empirical literature, trade scholars (such as Begović, 2011:56), use the logarithm of the central form of gravity equation (1) and include a residual term (ε_{ij}) to obtain the gravity equation (2):

$$\ln T_{ij} = \varphi + \alpha \ \ln GDP_i + \beta \ \ln GDP_j + \theta \ \ln DP_{ij} + \varepsilon_{ij} \qquad \textbf{(2)}$$

Operationally, the gravity equation describes the logarithm (log) of the value of the bilateral trade in monetary value for country *i* and country *j* to natural logarithm (ln) for the GDP_i and

GDP_j respectively. Further, a compound term is introduced to quantify trade incentives and trade barriers in relation to trade flows for two countries, along with each of them as well as other countries. This specification allows, furthermore, an interpretation of the estimate coefficients as follows: coefficients of a gravity equation estimated within the log are interpreted as elasticities of the variable. For instance, the estimated coefficient for the importing or exporting country's GDP in a gravity equation estimated in a log-linear equation is the elasticity of bilateral trade to importing or exporting country's GDP, implying the percentage variation in bilateral trade flows, following a 1% increase in importing or exporting country's GDP (Bacchetta, Beverelli, Cadot, Fugazza, Grether, Helbl, Nicita & Piermartini 2012:106).

In line with the study purpose, as suggested by Begović (2011:56), the dependent variable T_{ij} is considered as export flows. He argues that exports comparatively to imports are applied because almost all the empirical studies on trade among nations investigated the effects of exports on top of trade flows in several ways, and besides, exports represent potential growth and supply for the countries. For example, the following studies have specified trade flows by export values using gravity model of trade. Some of the leading studies in this regard are the works of Tang (2005:247), Mesanza and González (2009:206), Nuroglu and Dreca (2011:41), Jafari, Ismail and Kouhestani (2011:27), Bjelić and Mitrović (2012:273), Kapuya (2015:13), Kahouli (2016:453), Frede and Yetkiner (2017:635), Székelyhidi (2018:127-128), as well as Shahriar, Qian and Kea (2019:2554-2555). Over the past decade, apart from economic size and distance as significant variables, the specification of the gravity equation (2) has changed significantly. However, trade-related researchers still use an augmented gravity equation by adding other variables regarded as relevant factors of international trade, either as control, dummy or exogenous variables. Therefore, the next subsection presents the augmented gravity equation, as adopted in the study, as analysis of export flows linking SA and the EU.

3.3.2 Econometric approach: Augmented gravity equation adopted in the study

Bjelić and Mitrović (2012:271) indicate that the basic form of gravity model equation (2) are generally extended with some dummy variables on the right-hand side as determinants that promote bilateral trade flows as well as trade barriers affecting them(such as common currency, common language, common customs unions and free trade areas and common borders). It should be note that there is no common consent among economists on which

bilateral variables to augment as determinants of trade (bilateral) between country *i* and country *j* (Begović 2011:54). Besides, Hayakawa (2011:5) and, Panda, Sethi and Kumaran (2016:4) suggest that the gravity equation (2) is usually augmented to obtain the augmented gravity equation (3) as follows:

$$\ln T_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln Distance_{ij} + \beta_4 Cont_{ij} + \beta_5 Lang_{ij} + \beta_6 Col_{ij} + \varepsilon_{ij} \quad (3)$$

In this case, T_{ij} denotes bilateral commodity from country *i* to country *j*. *Cont* indicates contingency whether the two countries *i* and *j* are having a common border. *Lang* is the common (official) language between countries *i* and *j*, and *Col* is the colonial relationship if country *i*(*j*) was colonised by the country *j*(*i*) at some referenced time point. In the same way, Bacchetta *et al*. (2012:109) and Fadeyi, Bahta, Ogundeji & Willemse (2014:56) suggest that the augmented gravity equation (3) can be reformulated with other dummies and especially by adding regional trade agreement (RTA) dummy variables to obtain another augmented gravity equation (4) at some point in time as follows:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 Cont_{ij} + \beta_5 Lang_{ij} + \beta_6 CCol_{ij} + \beta_7 Col_{ij} + \beta_8 Landlock_{ij} + \beta_9 OneinRTA_{ijt} + \beta_{10} BothinRTA_{ijt} + \varepsilon_{ijt} \quad (4)$$

Where dummy variables are:

$Cont_{ij}$: contingency equates to one if the common border is shared by the country *i* and country *j* and, zero if otherwise.

$Lang_{ij}$: common language equals to one if it is commonly spoken (official language) in the two countries and, zero if otherwise.

$CCol_{ij}$: common coloniser equals to one if country *i*(*j*) was a colony of the country j(i) at some point in time and, zero if otherwise.

Col_{ij}: colonial relationship is set to one if country *i*(*j*) was colonised by the country *j*(*i*) at some referenced time point and, zero if otherwise.

$Landlock_{ij}$: landlock is set to one whether the country *i*(*j*) is a closed-in country *j*(*i*) (including when both countries are landlocked)and, zero if otherwise.

$OneinRTA_{ijt}$: is RTA dummy taking value of one if the importer country (*i*) belongs to RTA but the exporter country (*j*) does not at time *t*.

$BothinRTA_{ijt}$: is RTA dummy taking value of one if country *i* and country *j* are both members of RTA at time *t* and, zero if otherwise. ε_{ijt}: is the residual term at time *t*.

In the augmented gravity equation (4), the tariff barriers can also be included as an RTA dummy variable, along with a bilateral distance variable and other dummies (common border, landlocked countries and islands) that are usually expressed to measure bilateral trade costs. They are also presumptive evidence (Piermartini & Teh 2005; Bacchetta *et al*. 2012) of the transport costs which increase with distant countries (lands), but decrease with neighbouring (bordering) countries. Furthermore, dummies for colonial links, cultural characteristics, adjacency and common language handled for the reproduction of information costs are also introduced into the system equation.

In addition, firms in nations sharing a similarities in these dummies are likely to find suppliers or consumers in their adjacent countries because they have a good knowledge of the business environment rather than other distant countries where firms are competing into a less familiar environment (Piermartini & Teh 2005:37; Bacchetta *et al*. 2012:106). Besides, Martinez-Zarzoso and Nowak-Lehmann (2003:295-298; 2004:299-302), Eita (2008:5-8), Anggita (2016:153-154), and Abidin, Haseeb, Chiat and Islam (2016:393-394) suggest another type of the augmented gravity equation (4) to obtain its alternative equation (5) by adding gross domestic product per capita (GDPPK) with the real effective exchange rate (REER) of countries *i* and *j* as follows:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln GDPPK_{it} + \beta_4 \ln GDPPK_{jt} + \beta_5 \ln REER_{it} + \beta_6 \ln Distance_{ij} + A_{ij} + \varepsilon_{ijt} \quad \textbf{(5)}$$

Where:

A_{ijt} indicates dummy variables such as $Cont_{ij}$, $Lang_{ij}$, $CCol_{ij}$, Col_{ij}, $Landlock_{ij}$ and $OneinRTA_{ijt}$/$BothinRTA_{ijt}$ as previously specified. According to these authors, the relevance of having GDPPK and REER in the augmented gravity equation (5) is because they play a crucial determinant function in the bilateral export performance in two ways (increase or decrease), as explained in details in the next subsection (3.3.2).

However, some empirical studies in the international trade literature have also supported a comprehensive inclusion of GDPPK and/or REER in their augmented gravity equations in estimating export flows between countries. For example: GDPPK was introduced in isolated model in a few studies (Khan, ul Haq & Khan 2013:109), REER (Kahouli & Maktouf 2015:81-83; Kahouli 2016:453), while both GDPPK and REER were introduced into system equations in some other studies (Hatab, Romstad & Huo 2010:138-139; Serrano & Pinilla 2012:4201; Irshad, Xin & Arshad 2018:5-6; Shahriar, Qian & Kea 2019:2554-2555).

Besides, this study also looks at the statistical significance and importance of the relationship between export commodity flows and GDPs, GDPPKs, Dist, REER and dummy variables together with the Information and Communication Technology (ICT) as a key determinant that acts as an important stimulant (Tay 2017:1726) for South Africa. Recently the ICTs have been used in several empirical studies to investigate its impacts on trade (export) in goods and services (For instance, Ozcan 2016:15-17; Tay 2018:47-52; Wardani, Azizurrohman & Tanthowy 2019:195-198; Soeng 2020: 84-85).

As showed in the augmented gravity equation (5), our vector of dummy variables A_{ijt} in this study is explicitly expressed by $Lang_{ij}$, Col_{ij}, $OneinTDCA_{ijt}$ and $BothinTDCA_{ijt}$ as dummy variables. Other dummy variables such as $Cont_{ij}$, $CCol_{ij}$ and $Landlock_{ij}$ are not useful in the case of the EU-SA TDCA. For this reason, in this study they have been dropped from the adopted empirical estimation of the augmented gravity equation for the EU-SA TDCA.

Therefore as a result of the foregoing, the estimation regression model adopted in this study from equation (5) is re-specified as follows:

$$\begin{aligned} lnHS_{ijkt} = {} & \beta_0 + \beta_1 lnGDPSA_t + \beta_2 lnGDPEU_t + \beta_3 lnGDPPKSA_t + \beta_4 lnGDPPKEU_t \\ & + \beta_5 lnICTSA_t + \beta_6 lnREER_{it} + \beta_7 lnDist_{ij} + \beta_8 Lang_{ij} + \beta_9 Col_{ij} \\ & + \beta_{10} OneinTDCA_{ijt} + \beta_{11} BothinTDCA_{ijt} + \varepsilon_{ijt} \end{aligned} \quad (6)$$

Equation (6) is interpreted as follows:

HS_{ijkt} is the bilateral trade exports from country *i* [South Africa (SA)] to country *j* [European Union (EU) trader] in year *t* of commodity *k*;

$GDPSA_t$/$GDPEU_t$are respectively the GDPs of SA and EU trader in year *t*;

$GDPPKSA_t$/$GDPPKEU_t$ are respectively the GDP per capita of SA and EU trader in year *t*;

$Dist_{ij}$ is distance in kilometres separating the main economic city of SA and its EU trader;

$ICTSA_t$ is ICT- related service exports for SA in year *t*;

$REER_{it}$ is the real effective exchange rate of the currency (Rand) in year *t*;

$Lang_{ij}$ /Col_{ij} are respectively dummy variables to gauge if SA and its EU trader sharing a common language, as well as whether one was a former colony (colonial relationship) of the other at some point in time (in this case, SA was a colony of Britain, and Germany to some extent). Furthermore, $Lang_{ij}$ equates to one where the official language is English and zero otherwise, while Col_{ij} equates to one where South Africa has colonial ties with an EU country

and zero otherwise. Finally, $OneinTDCA_{ijt}$ equals one if one (SA), and only one (SA) country is a partner of the EU-SA TDCA in year t and zero otherwise. $BothinTDCA_{ijt}$ equals one if both countries (SA and EU traders) are members of that EU-SA TDCA in the year t and zero otherwise. ε_{ijt} is the error term in year t.

3.4. Econometric model specification for the EU-SA TDCA

The augmented gravity equation of the EU-SA TDCA adopted for this study is represented by equation (6). It thus follows that the empirical methodology adopted in analysing bilateral export flows for selected commodities between SA and the EU traders emanates from equation (6), on the basis of the fixed effects estimation as suggested in subsection 3.4.1. In this study, attempt is also made to estimate individual effects in order to find out whether EU-SA TDCA is trade creating or trade diverting through two EU-SA TDCA dummy variables ($OneinTDCA_{ijt}$ and $BothinTDCA_{ijt}$). This methodological scenario is presented in subsection 3.4.2.It should be noted that all coefficients β_i for i = 0, 1, 2...11 in the augmented gravity equation (6) are estimated in a logarithm-linear reformulation with the panel data estimation method (which is discussed in chapter four) for explaining the relationship between exports HS-2 of commodity k in year t with other determinants in relation to the flows of commodity exports amid SA and the EU countries.

3.4.1 Step 1: Fixed effects estimation for the EU-SA TDCA

The estimation of the augmented gravity equation (6) for the EU-SA TDCA at this first step follows the fixed effects regression which is carried out with the Ordinary Least Square (OLS) method. This approach has been adopted in a series of previous studies: (Jordaan 2014:598; Jordaan & Kanda 2011:236-237; Eita & Jordaan 2007b:84-85; Wardani *et al.* 2019:195-198; Oktora & Muhtasib 2019:124-125).

The equation is presented below:

$$\boldsymbol{lnHS_{ijkt} = \beta_0 + \beta_1 lnGDPSA_t + \beta_2 lnGDPEU_t + \beta_3 lnGDPPKSA_t + \beta_4 lnGDPPKEU_t + \beta_5 lnICTSA_t + \beta_6 lnREER_{it} + \varepsilon_{ijt}} \quad \textbf{(6.1)}$$

The expected signs are as follows:

In the augmented gravity equation 6.1, the correlation between commodity exports of SA to the country's GDP is predictably positive. Thus, the higher rank of South Africa's Gross

Domestic Product expresses the higher rank of its productive capacity which successively converts into the increased potentiality of exporting for South Africa (SA is potentially willing to supply the permissible commodity that is required by the EU member countries).

On the other hand, a higher rank of the EU's GDP expresses the higher rank of the absorptive capacity, i.e. the EU country is capable of more imports (The EU trading partner is potentially willing to demand the commodity). Therefore, the estimated parameters β_1 and β_2 are generally predicted to be positive and correlated to the exports (Eita & Jordaan 2007a:6; Jordaan & Kanda 2011:235). The same applies to estimated parameter β_5 (Tay 2017:1727; Tay 2018:49; Wardani *et al.* 2019:190) of the ICTSA, i.e. the greater level of income in SA, the greater the trend for SA to use different ICT and internet technologies, which consequently, expands its bilateral trade (export) flows with the EU countries.

However, an instance may occur whereby a rising gross domestic product per capita of the country exporting may propel expansion for more exports of the commodity which would potentially boost the trade volumes (bilateral) under the hypothesis of the increased ratio of the capital by labour. Therefore, the a priori expectation is that the estimated coefficients of the GDP per capita for the country exporting (β_3) and the gross domestic product per capita for importing country (β_4) are expected to have positive signs (Karemera *et al*. 2015:253).

Furthermore, the correlation between commodity exports and the rate of the currency for exchange, in SA is predicted to be positive (β_6) as an expression of the depreciation of the Rand. As a result, the EU trading partner would benefit from the cheaper exchange rate to make more effective payments for imports of the commodity which would lead in return, to the high demand of the commodity from South Africa (Jordaan & Kanda 2011:235; Jordaan & Eita 2012:42).

3.4.2 Step 2: Individual effects with inferences on EU-SA TDCA

In relation to trade creation and trade diversion effects, the augmented gravity equation (6) is reformulated in this step two by running an additional pooled regression with individual effects for the selected commodities at the HS 2-digit (IEHS) level by excluding some dependent variables (such as GDPs, GDPPKs and REER) except bilateral distance. This has been done in the previous studies (Jordaan 2014:598; Jordaan & Kanda 2011:237; Eita & Jordaan 2007b:85).

The model is presented as:

$$IEHS_{ijkt} = \alpha + \beta_7 lnDist_{ij} + \beta_8 Lang_{ij} + \beta_9 Col_{ij} + \beta_{10} OneinTDCA_{ijt} + \beta_{11} BothinTDCA_{ijt} + \varepsilon_{ijt} \quad (6.2)$$

The formula is interpreted as follows:

$IEHS_{ijkt}$ denotes individual effects of exported commodity *k* in year *t* from one country *i* (SA) to another country *j* (EU trader) and the rest variables in the equation remain their original identity as discussed in the previous specification. On the other hand, Jordaan and Kanda (2011), and Eita and Jordaan (2007b), and Jordaan and Eita (2012) suggest the following complete explanation of the signs of the dummy of the EU-SA TDCA variables' coefficients:

Trade creation & trade expansion = both β_{11} and β_{10} are greater than zero ($\beta_{11} > 0$, and $\beta_{10} > 0$)
Trade diversion = β_{11} is greater than zero ($\beta_{11} > 0$), and β_{10} is less than zero ($\beta_{10} < 0$)
Trade expansion = β_{11} is less than zero ($\beta_{11} < 0$), and β_{10} is greater than zero ($\beta_{10} > 0$)
Trade contraction =β_{11} is less than zero ($\beta_{11} < 0$), β_{10} and is less than zero ($\beta_{10} < 0$)

However, in equation 6.2, the β_7 is an estimated coefficient of bilateral distance that is defined as a proxy for transport expenses, which is usually predicted to carry a negative effect on exports of the commodity. That is, the more extended the bilateral distance between traders, the smaller the trade flows (bilateral) and vice versa. Furthermore, the estimated coefficient β_8 of common languages (*Lang*) and β_9 estimated coefficient of the colonial history (*Col*) amid SA and its European traders, are predicted as positive and have significant impacts on their flows of bilateral exports.

3.5. Chapter summary

A research design comprising population as well as data for this study in the context of investigating the trade flows (bilateral) between SA and EU countries has been provided in section 3.2 of this chapter. In this section, the study population, data collection and sources of variables are described through the period 2000-2017 as part of analysing the trade flows (bilateral) between SA as exporter country and twenty Member-States of the European Union (EU-20) as importer country-block. In addition, the research methodology chapter addressed an overview of the basic form of the gravity (model) equation for trade flows between two countries, which was detailed in section 3.3, as well as the econometric approach of the adopted augmented gravity equation for the EU-SA TDCA. The latter is related to the

sectoral exports of the top 10 selected commodities according to the HS at the 2-digit rank as reported. The augmented gravity equation of commodity exports for the EU-SA TDCA is specified along with GDPs, GDPPKs, ICTSA, REER, Dist as explanatory variables and other dummy variables such as *Lang*, *Col*, *OneinTDCA* and *BothinTDCA*.

After defining the econometric model specification for an augmented gravity equation in section 3.4, the adopted empirical methodology was implemented and split into two steps: step 1 for fixed effects estimation and step 2 for trade creation and diversion estimation. Amidst these two steps, all estimated coefficients of variables inclusively in augmented gravity model have been discussed following their expected signs and a priori expectations within the panel data estimation method.

CHAPTER FOUR
PANEL DATA ANALYSIS AND ECONOMETRIC MODEL SPECIFICATION RESULTS

4.1. Introduction

The aim of this chapter is to provide descriptive statistics for the variables, panel data analysis as well as econometric model estimation results of the extended gravity equation (6) for the EU-SA TDCA that this study has adopted. Indeed, in relation to studies on international trade, the gravity model usually applies time-series data or cross-sectional data to estimate the flows of trade (Baltagi, Egger & Erhardt 2017). Moreover, when applying cross-sectional data on available bilateral flows data over various periods (panel data), one can get some more useful information over time than when using a single cross-sectional (time-series data) (Novy 2013). Using the data in a panel environment to analyse the bilateral trade flows has various interests of reproducing significant correlations among determinants of trade over time, and giving an explanation of unobserved individual effects of exporter and importer partners (Nuroglu & Dreca 2011). Besides, panel data provides more degrees of freedom and possible variability of all variables overtime and decreases collinearity between the independent variables included, in gravity equation of trade, for instance (Feyrer 2019).

Therefore, panel data improves the econometric estimates efficiently in capturing the effects (such as country-pair fixed effects) that are unobserved in a single cross-section and time-series data (Jafari *et al*. 2011; Bacchetta *et al*. 2012). Before estimating and interpreting the equations (6.1) and (6.2) in section 4.6, the study first presents descriptive statistics for the variables in the panel data in section 4.2 and also analyses the unit root tests of the panel data as well as other diagnostic tests for fixed effects in section 4.3 and section 4.4, respectively. The diagnostic efforts proceeds later to examine the Hausman test, which draws a selection of the fixed effects model or random-effects model, Wald and modified Wald tests as well as Pesaran cross independence test for fixed effects model, and the Wooldridge serial correlation test are also conducted.

Section 4.5 suggests some implications of the results from panel data tests for the EU-SA TDCA through the gravity panel approach. Section 4.6 provides the econometric model specification results for the EU-SA TDCA, and the interpretation of the results based on both gravity equations (6.1) in step 1 and (6.2) in step 2, while section 4.7 concludes this chapter.

4.2. Descriptive statistics for the variables in the panel data

The summary of descriptive statistics for all variables is presented in Table 4.1 below.

Table 4.1 Summary of descriptive statistics

Variables	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Shapiro-W test*
HS08	360	14.96806	2.98579	2.484907	20.33334	5.381(0.000)**
HS22	360	14.71684	2.763096	3.806663	19.137	5.384(0.000)**
HS26	360	13.67404	4.998068	0.693147	20.54738	7.158(0.000)**
HS27	360	14.57865	4.59479	0	20.73723	7.446(0.000)**
HS71	360	12.74605	4.260668	2.995732	21.50131	6.464(0.000)**
HS72	360	15.63692	3.38357	1.609438	20.2989	7.217(0.000)**
HS76	360	13.05138	3.756869	1.609438	19.30949	5.482(0.000)**
HS84	360	16.19753	2.502795	10.54036	21.13581	4.996(0.000)**
HS85	360	14.75663	2.118653	7.620215	19.00267	2.709(0.003)**
HS87	360	15.4783	3.397681	4.762174	21.68828	6.578(0.000)**
GDPSA	360	26.58947	0.153737	26.31052	26.77961	7.033(0.000)**
GDPEU	360	26.51533	1.404379	23.02444	28.98959	5.113(0.000)**
GDPPKSA	360	8.844578	0.092380	8.672292	8.933742	8.731(0.000)**
GDPPKEU	360	10.20991	0.783300	7.383916	11.68877	7.362(0.000)**
ICTSA	360	19.626	0.671856	17.72854	20.31455	8.726(0.000)**
REER	360	4.47781	0.1121751	4.276867	4.627281	6.402(0.000)**

*Notes: The p-values of the Shapiro-Wilk test are in parentheses: *** p < 0.01, ** p < 0.05 and * p < 0.1. Obs: observations. Std. Dev.: Standard deviations. Number of observations: 360.*
Source: Author's calculations using Stata 14.

Table 4.1 reports that the *p*-values (0.000) for all variables are all less than 0.05 based on the critical *p*-value set at the 0.05 of the significance following the Shapiro-Wilk test for normality of the distribution (Brzezinski 2012), which fails to reject the null hypothesis of normal U-curved distribution. This means that panel data for all variables passed the most critical assumption of regression analysis, as they are all normally distributed. Besides, according to the summary of descriptive statistics contained in Table 4.1, the total observations for each export commodity (dependent) variable were 360.

One the one hand, a look at the dataset on the Microsoft Excel Spreadsheet suggests that the highest export flows from South Africa to Germany was recorded in 2017(21.68828) for HS87 (Vehicles other than railway or tramway), while two other highest South African exports were recorded again by Germany in 2008(21.13581) for HS84 (Nuclear reactors, boilers, machinery, etc.) as well as by United of Kingdom in 2007(21.50131) for HS71 (Pearls, precious stones and metals, coins, etc.). Furthermore, the smallest export value was zero (0) in HS27 (Mineral fuels, mineral oils and products of their distillation, etc.) between

South Africa and Austria in 2014, followed by Ireland (0.693147) in 2001 for HS26 (Ores, slag and ash).

Furthermore, Table 4.1 also contains the descriptive statistics results for the independent variables such as GDPSA, GDPEU, GDPPKSA, GDPPKEU, ICTSA and REER. Indeed, the correlation between each commodity export and gross domestic product (GDP) is predictably positive. Thus, in the Table 4.1 following the hypothesis that all data are normally distributed, on the one hand, the descriptive statistics for GDPSA suggests that South Africa generates the highest level of potentiality of exporting (supplying) the commodities to most European trading partners in 2017(26.77961), the smallest was generated by the country in 2000(26.31052). Further scrutiny of the Table 4.1 indicates that Germany expresses the highest level of absorptive capacity, i.e. potentiality of importing (demanding) of the commodities from South Africa in 2014 (28.98959), while the smallest in 2000(23.02444) was expressed by Cyprus.

The same law of normality hypothesis also applies to GDPPKSA and GDPPKEU as well as the South African information, communication and technology (ICTSA) and real effective exchange rate (REER). For instance, looking through South African telecommunication sector, the descriptive statistics for ICTSA suggest that South Africa produces the highest level of ICT service exports in 2017(20.31455).

This descriptive statistical analysis highlights the trade values of all variables (determinants) of the EU-SA TDCA as a preparatory to the analysis of the importance of this bilateral agreement on commodity exports. With regard to the specific approach adopted in this study, the proxies for these determinants are reported in section 4.6 below (Table 4.8 and Table 4.9) from empirical analysis of the adopted 'augmented gravity model' of trade.

4.3. Panel data analysis: unit root tests and results

Nell and Zimmermann (2011) point out that, when running the unit root test in panel dataset, asymptotical behaviour for the *T* being the time-series dimension and *N* being the cross-sectional dimension should be considered. Thus, the direction wherein *N* and *T* go towards time without end is crucial if a diagnosis of the asymptotical behaviour of variables and tests are applied for panel unit-roots (Hanck 2013; Fedeli 2015). Moreover, these authors suggest that there are different tests for unit roots (or stationarity) in panel datasets depending on

researcher's interest (approach). Thus, this section presents a panel-based unit root tests as adopted for the study, for example, the Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS), and Augmented Dickey-Fuller (ADF), which are the most stable and reliable form of analyses (Góes & Matheson 2017). The study does not look at all explicit equations or models and assumptions, as developed in detail by authors of each of these tests. The panel unit root tests are analysed broadly pertaining to the null hypothesis and alternative hypothesis (Klein 2013).

The LLC test is based on the homogeneous alternative in which all cross-sections have the same autoregressive coefficient (Inglesi-Lotz 2016). This panel unit root test is applicable for the panels of moderated size with N between 10 and 250, and T between 25 and 250; although, its predictive capability does not diminish in larger samples. This approach supposes that there is a common unit root procedure so that the lag order ρ_i has made possible variations across individuals and the LLC test has suggested these hypotheses as follows (Wiedmer 2018):

The null hypothesis H_0: $\rho = 0$, each panel encompasses a unit root;

The alternative hypothesis H_1: $\rho = \rho_i < 0$, each panel is stationary for all $i = 1 \ldots N$.

Therefore, LLC panel unit root test essentially relies on the independence assumption across cross-sections, and it might not be used if a cross-sectional correlation exists in the series (Levin, Lin & Chu 2002). On the other side of the LLC test, Im, Pesaran and Shin (IPS) (2003) suggest another unit root test which is the second-panel unit root test adopted in this study. The IPS test provides for the independence assumption across individuals which enable heterogeneity in the value of ρ_i under the alternative hypothesis (Pattnayak & Chadha 2016). The null hypothesis is that every individual series in the panel has a unit root, which is expressed as:

The null hypothesis H_0: $\rho_i = 0$ for all i

The alternative hypothesis H_1 lets some (but not all) of the individual series look like having unit roots as follows:

$$H_1: \begin{cases} \rho_i < 0 \text{ for } i = 1 \ldots\ldots N_1. \\ \rho_i = 0 \text{ for } i = N_1 + 1, \ldots\ldots N. \end{cases}$$

In addition to LLC and IPS tests, this study considers the third adopted test in the form of Augmented Dickey-Fuller (ADF). The ADF test defines the hypotheses as follows (Fedorovà 2016):

The null hypothesis H_0: each individual series in the panel has a unit root;

The alternative hypothesis H_1: there is stationarity.

The ADF tests specification may include an intercept but no trend or may include an intercept and time trend. In a nutshell, none of the unit root tests could be placed above the other in deterministic properties, but the combination of all the three helps to enhance the stability of the estimations. Thus, the adoption of each econometric tool is influenced by dynamic thinking of the various advantages and weaknesses inherent in each of the tests. However, the main decision on the efficiency of each approach is determined by making a comparison of the findings from those tests according to *T* (time) and *N* (cross-section) dimensions (Nell & Zimmermann 2011). The panel unit roots results for all variables are presented in Table 4.2.

Table 4.2 Results of the panel unit root tests

Variable	Levin-Lin-Chun	Im-Pesaran-Shin	ADF-Fisher
HS08	-8.9682 (0.0000) **	-3.7018 (0.0001) ***	-6.0826 (0.0000) **
HS22	-7.2079 (0.0000) **	-3.2513 (0.0006) **	-5.0619 (0.0000) **
HS26	-3.5568 (0.0002) **	-2.3338 (0.0098) **	-2.6782 (0.0043) **
HS27	-3.0624 (0.0011) **	-3.8639 (0.0001) ***	-6.0763 (0.0000) **
HS71	-4.9787 (0.0000) **	-5.2112 (0.0000) **	-8.7086 (0.0000) **
HS72	-3.1628 (0.0008) **	-3.4212 (0.0003) *	-7.3670 (0.0000) **
HS76	-2.6610 (0.0039) **	-4.8016 (0.0000) **	-7.1885 (0.0000) **
HS84	-1.7958 (0.0363) **	-2.3772 (0.0087) ***	-3.4247 (0.0004) **
HS85	-2.3772 (0.0087) **	-3.3959 (0.0003) **	-4.8456 (0.0000) **
HS87	-6.7981 (0.0000) **	-1.0508 (0.1467) **	-1.0674 (0.1441) **
GDPEU	-10.0074(0.0000) **	-4.2583 (0.0000) **	-4.5869(0.0000) **
GDPSA	-9.9693 (0.0000) **	-4.8313(0.0000) ***	-5.3470 (0.0000) **
GDPPKSA	-9.1201(0.0000) **	-4.3527 (0.0000) *	-4.5682 (0.0000) **
GDPPKEU	-9.6767 (0.0000) **	-4.2374 (0.0000) **	-4.5431 (0.0000) **
ICTSA	-6.6263 (0.0000) **	-10.1588 (0.0000) *	-24.1318 (0.0000) **
REER	-7.9450 (0.0000) **	-3.4256(0.0003) **	-3.2178 (0.0009) **

*Notes: The probabilities of the panel unit root test are in parentheses: *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.*

Source: Author's calculations using Stata 14.

Table 4.2 showed that the *p*-values are all less than 0.05 based on the critical *p*-value set at the 0.05 of the significance. As a result, the null hypothesis of unit root is rejected for all three tests: LLC, IPS and ADF. This suggests that the possibility of unit roots in the series are almost non-existent, except for HS87 (Ores, slag and ash) which is non-stationary from panel unit root testing of IPS and ADF. By implication, the study applies a sumptuous rejection of unit root incidence in at least one of the three adopted panel unit-root test approaches, thereby embracing across-board stationarity in the series. Thus, the overall results suggest that all variables are stationary and a co-integration test between the variables is not necessary.

4.4. Other tests of the applicability of the fixed-effect model

After obtaining the results of panel unit root tests in section 4.3, this section presents and analyses other diagnostic tests, such as the Hausman specification test, Wald test, Pesaran cross independence test, Wooldridge serial correlation test and Modified Wald heteroskedasticity test (Martinho 2016; Afonso, Marques & Fuinhas 2017; Koengkan 2018). These tests are used to check the applicability and effectiveness of the augmented gravity equation (6.1) estimated with regard to fixed effects model as the appropriate estimation technique adopted in this study, with the a priori expectation that it would give the most efficient results (Jordaan 2014; Jordaan & Kanda 2011; Eita & Jordaan 2007b).

4.4.1 Hausman specification test

The Hausman test (HT) is applied to test the null hypothesis, to the effect that there is no correlation between explanatory variables. The analysis informs the dynamics of individual effects to draw a valid selection of either the Fixed Effects Model (FEM) or Random-Effects Model (REM) (Dieleman & Templin 2014; Sheytanova 2015; Das 2019). Thus, in this study for each sectoral export, if the null hypothesis is refuted, then the FEM would be appropriate, but if otherwise, the REM will be proposed (Martinez-Zarzoso & Nowak-Lehmann 2004). The null (H_0) and alternative (H_1) hypotheses are defined as follows (Sheytanova 2015):

H_0**:** The appropriate model is Random Effects -there is no correlation between the error term and the independent variables in the panel data model ($\boldsymbol{Cov\alpha_i, x_{it}=0}$).

H_1: The appropriate model is Fixed Effects. The correlation between the error term and the independent variables in the panel data model is statistically significant ($\boldsymbol{Cov\alpha_i, x_{it} \neq 0}$).

Thus, this study applies the HT to panel data in comparing the estimates of FEM and REM under the $H_{0,}$ which imbibes orthogonality between the fixed effects and the regressors. In addition, the HT assumes that FEM is consistent and probably efficient under the $H_{1,}$ whereas REM is more consistent and efficient under the H_0. The Hausman Test (HT) results are presented in Table 4.3 where the *p*-values were obtained based on the chi-square (χ^2) distribution with six (6) degrees of freedom as a pre-set condition.

Table 4.3 Hausman test results

Sectoral exports	***χ^2 (p-value for χ^2)***	***Appropriate model***
HS08 (Edible fruit and nuts; peel of citrus fruit or melons)	11.48 (0.0746) *	**FEM**
HS22 (Beverages spirits and vinegar)	1.33 (0.9698) **	REM
HS26 (Ores, slag and ash)	13.36 (0.0341) **	**FEM**
HS27 (Mineral fuels mineral oils and products of their distillation)	0.03 (1.0000) **	REM
HS71 (Pearls precious stones and metals coins, etc.)	33.63 (0.0000) ***	**FEM**
HS72 (Iron and steel)	9.64 (0.1409) **	REM
HS76 (Aluminium and articles thereof)	3.47 (0.7482) **	REM
HS84 (Nuclear reactors boilers machinery, etc.)	4.12 (0.6606) **	REM
HS85 (Electrical electronic equipment)	5.67 (0.4614) **	REM
HS87 (Vehicles other than railway or tramway)	21.19 (0.0017) ***	**FEM**

*Notes: The p-values of the statistic based on the χ^2 distribution with 6 degrees [χ^2 (6)] of freedom are in parentheses: *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.*
Source: Author's calculations using Stata 14.

The results contained in Table 4.3 shows that the HT fails to reject the null hypothesis at the 0.05 level of significance for the following commodities: HS22, HS27, HS72, HS76, HS84 and HS85. Their *p*-values are 0.9698, 1.0000, 0.1008, 0.1409, 0.7482 and 0.6606 respectively, and they are higher than 0.05. Therefore, the HT provides evidence that REM should be used for these six products. Alternatively, the HT rejects the null hypothesis for commodities HS08 (Edible fruit and nuts; peel of citrus fruit or melons), HS26 (Ores, slag and ash), HS71 (Pearls, precious stones and metal coins), and HS87 (Vehicles other than railway or tramway), and this means that the country-specific effects correlate with the

regressors. From Table 4.3 the *p*-values associated with the χ^2 statistic of HS26, HS71 and HS87 are respectively, 0.0341, 0.0000 and 0.0017, and they are all less than 0.05, and the *p*-value of HS08 is 0.0746 and less than 0.1. These results imply that the FEM should be applied to these four commodities within the context of the EU-SA TDCA.

4.4.2 Wald test of the significance of the fixed-effects model

According to Spicka, Naglova & Gurtler (2017), to test FEM significance, one could use the typical Wald test under the following hypotheses:
The H_0: $\beta_i = 0$, all coefficients are simultaneously zero; The H_1: $\beta_i \neq 0$.

On the one hand, for an individual regressor or group of regressors, if there is significance in the Wald test, subsequently one would provide a conclusion that the coefficients related to these regressors are not zero so that the regressors must be added in the equation (Krzciuk & Żądło 2014). On the other hand, the included regressors could be dropped from the equation if the Wald test is not significant (Lee & Suh 2018). This methodological approach helps the stability of estimations in two ways:

1) it ensures that variables with strong explanatory powers are included in the estimation;
2) it helps to eliminate misspecification and omitted variable bias.

From the augmented gravity equation (6.1), the Wald test's null hypothesis in this study is that the coefficient of GDPSA equals 0, and the coefficient of GDPEU equals 0. The assumption goes further that the coefficient of GDPPKSA equals 0, and the coefficient of GDPPKEU equals 0, as well as the coefficient of ICTSA equals 0, while the coefficient of REER equals 0. After running Ordinary Least Squares (OLS) regression in relation to each sectoral export, Wald test's results are presented in Table 4.4.

Table 4.4 Wald test results

Sectoral exports	***F-statistic (p-value for F)***
HS08 (Edible fruit and nuts; peel of citrus fruit or melons)	21.03 (0.0000) ***
HS26 (Ores, slag and ash)	5.74 (0.0000) **
HS71 (Pearls precious stones and metals coins)	6.08 (0.0000) ***
HS87 (Vehicles other than railway or tramway)	36.05 (0.0000) ***

*Notes: The probabilities of the F-statistics are in parentheses: *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.*
Source: Author's calculations using Stata 14.

From the analysis contained in the above Table 4.4, the associated *p*-values of HS08, HS26, HS71 and HS87 are both 0.000 at all the chosen levels of significance. These results provide vivid evidence against the null hypothesis of no difference between the variables - which we do not fail to reject. In other words, all explanatory variables GDPSA, GDPEU, GDPPKSA, GDPPKEU, ICTSA and REER are significant for these four selected commodities at the 0.01, 0.05 and 0.1 levels. However, the study could conclude with caution that all regressors are also Wald tested significantly fit for a fixed-effects model.

4.4.3 Pesaran cross independence test in fixed effect model

This study uses the cross-sectional dependence (CD) tests of Pesaran, following De Hoyos and Sarafidis (2006), and Hoechle (2007; 2018) approaches. This estimation method is adopted to test if the residuals from fixed effects regression for the augmented gravity equation (6.1) are spatially independent. The null hypothesis of the Pesaran's (2004) CD test suggests that the errors are assumed not to be correlated (no cross-sectional dependence or cross-sectional independence) over a period while the alternative hypothesis is that the errors may be correlated across cross-sections (Pattnayak & Chadha 2016).

The Pesaran's CD test is validated when $T < N$ and can be applied with balanced or unbalanced panel data models (Sung, Choi & Song 2019). In this study, the panel datasets are strongly unbiased with small T=18 and large N=20. Pesaran test's results are reported in Table 4.5.

Table 4.5 Pesaran's test results

Sectoral exports	***CD statistic (p-value for CD)***
HS08(Edible fruit and nuts; peel of citrus fruit or melons)	0.473 (0.6359) *
HS26 (Ores, slag and ash)	0.623 (0.5333) **
HS71 (Pearls precious stones and metals coins, etc.)	-0.415 (0.6782) *
HS87 (Vehicles other than railway or tramway)	3.383 (0.0007) ***

*Notes: The probabilities of the CD statistics are in parentheses: *** p < 0.01, ** p < 0.05 and * p < 0.1.*
Source: Author's calculations using Stata 14.

Table 4.5 above shows the Pesaran's CD test for selected commodities HS08, HS26, and HS71 with the outcomes that the *p*-values associated with CD statistics are higher at any level of significance (i.e. they are higher than 0.01, 0.05 and 0.1). This implies that the Pesaran's

CD test fails to reject the null hypothesis of cross-sectional independence of panel data so built for these three selected commodities with exception of the *p*-value of HS87 (Vehicles other than railway or tramway) which, is 0.0007 smaller than 0.01. This means that there is cross sectional dependence of the error term for HS87.

4.4.4 Wooldridge serial correlation test

The serial correlation test of the data in the panel is done in this study by means of the Wooldridge Test. This approach tests the null hypothesis (H_0) that there is no first-order autocorrelation (in other words, there is no serial correlation in the residual term) (Rahman 2019). The autocorrelation suggests the presence of a connection between residual terms across observations of a panel data model (Abdulhafedh 2017).

On the one hand, the practical interpretation suggests that we fail to reject H_0 if the *p*-value of the *F*-statistic is higher than 0.05, which depicts the absence of autocorrelation. On the other hand, the alternative hypothesis (H_1) is not refuted if the *p*-value of the *F*-statistic is less than 0.05. Thus, the outputs from the serial correlation tests in the augmented gravity equation (6.1) are presented as indicated in Table 4.6.

Table 4.6 Wooldridge test results

Sectoral exports	***F-statistic (p-value for F)***
HS08 (Edible fruit and nuts; peel of citrus fruit or melons)	259.364 (0.0000) **
HS26 (Ores, slag and ash)	10.893 (0.0038) **
HS71 (Pearls precious stones and metals coins)	3.012 (0.0988) **
HS87 (Vehicles other than railway or tramway)	11.015 (0.0036) **

*Notes: The probabilities of the F-statistics are in parentheses: *** p < 0.01, ** p < 0.05 and * p < 0.1.*
Source: Author's calculations using Stata 14.

According to the analysis contained in Table 4.6, the *p*-values of HS08, HS26 and HS87 associated with the *F*-statistics are 0.0000, 0.0038 and 0.0036 respectively, and they are both smaller than 0.05 with an exception for the *p*-value of HS71 which, is 0.0988 larger than 0.05. Therefore, in general, the null hypothesis H_0 is refuted for HS08, HS26 and HS87; suggesting that serial correlations are present in these series, while the Wooldridge test fails to reject H_0 for HS71, i.e. there is no first-order autocorrelation in the series for this selected commodity.

4.4.5 Modified Wald heteroskedasticity test in fixed-effect model

This study uses the Modified Wald test for group-wise heteroskedasticity in the fixed-effects regression model in order to test if the residuals are randomly dispersed throughout the range of the identified dependent variable (Jiang & LaFree 2017). The null hypothesis is that there is homoskedasticity in the series (or constant variance for all values of the dependent variable) (Zambom & Kim 2017). The Modified Wald test results are presented in Table 4.7.

Table 4.7 Modified Wald test results

Sectoral exports	**χ^2(*p-value* for χ^2)**
HS08 (Edible fruit and nuts; peel of citrus fruit or melons)	0.000031 (0.0000) ***
HS26 (Ores, slag and ash)	15423.74 (0.0000) **
HS71 (Pearls precious stones and metals coins)	15780.07 (0.0000) ***
HS87 (Vehicles other than railway or tramway)	1109.15 (0.0000) **

*Notes: The p-values of the statistics based on the χ^2 distribution with 20 degrees [χ^2 (20)] of freedom are in parentheses: *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.*
Source: Author's calculations using Stata 14.

As the modified Wald test findings depict as presented in Table 4.7, the *p*-values associated with the Chi-square (χ^2) statistics with 20 degrees of freedom for all four sectoral selected commodities are the same (0.0000), and less than 0.01, 0.05 and 0.1. Although, their Chi-square (χ^2) statistics are different. We refute the null hypothesis and conclude that heteroskedasticity is present at any significance level. This implies that the regression of the augmented gravity equation (6.1) will generate inconsistent estimates. This problem is resolved as indicated in the paragraphs that follow.

4.5. Some implications of the results from panel data tests for the EU-SA TDCA: gravity panel data approach

In section 4.3, the unit root tests for Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS) and Augmented Dickey-Fuller (ADF) in the panel data refuted the null hypothesis of unit root for these explanatory variables in log-form (GDPSA, GDPEU, GDPPKSA, GDPPKEU and REER). The same result is also found for each of our selected top 10 export commodities as dependent variables except for HS87 (Ores, slag and ash) which is non-stationary from panel unit root testing of IPS and ADF. The overall results suggest that all variables are stationary. Hence, a co-integration test is not necessary and the augmented gravity equations (6.1) and (6.2) can be approximated using the method of Ordinary Least Square (OLS).

However, first, consideration has to be given to the Hausman test that was used to examine whether the fixed-effects estimation or random-effects estimation would be proper. These findings indicated that only four (4) out of top ten (10) export commodities are significant at the 5% level in fixed-effect models (FEM) such as HS08 (Edible fruit and nuts; peel of citrus fruit or melons), HS26 (Ores, slag in addition to ash), HS71 (Pearls, precious stones and metals coins, etc.) and HS87 (Vehicles other than railway or tramway). Second, other diagnostic tests of the applicability of the augmented gravity equation (6.1) have also shown their outputs. For instance, the Wooldridge test suggests the existence of the autocorrelation (serial correlation) in addition to the Modified Wald test which indicates the evidence of the heteroskedasticity (no homoskedasticity) for all four selected commodities. Finally, Pesaran's CD test indicates the existence of cross-sectional independence only for HS87.

To solve all these test problems that are related to making estimators unbiased in the augmented gravity equation (6.1), this study can compute standard errors for the model in order to provide robust arbitrary serial correlation (and heteroskedasticity) (Wooldridge 2019), or adopt another solutions that deals with the application of some panel Stata commands. For instance, the Stata command 'xtscc' calculates Driscoll and Kraay's (1998) Standard Errors (SEs) that represent coefficients which are estimated by pooled OLS or fixed-effects regression. The SEs are supposed to be heteroskedastic, autocorrelated up to some lag, and possibly correlated between the panels [Driscoll & Kraay 1998; Hoechle (2007; 2018), Appiah, Du, Yeboah & Appiah 2019]. The Stata command 'xtscc' is adequate for application with all panels (balanced and unbalanced) (Hoechle 2018; Shittu, Akerele & Haile 2018). Besides, it works with missing observations as well (Hoechle 2007; Le, Chang & Park 2017).

Therefore, in section 4.6 at step 1 of fixed effects (within) estimation of the augmented gravity equation (6.1), this study prefers a better approach of simple calculation in OLS regression for Driscoll and Kraay's Standard Errors in particular.

4.6. Econometric model estimations, results and discussion for the EU-SA TDCA

This section provides the empirical findings under panel data framework in estimating the gravity equations (6.1) and (6.2) of trade flows (bilateral) between SA and EU traders from 2000 to 2017. From gravity panel data estimation approach deployed in this study, we present

and discuss the findings based on estimated coefficients from Pooled OLS (POLS) and the Fixed Effects Model (FEM) with Driscoll-Kraay's Standard Errors estimator approach.

4.6.1 Step 1: Driscoll-Kraay POLS and FEM results for the EU-SA TDCA

Table 4.8 below reports the results from Driscoll-Kraay's POLS and FEM regressions of the augmented gravity equation (6.1).

Table 4.8 Step 1: Driscoll-Kraay POLS and FEM results for the EU-SA TDCA

	HS08 (Edible fruit and nuts; peel of citrus fruit or melons)		***HS26 (Ores, slag and ash)***		***HS71 (Pearls precious stones and metals coins)***		***HS87 (Vehicles other than railway or tramway)***	
	Driscoll-Kraay SEs		***Driscoll-Kraay SEs***		***Driscoll-Kraay SEs***		***Driscoll-Kraay SEs***	
	POLS	***FEM***	***POLS***	***FEM***	***POLS***	***FEM***	***POLS***	***FEM***
_Constant	0 (omitted)	-179.545 (0.000)**	0 (omitted)	46.811 (0.551)**	0 (omitted)	71.667 (0.064)**	0 (omitted)	-36.110 (0.606)**
GDPSA	4.502 (0.028)**	3.593 (0.031)**	-0. 948 (0.813)**	- 13.355 (0.000)***	5.804 (0.008)**	-0.160 (0.953)***	4.0139 (0.192)**	4.864 (0.262)***
GDPEU	1.219 (0.000)**	7.895 (0.000)**	2.149 (0.000)**	-0.314 (0.943)***	1.843 (0.000)**	-9.395 (0.000)***	1.766 (0.000)**	-9.268 (0.000)***
GDPPKSA	-4.724 (0.178)**	-5.339 (0.057)*	11.567 (0.083)**	41.874 (0.000)***	-7.218 (0.063)**	12.347 (0.031)**	4.416 (0.315)**	9.223 (0.163)***
GDPPKEU	-0.015 (0.964)**	-6.109 (0.003)**	0.275 (0.169)**	-2.945 (0.410)*	0.736 (0.000)**	7.875 (0.003)**	0.225 (0.419)**	10.339 (0.000)***
ICTSA	-0. 037 (0.772)**	-0.086 (0.445)**	-1.563 (0.000)**	-0.823 (0.003)***	-0.693 (0.001)**	-0.212 (0.137)***	-1.054 (0.002)**	-0.994 (0.009)***
REER	0.284 (0.629)**	0.212 (0.704)*	0.666 (0.587)**	1.408 (0.024)**	1.394 (0.018)**	2.012 (0.000)***	-1.128 (0.933)**	0.228 (0.867)*
Dist	-8.789 (0.000)**	- (-)	-3.687 (0.272)**	- (-)	-4.227 (0.024)**	- (-)	1.415 (0.494)**	- (-)
Lang	0.759 (0.000)**	- (-)	-5.354 (0.000)**	- (-)	2.235 (0.000)**	- (-)	-0.126 (0.348)**	- (-)
Col	2.986 (0.000)**	- (-)	4.707 (0.000)**	- (-)	1.590 (0.000)**	- (-)	-0.419 (0.425)**	- (-)
OneinTDCA	-13.052 (0.573)**	- (-)	-57.834 (0.496)**	- (-)	-85.277 (0.042)**	- (-)	-172.407 (0.014)**	- (-)
BothinTDCA	0.872 (0.363)**	- (-)	-2.370 (0.001)**	- (-)	-1.779 (0.000)**	- (-)	0. 849 (0.435)**	- (-)
R^2	0.695	0.274	0.558	0.0934	0.534	0.098	0.634	0.393

*Notes: The p-values of the t-statistics are in parentheses: *** p < 0.01, ** p < 0.05 and * p < 0.1. _Constant omitted because of collinearity. Number of observations: 360.Number of groups: 20*
Source: Author's calculations using Stata 14.

Table 4.8 above reports that estimated coefficients of gross domestic product for European Union (GDPEU) variable from POLS estimates for HS08 (Edible fruit and nuts; peel of citrus fruit or melons), HS26 (Ores, slag and ash), HS71 (Pearls, precious stones and metals, coins, etc), and HS87 (Vehicles other than railway or tramway) are positive and economically significant at the 5% level. Besides, estimated coefficients of gross domestic product for

South Africa (GDPSA) for HS87 (Vehicles other than railway or tramway) and HS26 (Ores, slag and ash) are both at the 5% level insignificant, with HS26 showing an unexpected negative sign. At this level of significance, only the estimated coefficients of GDPSA and GDPEU for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) and HS71 (Pearls, precious stones and metals, coins) are statistically and economically significant, and positive as per prior expectation. The HS08 and HS71's results imply that an increase in the market size (EU countries' GDP and South Africa's GDP) could lead to an increase in SA exports for HS08 and HS71. With respect to the estimated coefficients of GDP per capita for South Africa (GDPPKSA) and the European Union (GDPPKEU) trading partners, in a nutshell, the POLS estimates at the 5% level for South Africa show that they are insignificant for all four selected commodities with an unexpected negative sign for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) and HS71 (Pearls, precious stones and metals, coins), but they are positive for HS26 (Ores, slag and ash) and HS87 (Vehicles other than railway or tramway).

In the EU countries, the estimated coefficients of GDPPKEU are insignificant for theses three commodities (HS08, HS26, and HS87) at the 5% level: HS08 has a negative sign, but HS26 and HS87 both have positive signs. Finally, the POLS estimates report the predicted positive sign of the estimated coefficients of the South African Real Exchange Rate (REER) with HS08 along with HS26, but it is insignificant at the 5% level, suggesting that exchange rate does not affect South African exports for these commodities. Moreover, the results show a positive and economically significant value at 5% level only for HS71 (Pearls, precious stones and metals, coins, etc). Finally, REER is not positive, and it is statistically insignificant for HS87 on par with the significance level.

However, the Pooled Ordinary Least Squares (POLS) model infers that South Africa and its EU trading partners share homogenous economic traits due to the fact that there is no provision for heterogeneity for all country traders and country (or time) - specific effects are non-estimated, but the FEM (Fixed Effect Model) allows for country-pair heterogeneity on all countries. Therefore, interpretation and discussion of our estimated results are focused only on FEM (Jordaan & Eita 2011:161; Manwa, Wijeweera & Kortt 2019:113). This also is consistent with the purpose of our study.

Indeed, from Driscoll-Kraay FEM (Fixed Effects Model) estimates, both estimated coefficients of GDPEU for HS71 (Pearls, precious stones and metals, coins) and HS87

(Vehicles other than railway or tramway) have the unexpected negative signs. Statistically they are significant at the 1% level. In contrast, estimated coefficients of the GDPSA for HS87 are insignificant at the 1% level with the expected positive sign. For the sectoral exports of HS26 (Ores, slag and ash) and HS71, their GDPSA's estimated coefficients are negative, but they both exhibit significant and insignificant statistical behaviour, respectively at the 1% level.

The overall result is on the contrary of theoretical expectation. Accordingly, the GDP estimate captures the potential supply of exporting for South Africa (SA) and concurrently, the potential demand for importing on behalf of the EU countries, as indicated in chapter three. Regarding the GDP estimates that are based on the gravity model for trade (bilateral) flows, it is crucial to point out that the only estimated coefficients of GDPSA and GDPEU for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) are concurrently statistically significant and positive at the 5% significance level. More specifically, the predicted coefficient for GDPEU is significant and positive at any standard significance level (i.e. 1%, 5% and 10%) for HS08 (Edible fruit and nuts; peel of citrus fruit or melons). This result suggests that an expansion in the sectoral export for HS08, as the South African GDP increases, the demand for this particular commodity increases in the EU countries.

These findings are strongly consistent with empirical results from previous studies, for instance Kapuya *et al*. (2014:142), identified 44 out of 51 countries, amongst other EU trading partners, considered as strategic markets for the South African exports for citrus. The findings of that study suggest that the FEM showed that the estimated coefficients of the importer's GDP and South Africa's GDP are both positive and statistically significant at the 1% level for HS08. Similarly in another study, it was argued that the estimated coefficients of GDP for SADC and EU countries has been found significant in explaining South Africa's orange (citrus fruit) exports to 33 countries (Kapuya 2015:15-16).

In particular, for exports of HS26 (Ores, slag and ash), the trade effect of the GDPEU is statistically insignificant, and its estimated coefficient has been found negative while that for GDPSA negatively affects exports for this commodity at the 1% level of the significance from FEM estimates. This is similar to findings of Jordaan and Eita (2011:162) for a single commodity trade. That study, Jordaan and Eita (2011) estimated the South Africa's export for wood by applying the gravity equation and the report was that the estimated coefficient for

GDPSA was negative, probably resulting from the soaring growth rates in its construction sector at the local (domestic) level that makes South Africans' wood traders sell more domestically, and reduce their exports. Indeed, the negative estimated coefficient of GDPSA may be imputed to the fact of the overall fast decline by 28% of the exports for HS26 (Ores, slag and ash) from South Africa to EU-28 countries, particularly during 2012-2017. During this period, amongst others the top five importers, such as Netherlands, Belgium, Germany, France and Austria experienced some sharp need for wood importation (Chatham House 2018). Also, during the period under sample, it is important to note that the annual rate of the GDP growth for South Africa has a declining trend from 2.2% in 2012 to 1.3% in 2017 with a lowest economic growth rate around 0.6% in 2016 as well as 0.8% in 2018 (WDI 2019). Therefore, these figures have to be considered with caution with regards to SA economic behaviour, especially as regards the results of the analysis vis-à-vis the postulation the expansion of the domestic market for HS26 (Ores, slag and ash) may would boost the country's GDP – a priori explanation for the decrease in the sectoral import for the EU countries.

With regard to the estimated coefficients of gross domestic product per capita for SA (GDPPKSA) and its European Union traders (GDPPKEU), they are both negative for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) and significant at the 10% and 5% levels respectively. This result implies that GDPPKSA negatively affect exports of HS08, and it also indicates that a decrease in the GDPPKEU of the EU traders may lead to a decrease in South African commodity exports. According to this result, the effect of GDPPKSA or GDPPEU on the exports of HS08 is proven to be negative as well as statistically significant, as described above. In a similar study, Karemera *et al.* (2015:253) applied the modified gravity model on the bovine and swine meat trade flows amongst Southern Common Market (MERCOSUR), ASEAN, EU and NAFTA from 1986 to 2009. The result suggested that a negative estimated coefficient could be expected in a particular commodity in an instance where the exporting country experienced of an increase in the GDP per capita during some of the periods under investigation. This may also influence the redistribution of resources for a particular commodity to be traded with the highest marginal profit, which would result in decreasing the export volumes of any other single commodity trade that has a lower marginal profit.

In another study conducted by Eita (2008:6-7, 12) whereby the determinants of Namibian exports to the SADC and EU countries were estimated, the findings reported a negative sign of GDP per capita coefficient with regards to importers' country within the FEM. Similarly, within the gravity framework, Hatab *et al.* (2010:141) and, Balogh and Leitão (2019) assessed what determines agricultural exports in Egypt. The suggestion was that the estimated coefficient of GDP per capita for Egypt is negative and strongly significant. The authors concluded that a negative sign of the gross domestic product per capita could be explained as resulting from the combination of either of various factors. But the authors found at the different time periods that consideration for economic growth and population size as a component of GDP per capita are important elements.

In this specific study, the reality is that economic self-sufficiency may occur in large scale production, high division of labour and sectoral diversification opportunities with a large population so that the broad domestic market will consume more, and therefore less needs to export. However, the study analysis period is from 2000 to 2017. During this period, the South African population increased by 26.76%, while the European Union population showed a slight increase of 4.91%. Besides, as previously indicated, the South African economic growth declined during this given period (WDI 2019). Thus, regarding these figures, the study results related to the negative effect of GDP per capita for SA (GDPPKSA) on exports for HS08 (Edible fruit and nuts; peel of citrus fruit or melons), should therefore be interpreted with caution even if they are consistent with the previous findings, such as in Eita (2008), Hatab *et al*. (2010) as well as Shahriar *et al*. (2019) for reasons already stated above.

Furthermore, it appears that estimated elasticities for GDPPKSA together with GDPPKEU for HS71 (Pearls, precious stones and metals, coins) follows the a priori expectation. The coefficients are positive and they are also economically and statistically significant at the 5% level. This implies the GDPPKSA does proportionally affect exports of HS71 (Pearls, precious stones and metals, coins). Further, the result indicates that if the GDPPKEU of the EU trading partners increases, it could lead to an increase in South African exports for the commodity. Husain and Yasmin (2015:5) argued that the estimated coefficient for gross domestic product per capita is in most cases higher than 1. This suggests that the trade (bilateral) flow increases at a rate that exceeds the proportional increase in the economic growth of both countries. Thus, the elasticity of trade to GDPPKEU for the commodity HS71 is 7.88%. This indicates the percentage variation in South African exports for this single

commodity following a 1% increase in GDPPKEU of the EU countries (*ceteris paribus*, i.e. "if all other relevant things remain the same"). This result goes with the findings of Shahriar *et al*. (2019:2559), which relate to bilateral trade for a commodity-specific gravity model; where it was found that the coefficients of GDP per capita are positive and strongly significant for China and its trading partners in the case of China's pork exports.

Finally, the Driscoll-Kraay FEM estimates report the expected positive sign of the estimated coefficients for the South African real exchange rate (REER) for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) and HS87 (Vehicles other than railway or tramway), but they are insignificant at the 10% level, meaning that it does not have an effect on exports for these commodities. In contrast, the REER is positive and significant at the 5% for HS26 (Ores, slag and ash), and it is also strongly positive and statistically significant for HS71 (Pearls, precious stones and metals, coins) at the 1% significance level. This implies that a depreciation of the Rand by 1% alongside the EU trader's currencies will increase South Africa's pearls, precious stones, metals and coins exports, ceteris paribus, by 2%, according to the study estimations. About the export of a single commodity, this result is comparable to the gravity analysis of South Africa's exports of leather products. According to the results of the study, depreciation of REER had positive impact on the exports for leather products amid SA and its traders amongst these European Union countries (Jordaan & Eita 2012:45). The same applied to SA and its citrus exportation with 44 country destinations. These were strategically identified markets of which out of these, 12 Europe Union traders have a high potential market of importing. At the 1% level, statistically, the effect of the REER of the Rand was identified as positive and significant for South African citrus exports (Kapuya *et al*. 2014:139-142).

With respect to the estimated coefficients of Information, Communication Technology-related service exports for South Africa (ICTSA), in general, the FEM estimates at the 1% or 5% level for South Africa show that these variables have unexpected negative sign for all four selected commodities. They are also insignificant for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) and HS71 (Pearls, precious stones and metals, coins), but they are statistically significant for HS26 (Ores, slag and ash) and HS87 (Vehicles other than railway or tramway). This result implies that the ICTSA is negatively affecting South African exports for HS26 and HS87. In other words, in South Africa, the provision of telecommunication services (postal and courier services, computer data as well as news-related service

transactions) does not impact on these commodity exports, albeit at small magnitudes. Moreover, it should be noted that in South Africa, the telecommunication services refer also to fixed and mobile services as well as internet and data services (ICASA 2018). Thus, this result is similar to some extent, to empirical results from previous studies, for instance, Wang & Choi (2019:469-470), which examined the impacts of ICT on South Africa's export amongst other BRICS partners. The findings of that study suggest that the mobile-cellular does not have an effect on South African trade, neither the fixed-broadband nor the fixed-telephone were found to have any impact on it. This may be due to South Africa's ICT increasing inefficiency, which is depicted by the country's regressing overall international ranking on the ICT development index (IDI). It is noted that the country has retrograded for the past few years – from 86th position in 2015 to 88th position in 2016, and most recently; to 92 position in 2017. This regressive feat falls firmly within the estimated period and its effects can be seen to be important (ICASA 2018: 46-47).

The other aim of the study focuses on estimating the coefficients for time-varying and country-specific effects, in relation to bilateral trade. To achieve this, the FEM is not an appropriate econometric tool because of the potential of perfect collinearity which may occur in the estimation (Bacchetta *et al*. 2012:108). For this reason, in section 4.6.2, a distinct estimation has to be done with individual effects (IE) as a dependent variable along with the independent variables, we deploy distance variable in log-form, common language and colonial relationship dummy variables, as well as *OneinTDCA* and *BothinTDCA* other dummy variables that represent the EU-SA TDCA in terms of the effects of trade creation and/or trade diversion. This approach has been adopted in previous similar studies (Eita & Jordaan 2007b; Jordaan & Kanda 2011; Jordaan 2014).

4.6.2 Step 2: Driscoll-Kraay POLS results for the Individual Effects

This section focuses on the individual effects with inferences on trade creation and trade diversion of the EU-SA TDCA as applied to the Driscoll-Kraay POLS. This refers to step 2 regressions for the estimation of the augmented gravity (model). This investigation is modelled in equation (6.2) with individual effects (IE) as the dependent variable, *Dist*, *Lang*, *Col*, *OneinTDCA* and *BothinTDCA* as the independent variables. The step 2 regression results, including inferences in relation to trade creation and trade diversion, are contained in the results presented in Table 4.9 below.

Table 4.9 Step 2: Driscoll-Kraay POLS results for the independent effects

	HS08 (Edible fruit and nuts; peel of citrus fruit or melons)	***HS26 (Ores, slag and ash)***	***HS71 (Pearls precious stones and metals coins)***	***HS87 (Vehicles other than railway or tramway)***
	Coef. (t-statistic)	***Coef. (t-statistic)***	***Coef. (t-statistic)***	***Coef. (t-statistic)***
_Constant	*(omitted)*	*(omitted)*	*(omitted)*	*(omitted)*
Dist	-12.895 (0.000)***	-11.254 (0.000)***	-10.812 (0.000)***	-4.412 (0.001)***
Lang	0.948 (0.004)**	-4.834 (0.000)**	2.919 (0.000)***	0.238 (0.104)*
Col	4.666 (0.000)***	7.7497 (0.000)***	4.294 (0.000)***	2.048 (0.000)***
OneinTDCA	134.174 (0.000)***	119.029(0.000)***	112.570(0.000)***	52.564 (0.000)***
BothinTDCA	3.448 (0.000)***	2.1034 (0.000)***	2.635 (0.000)***	5.128 (0.000)***
R^2	0.44	0.28	0.24	0.22

*Notes: The p-values of the t-statistics are in parentheses: *** p < 0.01, ** p < 0.05 and * p < 0.1. _Constant omitted because of collinearity. Coef.: coefficient.*
Source: Author's calculations using Stata 14.

In Table 4.9 above, the overall estimation unveil that the expected signs and coefficients are strongly significant at the 1% level for all variables. Indeed, according to the findings from Table 4.9, there is a negative estimated coefficient of distance which is significant statistically. This suggests that distance, being a proxy of transportation costs, has adversarial effects on South African exports for all four selected commodities. For instance, South Africa has more commodity trades with the EU partners for which transportation costs are cheaper, as compared to those for which they are expensive. On the one side, the result goes along with the findings from some previous studies (Eita & Jordaan 2007b:88, Jordaan & Kanda 2011:238, Jordaan 2014:600, Kapuya 2015:15) that analysed the export volumes between SA and major traders (among others, European Union together with SADC countries) in accordance with the gravity model framework and it has been reported that the significance of distance has a negative impact on bilateral trade flows. On the other hand, the overall estimated coefficients of the common colonial relationship and common language as dummy variables possess the predicted positive signs. In addition, their statistical significance lies at the 1% level. These findings reveal that South Africa's exports for these selected commodities (HS08, HS26, HS71 and HS87) are likely to increase towards EU countries where the historical ties (English as official language and colonial relationship) are considered to have roots, which suggest that sharing the same language (Eita & Jordaan 2007a:15; Jordan & Eita 2011:162; Dal Bianco *et al*. 2015:20; Karamuriro & Karukuza 2015:51; Dlamini *et al*. 2016:78) and colonial links (Egger *et al*. 2011:124-125; Steiner 2015:35-36) could contribute to an increment in exports of goods.

However, English is an official language among 11 of the official languages in SA, and it is one of the 24 official languages of the European Union. The EU has implemented multilingualism as an essential tool in the competitiveness of Europe, and besides, the EU's language policy stipulates that, in addition to the European citizen's mother tongue, every citizen should master two other languages. Additionally, the documents from parliamentary proceedings are translated into all the official languages in the EU (Hériard 2019:1-4). Therefore, this enhances the opportunity for South Africa to negotiate more or conclude trade arrangements in English language in order to expand and promote its commodity exports to the EU countries at the bilateral or multilateral level.

Our findings followed the outcome of Jordaan (2014:600) study, where it was found that an increase in export volumes in South Africa is commonly linked with the importing trade partners where the official language is English. Finally and most importantly, are the signs and significance of the predicted coefficients of bilateral trade agreement dummies (*OneinTDCA* and *BothinTDCA*) which also are reported in Table 4.9. These two bilateral trade dummies are positive and strongly significant at the 1% level. This suggests that the EU-SA TDCA contributes, to some extent, to trade creation and trade expansion possibilities for our selected commodities. This result is concurrent with the previous research by Jordaan and Kanda (2011:239) which was based on the EU-SA FTA by applying the gravity equation for bilateral trade. These authors found both trade creation and expansion impacts between the EU-SA country signatories with the rest of the world, but with the cautionary remark that the EU-SA did not create considerably more bilateral trade amid South Africa and other major European Union trading countries, as opposed to creating and expanding more trade with the non-EU signatories in the rest of the world.

In a similar study, Potelwa *et al.* (2016:202-203) explored within the gravity model, the factors influencing the growth of agricultural exports in SA through AGOA and TDCA trade agreements between 2001 and 2014. The results of the study showed a positive effect of the EU-SA TDCA on expansion in SA export performance. However, contrasting results have been partially revealed in a study conducted by Kahouli and Maktouf (2015:89-90), where the gravity equation was applied for analysing trade creation and expansion impacts in the EU-Mediterranean region with 27 countries including the EU-15 countries. Kahouli and Maktouf (2015) argued that the estimated coefficients of all the regional blocks, wherein

most cases lie at the 1% level of significance, were found to positively affect the volumes of exports.

From the comparative analysis presented above, therefore, it could be safely suggested that being part of the EU-15 exerts more influence on the orientation of export flows, compared to being a member of the AGADIR (FTA between Egypt, Jordan, Morocco and Tunisia) or AMU (Algeria, Libya, Morocco, and Tunisia) agreement, which are major components of the African Free Trade arrangement. Besides, the FTAs in the EU-Mediterranean region had not only taken part in the creation of trade but included its diversion. Similarly, Kahouli (2016:461) unveiled trade creation and diversion with the EU-15 trading partners in examining the effects of RTAs on export flows between the EU-15, NAFTA, ASEAN and MERCOSUR. This is a cautionary note for South Africa's trade envision with other trading arrangements that may particularly share colonial (historical) traits or language similarity.

4.7. Chapter summary

In this chapter, a presentation was made on the empirical panel data analysis together with econometric model estimation results from augmented gravity equation for the EU-SA TDCA that was adopted for this study. In section 4.2, the researcher analysed the panel data-based unit root tests. This was done according to the proposed formula by Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS), and Augmented Dickey-Fuller (ADF) at the 1%, 5% and 10% levels of significance respectively. Results show that inclusive panel data were stationary as seen in Table 4.2, except for commodity HS87 (Ores, slag and ash) which is non-stationary from panel unit root testing of IPS and ADF.

In addition, other diagnostic tests of fixed effects were also reported in section 4.3, such as the Wooldridge test that suggested the existence of autocorrelation (serial correlation) and Modified Wald test that indicated the evidence of heteroskedasticity (no homoskedasticity) for all four selected commodities. Also, Pesaran's CD Test concluded no cross-sectional dependence errors for HS08, HS26 and HS71 selected commodities with exception for HS87. Section 4.4 described some implications of the results from panel data and other diagnostic tests for the EU-SA TDCA in proposing that there is a need to conduct a gravity panel approach with simple OLS regression following Driscoll and Kraay's Standard Errors. This methodological approach was favoured in particular, because it is more appropriate than other estimation techniques, for instance, Feasible Generalised Least Squares (FGLS)

together with Panel-Corrected Standard Error (PCSE). Section 4.5 presented the empirical results for the EU-SA TDCA as well as the interpretation of the econometric model specification results based on both gravity equations (6.1) (Step 1) and (6.2) (Step 2) following FEM and individual fixed effects respectively, following the Driscoll-Kraay standard errors estimator.

The Pooled Ordinary Least Squares (POLS) model infers that South Africa and its EU trading partners are homogenous. This is due to its failure to estimate the heterogeneity of all country traders and country (or time) specific effects. However, the FEM allow country-pair heterogeneity on all the countries. Therefore, interpretation and discussion of our estimated results were focused only on FEM, which is also consistent with the purpose of the study. In the step 1 regression (equation 6.1), the overall result from Driscoll-Kraay FEM for the EU-SA TDCA was contrary to the a priori theoretical expectation related to GDP that captures the potential supply of exports for South Africa and at once, the potential demand for importing in respect of the EU countries as outlined in chapter four.

The same overall result almost applies to the estimated coefficients of gross domestic product per capita for South Africa (GDPPKSA) and the respectful European Union trading members (GDPPKEU). In other words, in most cases for the selected commodities (HS08, HS26, HS71 and HS87), the estimated coefficients of GDPs/GDPPKs for both countries for a single commodity have been found to have moved away in the opposite direction from each other, for example, if GDPSA/GDPPKSA is negative and significant, the opposite applies to GDPEU/GDPPKEU being positive and non-significant with regard to that commodity. The study provided some economic explanations regarding this opposite reactions, which are contrary to the prior theoretical expectation.

The study found that in South Africa, on the one hand, the provision of ICTSA services (postal and courier services, computer data as well as news-related service transactions) does not impact on the commodity exports for HS26 (Ores, slag and ash) and HS87 (Vehicles other than railway or tramway), albeit at small magnitudes at the 1% or 5% level of significance. On the other hand, the REER is positive and significant for HS26 (Ores, slag and ash) at the 5% level of significance, while it is also strongly positive and statistically significant for HS71 (Pearls, precious stones and metals, coins) at the 1% significance level.

Under other conditions (step 2), a regression was ran to estimate the equation 6.2 for the individual effects. The estimated coefficients of the common language and common colonial relationship as dummy variables indicated the predicted positive signs and all lied at the 1% level of statistic significance. These overall results revealed that South Africa's exports for these selected commodities (HS08, HS26, HS71 and HS87) were likely to increase towards EU countries where the historical ties (English as the official language and colonial relationship) were well-established. Finally, the estimated coefficients of bilateral distance were negatively significant. This suggests that distance bears a negative effect on South African exports for all four selected commodities while English as common official language and common colonial relationship had a positive effect on exports.

CHAPTER FIVE
CONCLUSIONS, POLICY RECOMMENDATIONS AND AREAS FOR FURTHER RESEARCH

The study strive to contribute to existing literature by conducting in-depth analysis of the patterns of bilateral trade flows for markets that are considered strategic in a way of generating significant boost for economic growth and the development of South Africa and the European Union. In this chapter, section 5.1 reports the conclusions of the study, while section 5.2 focuses on conclusions on the EU-SA TDCA effects for Member countries. Thereafter, policy implication and recommendations are presented in section 5.3 and in section 5.4 the chapter concludes with suggestions of area that can benefit from future research.

5.1. Study conclusions

This study analysed the importance of the bilateral agreements on trade flows: a case of the Trade Development and Cooperation Agreement between South Africa and the EU. Chapter one introduced the research topic, background and the problem statement. Some trade issues were identified such as imbalances in process of the TDCA between South Africa and European Union and identification of who is losing or benefiting from this bilateral trade agreement. Thus, chapter two overviewed the international trade country-based theories and reviewed the TDCA issues as raised broadly by several researchers in the literature on the RTAs, and mainly through a gravity model of bilateral trade flows. The chapter also presented literature discourse on FTAs, which are more ratified by a large number of countries than other forms of RTAs. This led to the presentation of the literature approaches on the evaluation of the TDCA between SA and the EU.

Chapter three provided a research design, empirical methodology as well as data for this study in the context of assessing the export effects on top 10 selected commodities at the HS-2 between SA and EU countries through a gravity approach of bilateral trade. In accordance with study purposes, the adopted 'augmented gravity model' of the EU-SA TDCA was specified with GDPs, GDPPKs, REER, ICTSA and *Dist* as independent variables and dummy variables such as *Lang*, *Col*, *OneinTDCA* and *BothinTDCA*. The adopted empirical methodology was split into two steps: step 1 regression for fixed effects and step 2 regression

for trade creation and trade diversion. Lastly, the expected signs for the coefficients of all variables were discussed. Finally, data collection was based on South Africa and its EU-20 trading partners instead of the EU-28, because other 08 EU countries (Estonia, Hungary, Latvia, Lithuania, Malta, Slovak Republic, Slovenia and Croatia) have been dropped from the EU country sample, due to lack of trade data over the study period 2000-2017.

Chapter four presented the descriptive statistics for all variables, and panel data-based unit root tests as suggested by Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS), and Augmented Dickey-Fuller (ADF) at the 1%, 5% and 10% levels of significance. The overall results revealed stationarity for all variables. Besides, other diagnostic tests were also performed, for instance, a Hausman test identified four (4) out of the ten (10) selected commodities following the fixed effects model as the appropriate model specification for adoption, which was carried out in this study. The four selected commodities are as follows: HS08 (Edible fruit and nuts; peel of citrus fruit or melons), HS26 (Ores, slag in addition to ash), HS71 (Pearls, precious stones and metals coins, etc.) and HS87 (Vehicles other than railway or tramway).

To further the power properties of the estimates, Driscoll-Kraay standard errors approach was applied on the augmented gravity model in chapter five. The empirical results for the EU-SA TDCA as well as the interpretation of the econometric specification results based on both gravity equations (6.1) in step 1 and (6.2) in step 2 were done following Driscoll-Kraay FEM and Driscoll-Kraay POLS individual fixed effects respectively by applying Stata command 'xtscc'. In a nutshell, the study showed mixed results for GDPs as well as GDPPKs for both South Africa and the EU countries during 2000-2017. On average, it was observed that these variables negatively affected South African commodity exports, albeit with few positive effects from the EU countries in particular.

With regard to the Information, Communication Technology-related service exports for South Africa (ICTSA), it has been found that ICTSA does have a meaningful effect on commodity exports, while the South African REER is positively affecting some commodity exports, and it also does not have an impact on other commodity exports. Lastly, the distance as a proxy of transportation costs negatively affects South Africa’s commodity exports while common colonial relationship and English as common official language have a positive effect on exports.

In the light of the above, the study results indicate that ICTSA was more negative and significantly associated with commodity exports, thus do not support hypothesis I. However, the current results are to some extent consistent with a few previous empirical studies, such as Wang & Choi (2019:469-470), which suggest that the mobile-cellular, fixed-broadband and fixed-telephone do not have an effect on South African exports with the exception of the internet.

Most importantly, the signs and significance of the estimated coefficients of bilateral trade agreement dummies (*OneinTDCA* and *BothinTDCA*) are reported to be positive and strongly significant at the 1% level for the all four selected commodities. This meant that both *OneinTDCA* and *BothinTDCA* suggested trade creation and trade expansion possibilities for these commodities between signatory members, i.e. South Africa and the EU countries. In other words, the EU-SA TDCA possibly accounted for the promotion of commodity exports between its member countries. Obviously, the trade creation took place more than with all other countries (among others SADC and the rest of the world) that were not part of this bilateral trade agreement. The results buttressed the fact that the EU-SA TDCA was implemented by the trade parties to generate such expected positive trade effects after the removal of trade barriers between the parties. This provided support for hypothesis II, which is in line with empirical results from previous studies; for instance, Jordaan and Kanda (2011) analysed the effects of the EU-SA FTA on the bilateral trade flows by applying the gravity equation of trade and found both trade creation and expansion effects between the EU trading partners and South Africa.

However, South Africa's commodity trade has been positively improved slightly from the time of the implementation of the free trade agreement on average. But, it may become more difficult to state that it is a direct result of the EU-SA TDCA because for more than two decades, South Africa has integrated extensively into the global economy by supporting trade liberalisation, promoting economic growth and investments, and encouraging competitiveness in both domestic and regional levels (Mshomba 2017; Nölke, Ten Brink, May & Claar 2019).

5.2. Conclusions on the EU-SA TDCA effects for the EU member countries

In this study, the relevant results about the EU-20 country-specific effects estimates indicated in bilateral trade flows that the effects of some importing country's factors were specific to

every EU country. It must be indicated that these individual country effects were factored into the analysis through the panel approach, especially given that they were treated as exogenous determinants in the specification of the gravity equation. The researcher discovered that the EU country-specific effects were all positive and significant at the 5% level of significance. This extended to the majority of the results at the 1% level. However, the time (year) dummies were not significant in general, at any per cent (%) level when we considered both country and time effects simultaneously. The study concluded that in the presence of the EU-SA TDCA, South African exports for the selected commodities had not expanded much over the period 2000-2017, but the most significant changes have been realised by the EU-20 traders.

In specific, Germany, the United Kingdom, France, Italy, Spain, Netherlands, Sweden and Belgium have been found most likely to raise trade in South Africa's exports of HS26 (Ores, slag and ash), HS71 (Pearls, precious stones and metals coins, etc), and HS87 (Vehicles other than railway or tramway). Their highest potential to trade in these commodities connected to other EU trading members could be attributed to an income (GDP) effect. Eurostat (2019) reported that over half of the EU's GDP from 2000 to 2017 was produced by Germany, the United Kingdom and France. For example, in 2017, the cumulated share of these three countries accounted for 21.3%, 15.2% and 14.9% of the EU's GDP respectively. These were followed by Italy with 11.2%, Spain 7.6%, the Netherlands 4.8%, Sweden 3.1% and Belgium 2.8%. Obviously, these EU Member States may be found to have positive and significant import-specific effects for HS26, HS71 and HS87, according to their higher absorption capacity. Thus, South Africa with a high potential comparative advantage in these commodities would be major beneficiary, but potential buyers in EU countries would also benefit. Thus, fair trade measures would help both South Africa and EU countries alike through lower prices to boost the exports market.

However, the same EU Member States were however found to be negative and significant for HS08 (Edible fruit and nuts; peel of citrus fruit or melons) from SA. It could then be safely suggested that there are some unobserved factors that discouraged the exports of SA's HS08 commodities to those EU member-countries, except for Belgium and Sweden, and a few other EU traders (For instance, Denmark, Finland, Greece, Ireland, Luxembourg, Portugal, and Cyprus, together with Bulgaria). Contrarily, it was found that other EU traders (for example, Ireland, Denmark, Finland, Greece, Luxembourg, Bulgaria and Cyprus) found some

discouraging effects towards South African exports of these commodities due to some unobserved characteristics.

Another hypothetical explanation for this negative country-effect may be found in one of the significant importer-specific factors (for example, the size of the importer's gross domestic product) that signify the total amount that the EU importers were willing to demand of certain products from South Africa. In other words, a lower (or higher) EU trading partner's GDP means a lower (or higher) capacity to demand (import) from South Africa. For example, Cyprus, Bulgaria and Luxembourg belong to the group of 11 EU countries which had a GDP that accounts for less than 1% in the share of the total EU's GDP in 2017 (Eurostat 2019). By implication, these EU countries are likely characterised by a lower absorption capacity for HS26 (Ores, slag and ash), HS71 (Pearls, precious stones and metals coins, etc), and HS87 (Vehicles other than railway or tramway). The same applied to HS08 (Edible fruit and nuts; peel of citrus fruit or melons) to Czech Republic, Poland and Romania.

5.3. Policy recommendations

As previously pointed out, the findings of this study revealed that in the presence of the EU-SA TDCA, the time-specific effects have not affected the export flows of South Africa for our selected commodities (HS08, HS26, HS71 and HS87) to EU-20 countries and in addition, almost half of these studied countries were found likely to have a negative importer-specific factor. As a consequence, trade policymakers should analyse carefully the time-varying country-specific factors that may negatively affect the exports for SA's commodities to the related EU traders while keeping in mind that, as argued by Hornok (2012:9-10), culture or institutions as components of bilateral trade costs are unobserved, and they do not change significantly with time.

Furthermore, the REER (Real exchange rate for South Africa) does not have an effect on exports for two out of the four selected commodities (with the exception for HS26 and HS71), while the overall result showed that distance (as proxy for transportation expenses), GDPSA (gross domestic product as a proxy for South Africa's market) and GDPPKSA (gross domestic product per capita as a proxy for the economic development for South Africa), and the Information, Communication Technology-related service exports for South Africa (ICTSA) had, to some extent, negative effects on all selected commodities. It is for this reason that Political Analysts in the Department of Trade and industry (DTI) in South Africa

should advocate for policies that exert some degree of diplomatic control on the multilateral trade-resistance (for instance, trade barriers, trade tariffs together with quotas, physical distance, transportation costs and other trade costs) for both exporting and importing countries. This would help to ameliorate some of the hindrances to the effective and efficient functioning of the EU-SA free trade liberalisation in favour of South Africa's economic growth. Damoense-Azevedo and Jordaan (2011:173) stated that GDP per capita as a significant trade component reflects differences amid SA and EU countries in technology intensity, income, and human capital and factor endowments. To that extent, some degree of policy attention is required. Regarding especially the human capital in SA's trade policy issues, Kowalski, Lattimore and Bottini (2009:8) as well as Kanda and Jordaan (2010) argued that South Africa has the need to attend to main labour market matters in relation to the employment equity, low skilled employment and other good workplace practices, in order to decrease unused resources and to make them efficient.

Therefore, policymakers in South Africa should encourage policies that result in the combination of economic growth and optimal technological adoption. This form of investment would boost the quality and size of the market as a component of GDP per capita. If achieved, economic self-sufficiency may occur through large scale production, which may increase economies of scale through high division of labour and sectoral diversification opportunities within the broader South African economy. As a result, the broader domestic market will consume more, and at the same time distribution of the resource endowments may be done efficiently to export more all the commodities, not only those having a higher marginal profit but also those with a lower marginal profit.

On another particular note, the ICTSA is negatively affecting some commodity exports, and it also does not have an effect on other commodity exports. The contrasted implication of these findings underscores that an access to ICT may decrease trade costs through the diminution in information and transaction costs. With ICT, export-oriented firms may find it easier to get information concerning potential buyers and global markets, as well as for advertising their commodities internationally, through which they may build international trade relationships. These may also promote trade flows between countries (Fernandes, Mattoo, Nguyen & Schilffbauer 2019), in this instance, between South Africa and its EU traders. Therefore, it can be expected that policy makers should emphasize on an appropriate technological progress, together with fair business practices, which will allow South Africa as

developing country to promote modern trade services and acquire a competitive advantage in more advanced services sectors. Besides, some experts note that South African policy analysts should foreground technological policies that support optimal use of ICT resources rather than engage in further investments (Binuyo & Aregbeshola 2014) as well as retraining the staff working at the DTI in order to adapt themselves especially to the ICT in goods and services at the global level, and also to work with new technologies.

5.4. Areas for further research

Future studies could take active interest in the importance of the EU-SA TDCA by using an extended gravity model of trade to further examine what determines SA's export commodities. This would help in finding out whether this bilateral trade agreement was for either trade diversion and/or trade creation. For example, the right side in the augmented gravity equation, first, to decompose TDCA dummy variables into more components, such as TDCAImporter and TDCAExporter for member and non-member countries those belong to different regional trading arrangements. Second, it could be appropriate to focus on using a population variable instead of GDP per capita because population size (larger or smaller) could influence export flows (increase or decrease). Third, it would be interesting to use the simultaneous presence of overall trade costs in the Gravity Model as observed impacts on trade (bilateral) flows. Fourth, other trade variables that interested researchers may focus on include GDP/GDP per capita differences, purchasing power indices, inflation, infrastructure and trade openness.

Further research could contribute to in-depth analysis of the significance of the EU-SA Trade Agreement in a way that augments the predictability of the previous studies (including this). This could assist in explaining how SA's exports of commodities have changed with the WTO Member countries. Thus, equipped with the above mentioned bilateral trade variables, other analytical tools of an econometric approach for trade flows may be applied instead of a static form of the gravity model. Indeed, the empirical literature on international trade agreements has demonstrated several approaches to predict the impacts of trade agreements on trade flows between countries.

However, it should be noted that strengths and weaknesses of some enumerated approaches below will not be discussed or questioned in this section or their appropriateness. It can be observed that different approaches to the static gravity model of international trade analysis

applied in this study are in-exhaustive. Some of the possible alternative approaches to the one adopted in this study are:

i) Dynamic gravity model (Rahman & Ara 2010; Kahouli 2016; Gurevich & Herman 2018),
ii) Generalised Method of Moments (GMM) estimation (Kahouli & Maktouf 2015);
iii) The Poisson gravity model together with Pseudo Maximum Likelihood (PPML) (Krisztin & Fischer 2015; Khurana & Nauriyal 2017; Irshad *et al.* 2018; Shahriar *et al.* 2019), and
iv) An Instrumental Variable (IV) approach (Mitze 2010; Brueckner & Lederman 2015; Dippel *et al*. 2019).

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