The estimation of export potential values in international market selection methods: A comparative analysis

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ABSTRACT

Owing to the renowned link between exports and economic growth, governments pursue export promotion. As resources for export promotion are scarce and incorrect market selection can lead to significant losses, important market selection decisions are often based on estimated export potential values.

In the literature, three international market selection methods attempt to estimate export potential values, namely, the gravity model, the Export Potential Assessment of the International Trade Centre and the Decision Support Model. It is, however, challenging to put a specific value to export potential as it is difficult to evaluate its accuracy due to the potential not always being actively pursued and/or realised in actual trade.

This study, therefore, sets out to compare these three international market selection methods to establish whether the existing methods (for estimating export potential values) give similar answers. This comparison is applied to a selection of South Africa's top manufacturing products, based on the fact that the South African government has identified the increased exporting of manufactured goods as an important component and driving force to reach the economic growth target of 5.4% by 2030.

The empirical analysis (tests) used in this study to compare the ranks of the estimated export potential values were the Spearman rank-order correlation test, frequency distributions and a comparison of the top 10 product-country combinations assigned by the respective methods.

The results of the Spearman rank-order test indicated that the International Trade Centre and Decision Support Model approaches had the highest overall correlation (0.694), followed by the International Trade Centre and gravity approaches (0.650). The correlation between the Decision Support Model and gravity methods were much lower (0.377). Furthermore, the International Trade Centre and Decision Support Model approaches had the fewest differences in the ranks of product-country combinations (only 13% of product-country combinations had differences in ranks of more than 10 places), followed by the International Trade Centre and gravity approaches with 21% of product-country combinations where this was the case. The Decision Support Model and gravity methods only had slightly more product-country combinations (25%) with differences in ranks of more than 10 places. Considering the overall comparison of the top 10 product-country combinations emanating from the different methods, the International Trade Centre and Decision Support Model methods have the most product-country combinations with the exact same rank, as well as the most product-country combinations included in both methods' top 10. The Decision Support Model and gravity model, on the other hand, have the fewest product-country

combinations with the same ranking, along with the fewest product-country combinations included in both models' top 10.

Overall, the results of the study, therefore, indicate that the rankings based on the export potential values estimated by means of the International Trade Centre and Decision Support Model approaches are the most comparable among the three approaches, while the comparison between the ranks assigned by means of the Decision Support Model and gravity approaches shows the lowest similarity levels. A possible reason for this might be that the gravity model can be computationally burdensome when estimating export potential values on a large, detailed scale (product level). The variables used in the gravity model are also mostly on country level, which makes product-specific analysis challenging. Furthermore, the variables used in the gravity approach to estimate export potential values can be considered outdated. Conversely, the International Trade Centre and Decision Support Model approaches have been designed to analyse export potential on a large scale and detailed product level. These two approaches also incorporate variables relevant to trade in the 21st century.

Based on the literature and empirical analysis of this study, a conclusion was drawn that the Export Potential Assessment of the International Trade Centre are the most comprehensive to estimate export potential values on a detailed product level. This approach was inspired by the gravity model, which incorporates market attractiveness and trade barriers. It also includes most of the aspects of trade potential that the Decision Support Model encompasses, such as import size and growth and market accessibility. It is, however, important to keep in mind that each of the three approaches has a specific purpose, benefits and limitations.

It is, therefore, recommended that the gravity, International Trade Centre and Decision Support Model approaches be used to enhance and complement one another. Export promotion decisions should, however, not be based on export potential values alone as other immeasurable components of export potential should be considered in addition to the quantitative analysis.

Keywords: International market selection, export potential values, gravity model, Export Potential Map, Decision Support Model, export promotion

OPSOMMING

Weens die bekende skakel tussen uitvoere en ekonomiese groei, streef regerings daarna om uitvoere te bevorder. Aangesien bronne vir uitvoerbevordering skaars is en foutiewe mark-seleksie aansienlike verliese kan voortbring, word belangrike besluite rakende mark-seleksie dikwels gebaseer op beraamde uitvoerpotensiaalwaardes.

Drie internasionale mark-seleksie metodes wat poog om uitvoerpotensiaalwaardes te beraam word in die literatuur gevind, naamlik die *gravity* model, die *International Trade Centre* se *Export Potential Assessment* en die besluitnemingsondersteuningsmodel. Dit is egter uitdagend om ’n spesifieke waarde te heg aan uitvoerpotensiaal aangesien dit moeilik is om die akkuraatheid daarvan te evalueer. Dit kan toegeskryf word aan die feit dat die potensiaal nie altyd in werklike handel realiseer nie.

Gevolglik poog hierdie studie om die drie internasionale mark-seleksie metodes te vergelyk ten einde vas te stel of die bestaande metodes (vir die beraming van uitvoerpotensiaalwaardes) soortgelyke antwoorde oplewer. Hierdie vergelyking word toegepas op ’n seleksie van Suid-Afrika se top vervaardigde produkte. Dit is voorts gebaseer op die feit dat die Suid-Afrikaanse regering verhoogde uitvoere van vervaardigde produkte as ’n belangrike komponent en dryfmeganisme geïdentifiseer het om die ekonomiese groei doelwit van 5.4% teen 2030 te bereik.

Die empiriese analise (toetse) wat in hierdie studie gebruik is om die range van die beraamde uitvoerpotensiaalwaardes te vergelyk is die Spearman rang-orde korrelasie toets, frekwensie distribusies en ‘n vergelyking van die top 10 produk-land kombinasies soos toegeken deur die onderskeie metodes.

Die resultate van die Spearman rang-orde toets het aangedui dat die *International Trade Centre*- en *Decision Support Model*-benaderings die hoogste algehele korrelasie het (0.694), gevolg deur die *International Trade Centre*- en *gravity*-modelle (0.650). Die korrelasie tussen die *Decision Support Model*- en *gravity*-metodes is heelwat laer (0.377). Verder is die algehele verskille in die rang-ordes van die produk-land kombinasies die minste tussen die *International Trade Centre*- en *Decision Support Model*-benaderings (slegs 13% van die produk-land kombinasies het verskille in rang-ordes van meer as 10 plekke), gevolg deur die *International Trade Centre*- en *gravity*-benaderings, waar dit die geval is met 21% van die produk-land kombinasies. Die *Decision Support Model*- en *gravity*-metodes het slegs geringweg meer produk-land kombinasies getoon (25%) met verskille in rang-ordes van meer as 10 plekke. In ag genome die algehele vergelyking van die top 10 produk-land kombinasies wat voortspruit uit die verskillende metodes, het die *International Trade Centre*-- en *Decision Support Model*-metodes die meeste produk-land

kombinasies met dieselfde rang-orde, sowel as die meeste produk-land kombinasies wat ingesluit is in beide metodes se top 10. Die *Decision Support Model*- en *gravity*-modelle, daarenteen, het die minste produk-land kombinasies met presies dieselfde rang-orde, tesame met die minste produk-land kombinasies wat in beide modelle se top 10 ingesluit is.

In geheel het die resultate van die studie dus aangedui dat die rang-ordes gebaseer op die uitvoerpotensiaalwaardes beraam deur die *International Trade Centre*- en *Decision Support Model*-benaderings, die mees vergelykbaar is tussen die drie benaderings, terwyl die vergelyking van die range toegeken deur die *Decision Support Model*- en *gravity*-modelle die laagste vlakke van ooreenkoms toon. ’n Moontlike rede hiervoor is die feit dat die *gravity*-model se berekening van uitvoerpotensiaalwaardes uitdagend kan wees op ’n groot en gedetailleerde skaal (produk vlak). Veranderlikes wat in die *gravity*-model gebruik word is ook meestal op land vlak, wat produk-spesifieke analise uitdagend maak. Verder kan die veranderlikes wat in die *gravity*-benadering gebruik word om uitvoerpotensiaalwaardes te bereken as verouderd beskou word. Daarteenoor kan die *International Trade Centre*- en *Decision Support Model*-benaderings uitvoerpotensiaalwaardes op ’n groot skaal en gedetailleerde produk vlak analiseer. Hierdie twee benaderings sluit ook veranderlikes in wat relevant is tot handel in die 21ste eeu.

Gebaseer op die literatuur en empiriese analise van hierdie studie, kan die gevolgtrekking gemaak word dat die *International Trade Centre* se *Export Potential Assessment* die mees omvattendste is om uitvoerpotensiaalwaardes op ’n gedetailleerde produk vlak te beraam. Hierdie benadering is gebaseer op ’n *gr*avity-model wat beide handelversperrings en die aantreklikheid van markte inkorporeer. Dit sluit ook meeste aspekte van die *Decision Support Model* se handelspotensiaal in, soos marktoeganklikheid, markgrootte en -groei. Dit is egter belangrik om in gedagte te hou dat elkeen van die drie benaderings ’n spesifieke doel, voordele en beperkings het.

Dit word dus aanbeveel dat die *gravity*-, *International Trade Centre*- en *Decision Support Model*-benaderings gebruik word om mekaar te verbeter en aan te vul. Besluite rakende uitvoerbevordering behoort egter nie op uitvoerpotensiaalwaardes alleen gebaseer te word nie, aangesien daar ander onmeetbare komponente van uitvoerpotensiaal is wat ook tydens analise in aanmerking geneem moet word.

Sleutelwoorde: Internasionale mark-seleksie, uitvoerpotensiaalwaardes, *gravity*-model, *Export Potential Map*, *Decision Support Model*, uitvoerbevordering

ABBREVIATIONS

CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CIF	Cost, insurance and freight
DSM	Decision Support Model
DTI	Department of Trade and Industry
EDI	Electronic data interchange
EPI	Export Potential Indicator
EU	European Union
FOB	Free on board
GDP	Gross domestic product
HHI	Herfindahl-Hirshmann Index
HS	Harmonised System
ICT	Information and telecommunications technology
IDC	Industrial Development Corporation
ILO	International Labour Organisation
IMF	International Monetary Fund
IMS	International Market Selection
INES	Integrated National Export Strategy
ITC	International Trade Centre
LPI	Logistics Performance Index
NAFTA	North American Free Trade Agreement
NDP	National Development Plan
NPC	National Planning Commission
NTB	Non-tariff barrier
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PDI	Products Diversification Indicator
RCA	Revealed Comparative advantage

REO	Realistic export opportunities
RTA	Regional trade agreement
Stats SA	Statistics South Africa
UN	United Nations
UN Comtrade	United Nations International Trade Statistics Database
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
USITC	United States International Trade Commission
WDI	World Development Indicators
WEF	World Economic Forum
WEO	World Economic Outlook
WITS	World Integrated Trade Solution
WTO	World Trade Organisation

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CHAPTER 1 INTRODUCTION

1.1 Background and motivation

Exports are crucial for the prosperity of a country owing to the positive relationship between exports and economic growth (Awokuse, 2008:162; Belloumi, 2014:272; Riaz, 2010:6). Increased exports have various positive economic spillovers, which include an increase in foreign exchange (Thirlwall, 2000:7), more productive and efficient exporting industries (Jayachandran & Seinlan, 2010:74) and improved knowledge of effective management and production techniques (Ho, Wang & Yu, 2018:30). Furthermore, by increasing exports, economies of scale can be achieved (Barker & Kaynak, 1992:27; Sheridan, 2012:5); employment, income and output can increase (Awokuse, 2008:162); and countries can become more competitive owing to foreign competition (Riaz, 2010:6).

Export promotion strategies pursued by governments, therefore, also influence the economic growth of countries positively as such strategies aim to increase exports (Belloumi, 2014:272). These strategies can improve countries' trade balance and contribute to helping a country's economy recover after an economic crisis. This was evident in South Africa after the country experienced an economic isolation period from the mid-sixties to 1994. As measured by Loots (2003:238-239), export promotion strategies and other trade liberalisation efforts led to higher economic growth from 1990 to 2001. Xuefeng and Yaşar (2016:29) support this argument by stating that industries in countries that pursue export-led growth strategies are able to enjoy minimised political and exchange rate risks, and reduced effects when a foreign trade shock occurs. Ultimately, the more a country exports, the better prosperity that country experiences (Calof, 1993:60).

In South Africa in particular, the National Development Plan (NDP) highlighted the fact that the country would experience increased income if the volume of exports increased, as there would be significantly more foreign exchange earnings. These earnings would not only assist in the purchasing of inputs which could be used for further industrialisation but could also enhance infrastructure investment. This would once again spur productivity and contribute to reaching the economic growth target of 5.4% by 2030, as set out in the NDP (NPC, 2012:64,120).

Furthermore, unemployment, which is 29.1% (for the fourth quarter of 2019), will decrease as a result of higher levels of exports (NPC, 2012:120; Stats SA, 2020a:1). A study conducted by Kucera, Roncolato and Von Uexkull (2012:1126), which investigated the effects of trade contractions on employment in South Africa, resulting from the global financial crisis in 2008, offers a perspective on the number of jobs the exporting industry provides. Based on mirror data

from the EU and the USA, it was found that approximately 886 000 jobs had been lost in South Africa due to trade contractions (in other words, a decrease in exports) as a result of the global financial crisis, while an estimated 77 000 “possible jobs created” had also been lost. Therefore, owing to the positive relationship between exports and employment, if exports were to increase, employment would also increase (Kucera *et al.,* 2012:1126).

As the World Bank and the International Monetary Fund (IMF) have adjusted South Africa’s economic growth outlook for 2020 downwards from 1.5% in 2019 to 0.9% and 0.8% respectively, the unemployment rate is not likely to improve significantly in the near future (Mahlaka & Stoddard, 2020; Winning, 2020). Unemployment is usually associated with decreased consumer spending, which negatively affects businesses and could even lead to higher unemployment; high crime rates; increased poverty and, therefore, a general economic slowdown (Makaringe & Khobai, 2018:1). Accordingly, as the percentage of unemployed people in South Africa has been following an upward trend for the past 10 years (see Figure 1-1), reformative steps are necessary to reduce unemployment and, therefore, encourage economic growth.

Figure 1-1: South African unemployment rate (according to the official/narrow definition) (2010-2020)



Source: Trading Economics (2020)

As a reformative step, National Treasury (2019:13) acknowledged that export-led growth is essential for earning revenue to fund investments and is, therefore, necessary for assisting in increasing economic growth. The report indicated that the high-value exports of the manufacturing sector, among other factors, has a strong competitive advantage, which should be used as a means to encourage export-led growth (National Treasury, 2019:13). This complements the Department of Trade and Industry’s (DTI) Integrated National Export Strategy (INES), of which the main aim is to double manufacturing exports by 2030 (Oliveira, 2017).

In 2018, the manufacturing sector was the fourth largest sector in South Africa and contributed 13.53% to the gross domestic product (GDP) (Stats SA, 2019a). The manufacturing sector's contribution to the GDP in 2019, however, started declining, mainly due to weak demand, continued interruptions in energy supplies, operational challenges and an increase in input costs (IDC, 2020:7). Nevertheless, the sector recorded a growth of 2.1% in the second quarter of 2019 (Stats SA, 2020b). Furthermore, this sector employs more than 1.7 million people in South Africa (Stats SA, 2019a). This number continues to increase as there was an average of 2.4% upsurge in employment in the manufacturing industry from the third quarter of 2018 to the third quarter of 2019 (Stats SA, 2019b:2). Local manufacturers also believe that a modest improvement in the manufacturing sector's export performance is possible in the next 12 months (IDC, 2020:2).

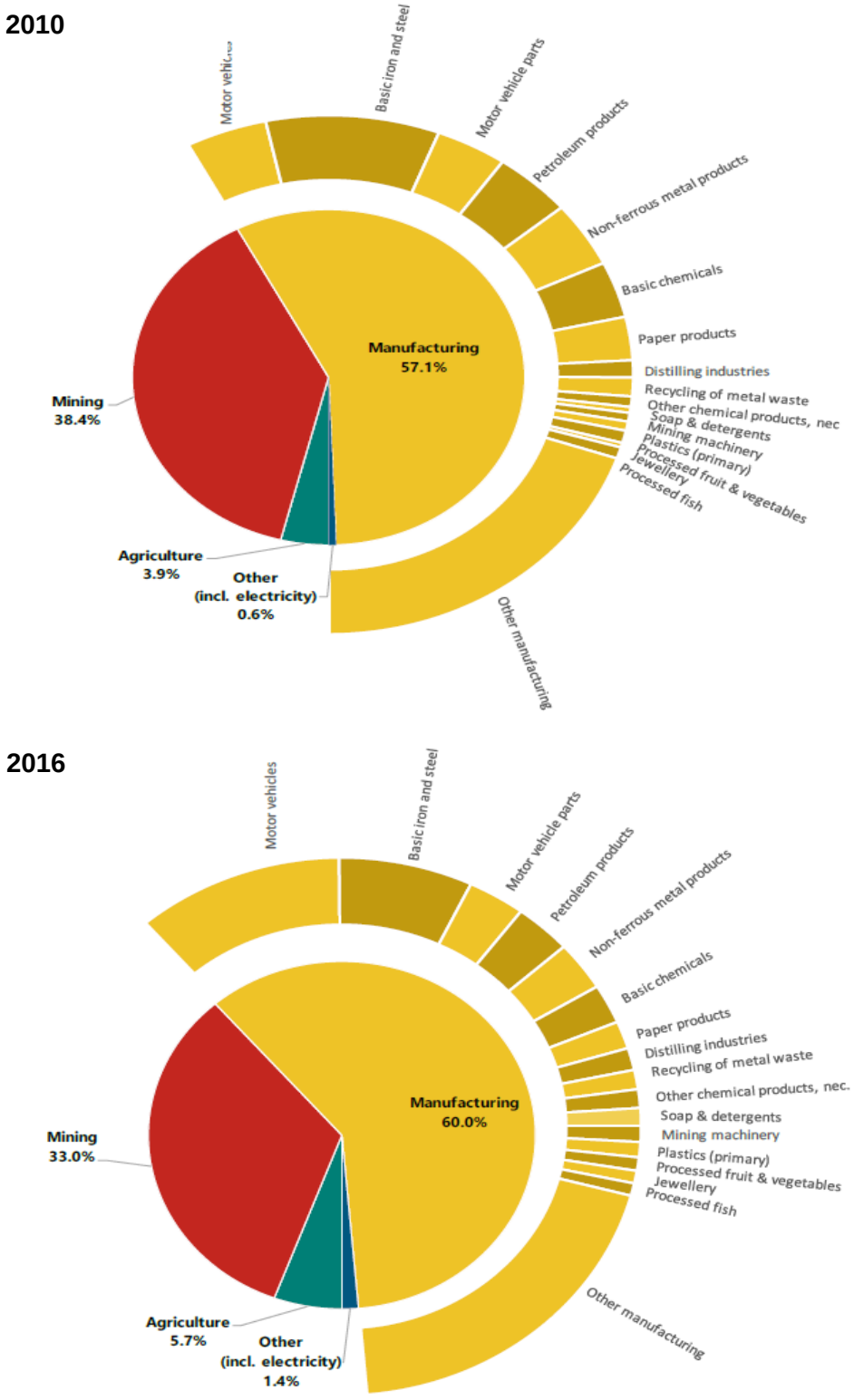
In addition, the South African manufacturing sector has increased its contribution to the national merchandise export basket in the past decade. As indicated in Figure 1-2, the manufacturing sector accounted for 60% of the total merchandise export basket in 2016, compared to 57.1% in 2010 (IDC, 2017:7). The manufacturing export basket has experienced a number of changes over this period, with motor vehicles' export share increasing substantially, while subsectors such as basic iron and steel's export share decreased (IDC, 2017:7). In 2019, motor vehicles remained the top exported product category in South Africa (IDC, 2019:8).

It is necessary to encourage manufacturing exports as it will not only increase employment in the manufacturing sector, but also in non-manufacturing industries, such as mining and agriculture, as the sector is known for having multiple backward and forward employment linkages (Kotabe & Czinkota, 1992:638). Therefore, if South Africa focuses its resources on promoting the exports of manufacturing products to the correct markets, unemployment could potentially be reduced and economic growth enhanced.

Resources for export promotion are, however, limited as it is impossible to profitably and successfully export all products to all countries (DTI, 2013:58; Papadopoulos & Denis: 1988:38). Decisions should, therefore, be made regarding which export opportunities to pursue in order not to waste the scarce resources on export markets that may not yield high returns on the export investment made and are, thus, less attractive (Cuyvers, 2004:255-256; Rahman, 2003:119).

Rahman (2003:119) contributed that the selection of "incorrect" markets could result in market failures, which usually lead to significant losses. Therefore, markets with the highest export potential need to be selected and prioritised to ensure that the scarce resources are used in a way that contributes to economic growth (DTI, 2013:58; Shankarmahesh *et al.,* 2005:204). Trade and the economic prosperity of a country, therefore, rely on resources being governed and distributed properly (Decreux & Spies, 2016:2).

Figure 1-2: Composition of South Africa's merchandise export basket in 2010 and 2016



Source: IDC (2017:8)

The process of international market selection (IMS) involves determining the unrealised export potential of a country's products in international markets (Papadopoulos & Denis, 1988:38). It is, however, difficult to put a specific value to export potential since the accuracy thereof cannot be evaluated in retrospect if the potential was not pursued actively and successfully (ITC, 2017).

IMS methods attempting to calculate export potential values include (i) the gravity model, of which some researchers use the estimated panel regression equation representing the determinants of bilateral trade to calculate trade potential values (Breytenbach & Jordaan, 2010:24; Drottz & Lantz, 2008:9; Jordaan, 2015:355); (ii) the International Trade Centre (ITC) recently having developed a methodology (Export Potential Map) to determine the export potential for exporting countries on a detailed product level (Decreux & Spies, 2016:2); and (iii) the decision support model (DSM), which was designed in the early 1990s to identify realistic export opportunities (REOs). The more recent applications of the DSM also included estimating an export potential value for each of these REOs on an HS 6-digit level (Cuyvers, *et al*., 2012:74; Cuyvers *et al.*, 2017:7,19; Viviers *et al.,* 2014:42).

Although the methodologies of these IMS approaches differ, all three attempt to estimate export potential values. However, a comparison between the ranking or priority given to product-country combinations, based on the export potential values calculated by means of the three methods, has not been done in the literature. Nevertheless, from the literature, it is clear that it is important to estimate export potential values as resources for export promotion on country and firm level are scarce and incorrect market selection could lead to large losses (Papadopoulos & Denis, 1988:38; Shankarmahesh *et al*., 2005:204). Therefore, by estimating export potential values and actively pursuing those markets with the highest export potential, or unused export potential, economic growth can be encouraged.

1.2 Problem statement

Important market selection and prioritisation decisions are often based on estimated export potential values, as resources for export promotion strategies are scarce and incorrect market selection could lead to significant losses. It is, however, challenging to put a specific value to export potential as it is difficult to evaluate the accuracy thereof in retrospect, due to the potential not always being actively pursued and realised in actual trade (ITC, 2017).

Three methods are found in the literature that attempt to estimate export potential values. Since the estimated export potential values are expected to differ between these methods, it is necessary to compare the rankings assigned to product-country combinations to ultimately assist with export promotion decisions. This is especially necessary in the case of South African

manufactured products, as it can potentially contribute to increase economic growth in the country.

1.3 Research questions

In order to establish whether the existing methods for estimating export potential values give similar answers, the following research questions can be formulated:

(i) How does the rank/priority assigned to the same product-country combinations; based on the export potential values calculated by means of the gravity model, ITC's Export Potential Map and the DSM; compare?

(ii) What are the benefits and limitations of each method? With a specific focus on the calculation of the export potential values, and how the approaches can be refined/enhanced.

1.4 Research objectives

The research objectives are classified into two categories, namely a general objective and specific objectives.

1.4.1 General objective

The general objective is to determine whether the gravity, ITC and DSM approaches give similar rankings/priority to the same product-country combinations based on the export potential values estimated.

1.4.2 Specific objectives

The specific objectives of this study are as follows:

(i) Providing an overview of the literature on the importance of export promotion and IMS, and specifically identifying the determinants of export potential.

(ii) Comparing the rank/priority based on the export potential values calculated for South Africa by means of the three methods for the same products and countries by using the Spearman rank-order test, frequency distributions and a comparison of each product's top 10 countries.

(iii) Identifying the benefits and limitations of each export potential value calculation method based on the literature and empirical analyses; and making recommendations on how the approaches can be refined/enhanced.

1.5 Research methodology

The research relating to the specific objectives is twofold, namely a literature review and an empirical study.

1.5.1 Literature review

The literature review investigates previous studies conducted on the importance of exports, export-orientated trade policies and IMS. It will also identify the determinants of exports or export potential.

1.5.2 Empirical study

The empirical study is conducted by firstly estimating the export potential values of 15 of South Africa's main exported manufactured products by using the three approaches for estimating export potential values. These include the gravity model, the Export Potential Map of the ITC and the DSM. Thereafter, the estimated export potential values of the three methods are compared for the same products and countries by using the Spearman rank-order correlation test, frequency distributions and a comparison of each product's top 10 countries. This is done in order to ultimately compare the ranking/priority assigned to the same product-country combinations. The benefits and limitations of each method, specifically regarding the calculation of export potential values, are also identified. Furthermore, recommendations are made on how each approach can be refined/enhanced. A short explanation of each of the three approaches in terms of estimating export potential values follows in Chapter 3.

The gravity model analyses potential trade flows by means of a panel regression analysis based on historic bilateral trade data. It takes into consideration the size of markets, which serves as an attraction for trade, and the distance and/or trade costs between markets, which serves as resistances to trade (Jordaan, 2015:355).

Secondly, the Export Potential Map of the ITC calculates export potential values by using the export potential indicator (EPI), which is based on an economic model that combines the supply of the exporter with the importing country's demand and market access conditions to calculate export potential values (ITC, 2019a). The EPI aims to assist established exporting industries by enabling them to increase their exports to current and new target markets. It, therefore, provides practical trade information on a detailed product level. Furthermore, export potential values are

estimated in an Export Potential Map based on datasets accumulated by the ITC from various sources, including data on tariffs, import and export data, GDPs of countries, as well as geographical data (ITC, 2017).

Finally, the DSM involves four sequential filters that aim to eliminate less-promising markets to ultimately produce a list of product-country combinations of REOs. These filters take into account the size and growth of import demand, as well as import market concentration and market access (Viviers *et al*., 2014:33). Once the REOs have been identified, export potential values are estimated based on the top six competing countries' average market share in each market. This average provides an indication of the size of the potential of each market relative to the others in order to rank or prioritise among product-country combinations identified as REOs (Cuyvers *et al*., 2017:14; Viviers *et al.,* 2014:42).

All three methods, therefore, estimate export potential values by using historical data, which is available on databases such as the UN Comtrade or the CEPII-BACI.

1.6 Chapter outline

Chapter 1 provides the background and motivation for the study, along with the problem statement. This chapter also specifies the research question, objectives and methodology used for estimating export potential values by means of the gravity model, Export Potential Map of the ITC and the DSM.

In Chapter 2, the literature on the importance of exports, export promotion strategies and IMS for a country is revisited. This chapter also provides an overview of the literature on the determinants of exports or export potential.

Chapter 3 offers an explanation of the respective methods and the data used to estimate the export potential values of South Africa's top exported manufactured products. The Spearman rank-order correlation test, among others, which is used for comparing the rank or priority of the export potential values, are also explained.

In Chapter 4, the rank/priority assigned to the export potential values calculated by the respective methods for the same products and countries are compared by means of three tests. If the rank/priority differs among the three methods, recommendations on how the approaches can be refined/enhanced, are made.

Lastly, in Chapter 5, an overall summary and conclusion of the study are made, together with recommendations for practical applications and future studies.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Chapter 1 introduced the motivation, problem statement and objectives of this study. From the first chapter, it is evident that the comparison of the ranks/priorities assigned to the export potential values estimated by the gravity, ITC and DSM approaches serves as the focus of this dissertation. In order to make a valuable comparison, it is necessary to investigate and understand the importance of exports, export promotion and IMS. It is also vital to identify and comprehend the factors that generally affect exports, as these factors form part of the foundation of the respective methodologies' estimation of export potential values. Chapter 2, therefore, aims to contextualise this study into the literature.

2.2 Importance of exports, export promotion strategies and international market selection

Exporting is one of the main contributors to economic growth (Awokuse, 2008:162; Belloumi, 2014:272; Chen, 2009:127; Jayachandran & Seinlan, 2010:74; Riaz, 2010:6; among others). The extent of the positive relationship between exports and economic growth is, however, different for each country due to different economic structures, as well as the fact that economic growth can indeed also contribute to increasing exports (Giles & Williams, 2000:267; Jayachandran & Seinlan, 2010:75). Nevertheless, export-orientated trade policies, which leads to increased exports, help countries to take advantage from positive externalities which ultimately enhances economic growth (Awokuse, 2008:162; Sheridan, 2012:6).

The first positive externality of increased exports is the spillover of knowledge (Ho *et al*., 2018:30; Thirlwall, 2000:9). By learning from international competitors, industries can improve and optimise their management and production techniques. This may ultimately enhance innovation and lead to the expansion of production in the respective industries (Görg & Greenaway, 2004:174; Sheridan, 2012:5-6). Belloumi (2014:270) supports these findings and states that exports help to improve skills of exporting industries by adopting innovation and advanced technology for the production of goods and services. Belloumi (2014:270) even states that the transfer of knowledge and technology through trade is the main contributor to positive economic growth.

Secondly, Jayachandran and Seinlan (2010:74) have found that countries that export more, have more productive and efficient exporting industries. Sheridan (2012:5), as well as Giles and Williams (2000:263), elaborates by stating that increased exports can enhance specialisation when producing export products. This can spur on productivity and lead to the development and

improvement of skills, as well as better use of production capacity. The increase in productivity can, therefore, also lead to increased growth in outputs, which is a phenomenon known as Verdoorn's law, as first suggested by Verdoorn in 1994 (Giles & Williams, 2000:63). Nevertheless, more productive and efficient exporting industries can ultimately result in the exploitation of economies of scale (Sheridan, 2008:5).

Furthermore, if a country applies export promotion strategies and, hence, exports more, it can experience an improved trade balance and, therefore, economic growth (Barker & Kaynak, 1992:27). This was evident in the significant development, through export-led growth, of the once primitive economies of South Korea, Taiwan, Hong Kong and Singapore (better known as the "East Asian Tigers"), as well as Japan and Germany's remarkable economic comeback after the Second World War (Stiglitz & Yusuf, 2001:423; The World Bank, 1993).

It is also argued that export-orientated trade policies assist countries in acquiring additional foreign exchange, which can be used to pay for the imports of intermediate and other goods (Thirlwall, 2000:7). Thirlwall (2000:7) elaborates that increased exports is the only element of aggregate demand able to allow other elements, such as investment, consumption and government expenditure, to grow faster. This is due to the fact that all the other elements have an import side that needs to be paid for by foreign exchange (Thirlwall, 2000:7). Therefore, exports reduce the balance of payments constraint on demand, while also positively influencing growth from the supply side. Awokuse (2008:162) also contributes to the discussion by indicating that increased foreign exchange will help a country to increase its capital formation, thereby stimulating the growth of outputs.

Increased exports can also lead to an increase in employment and income, with a subsequent increase in output (Awokuse 2008:162; Lourens, 2016:11). The World Trade Organisation (WTO, 2001) supports this view by stating that countries with open economies (in other words, countries that export) are able to reduce poverty more effectively than countries with closed economies. Therefore, countries that export more regularly experience better prosperity (Calof, 1993:60).

Moreover, Nasiri and Asl (2013:1488) have found that when a country exports more, it will be easier to find new markets to export to, thereby preventing countries from only exporting to a few markets. By diversifying export markets, exporting industries are expected to experience improved productivity and reduced average cost when producing goods and services due to economies of scale and economies of scope (Xuefeng & Yaşar; 2016:39-40). Furthermore, it is expected that these industries have the benefit of enjoying minimalised political and exchange rate risks, as well as reduced effects when a foreign trade shock occurs (Lourens, 2016:18; Nasiri & Asl, 2013:1488; Xuefeng & Yaşar, 2016:29). This was, for example, evident in the USA after its

exports contributed to mitigating the impact of the domestic recession in the 1990s (Shankarmahesh *et al*., 2005:203). Diversified export markets will, therefore, ultimately be beneficial for economic growth.

In addition, exporting industries in countries that follow an export-orientated strategy tend to be more competitive owing to foreign competition. This is beneficial for domestic and foreign consumers as the prices of goods and services will be as low as possible (Riaz, 2010:6; Thirlwall, 2000:24).

From section 1.1, it is clear that exports and export promotion strategies play an important role in contributing to South Africa's economic growth. It has, for example, been estimated by Rangasamy (2009:608) that a 10% increase in real exports can lead to an approximate increase of 8.5% in South Africa's real GDP, along with an increase of 8% in real non-export GDP in the long term. Cipamba (2015:14-15) found similar results and contributed that export growth in South Africa results in higher GDP growth through spillovers such as increased productivity gains in the international trade sector. Furthermore, it has been established that exports' contribution to South Africa's economic growth is in fact more than what has been initially estimated by the GDP accounting identity (Rangasamy, 2009:609).

Nevertheless, resources for export promotion strategies on country and firm levels are scarce and if the incorrect markets are selected, economic growth can be affected negatively (Papadopoulos & Denis: 1988:38). Insufficient market evaluations can, therefore, result in market failures when resources for export promotion strategies are allocated to the incorrect markets. Market failures, in turn, could lead to significant losses as the cost is almost always greater than the cost of systematically evaluating the markets beforehand, thereby discouraging growth (Rahman, 2003:119).

Kumar, Stam and Joachimsthaler (1994:29) also contribute to the discussion by stating that the selection of the right markets is crucial as it forms the foundation for companies' future export developments and success. Without the proper initial evaluation of markets, companies might struggle financially in the future due to incorrect markets being selected and pursued (Kumar *et al*., 1994:29; Rahman, 2003:119). Therefore, as a result of poor market selection, companies may have to undergo restructuring, which could ultimately impact an economy negatively.

It is, therefore, vital to promote exports, select the correct markets and allocate resources for export promotion activities effectively as economic growth and prosperity can be enhanced (Weede, 2004:173,178). As mentioned in Chapter 1, the aim of this study is to compare the ranks assigned to the export potential values estimated for South Africa by the gravity, ITC and DSM

approaches. It is, however, necessary to understand which factors generally influence exports as they form part of the foundation for the analysis of export potential values, which is used to select the correct markets. The following section will discuss these factors/determinants.

2.3 Determinants of exports

Determinants of exports are used in the international trade literature to estimate the export potential of goods and services. These determinants usually include proxies for the size and growth of import demand and export supply, such as the GDPs of the importer and the exporter. Exporters are also confronted with political and exchange rate risks when exporting goods. Other determinants include market concentration, trade agreements, tariffs, non-tariff barriers (NTBs) and the operating environment. Several trade cost estimators also have an impact on the export potential of a country. Trade cost estimators traditionally comprise the time and cost to import, the availability and quality of trade facilitation, distance/proximity, and cultural differences. Each of these determinants are discussed below.

2.3.1 Size and growth of import demand and export supply

Krugman, Obstfeld and Melitz (2012:11) state that a country's economic size and volume of traded goods and services have a significant relationship. When estimating determinants of trade, the GDPs of countries are often used as a proxy for the size of supply and demand. This is due to the fact that countries with larger GDPs usually trade more as they have higher incomes and production levels, as well as a wider variety of available goods and services (Arnold & Quelch, 1988:13; Braha, Qineti, Cupák & Lazorčáková, 2017:6; Drottz & Lantz, 2008:9; Eita & Jordaan, 2007:6; Nilsson, 2000:812). It can, therefore, be said that there is a positive relationship between GDP and bilateral trade growth (Ashby, Cochran, Childs & Velikova, 2016:96; Atif, Haiyun & Mahmood, 2017:267; Braha *et al*., 2017:6,10, among others).

The population of the importer and the exporter can also be used along with GDP values as an indication of the size of a country's economy and, therefore, the potential supply and demand (Arnold & Quelch, 1998:13; DTI, 2008:4; Eita & Jordaan, 2007:3). As a result, GDP per capita is sometimes used as a proxy for the size of supply and demand (Armstrong, 2007:6; Nilsson, 2000:812).

According to Nilsson (2000:812), a country's population can influence international trade twofold. On the one hand, a large population is an indication that a country is more self-sufficient, has a larger domestic market and, therefore, does not need to trade that much. On the other hand, if a country's population is large, more opportunities arise for trading with a wider variety of goods. This is due to the fact that labour is more divisible and economies of scale can be achieved.

Therefore, the relationship between exports and the population of a country cannot be determined *a priori* (Martinez-Zarzoso & Nowak-Lehmann, 2003:296-297; Nilsson, 2000:812). Armstrong (2007:5), however, states that a positive relationship is usually expected for developing countries as they typically specialise in labour-intensive exports. Conversely, Martinez-Zarzoso and Nowak-Lehmann (2003:296-297) expect a negative relationship to exist if countries with large populations experience an absorption effect.

2.3.2 Political risks

According to Weston and Sorge (1972:60), political risks occur due to national governments' actions to (i) prevent or interfere with business transactions, (ii) cause partially or wholly foreign-owned business property to be confiscated or (iii) make changes to the terms of agreements. Stapenhurst (1992) proclaims that the general assumption is that exporters have less capital at stake than foreign direct investors and, therefore, political risks are not as important for them. Gillespie (1989:42), however, states that the value of expropriated assets is usually significantly less than the loss of expected future revenues.

A more recent study by Agarwal and Feils (2007:166) supports this view and elaborates that, although exporters will not lose their facilities, they have already shipped their goods, are faced with non-payments and may also lose expected future sales. Furthermore, Minor (1994:186) confirms that outright expropriation is declining significantly and is even being reversed in some countries. It can, therefore, be said that political risks and export growth are expected to have a negative relationship. This is confirmed by Moser, Nestmann and Wedow (2008:797). They established that, for example, if there is a 1% increase in the Political Risk Index of a country, German exports will decrease by approximately 0.5% in the short term and roughly 2.1% in the long term (this study included South Africa in the sample). They, therefore, concluded that countries with higher levels of corruption, unstable governments and a higher likeliness of conflict would lead to a reduction in trade (Moser *et al*., 2008:792;797).

2.3.3 Exchange rate risk

The general argument is that increased exchange rate volatility leads to reduced trade due to the transaction costs and risks related to the variability in exchange rates (Broll & Eckwert, 1999:178; Nicita, 2013:1; Majidi, Ahmadzadeh & Najafi, 2019:65). However, exchange rate volatility is not necessarily a serious concern for international trade. This is mainly due to the increased availability of financial instruments (such as currency options and forward contracts) used by firms to hedge against exchange rate risks (Auboin & Ruta, 2012:5).

For example, after analysing the effect of exchange rate volatility on trade in 95 countries, Nicita (2013:2) found that international trade was not influenced by the volatility of exchange rates, with the exception of pegged exchange rates and currency unions. Nicita (2013:2) concluded that the relationship between trade and exchange rate volatility was presumably determined by the credibility of long-term policy associated with pegged exchange rates and currency unions, instead of short-term volatility. De Sousa (2012:920), however, reports that the significant positive impact of currency unions on global trade decreases over time, most likely as a result of trade and financial globalisation.

Nevertheless, with the focus on South African trade, Sekantsi (2011:132) estimated that the exchange rate volatility of the South African Rand has a significant negative impact on aggregate exports. According to Sekantsi (2011:132), a 1% increase in the variability of the Rand/Dollar real exchange rate results in a decrease of 2.76% in South African aggregate exports to the US. Sekantsi (2011:132,134) stated that this is most likely due to South Africa's currency being significantly volatile since the government adopted the flexible exchange rate system as well as the fact that South African exporters are considered to be risk-adverse when it comes to exchange rate fluctuations. From this, it is evident that exchange rate risk poses a significant threat to South African trade, and therefore, it should be incorporated as a measure of exports in this study.

2.3.4 Market concentration/international competition

Reis and Farole (2012:35) state that, over time, a country's export performance is measured by the market shares of a specific product or sector. The OECD (2019) defines market concentration as "the extent to which market shares are concentrated between a small number of firms (and) it is often taken as a proxy for the intensity of competition." Cuyvers, De Pelsmacker, Rayp and Roozen (1995:180) support this view and state that a significantly concentrated market is difficult to enter due to the fact that only a few exporting countries have a substantial market share in the importing country, thereby resulting in a strong competitive edge.

Williamson, Kshetri, Heijwegen and Schiopu (2006:78) is of the opinion that exporters attempting to compete in a highly competitive country will experience greater pressure in terms of profit margins. Furthermore, a few predominant exporters will have the benefit of having remarkable knowledge about the market and enjoy being well-known by local customers (Cuyvers *et al*., 1995:180; Papadopoulos, Chen & Thomas, 2002:171; Papadopoulos, 1999).

Cuyvers (1995:180), however, has indicated that market concentration may be less of a concern in a relatively large and growing market than in a non-growing market. Nevertheless, Cuyvers *et*

al. (1995:180) established that there is a negative relationship between market concentration and export performance.

2.3.5 Trade agreements and tariffs

Trade agreements are intended to reduce trade barriers between countries, thereby improving the chance of exporting/importing higher trade volumes (Ashby *et al*., 2016:96). Baier and Bergstrand (2007:94), for example, established that two member countries of a free trade agreement would experience an increase in trade of approximately 100% after 10 years. Hellmanzik and Schmitz (2016:699) are of the opinion that if trade were more restricted, countries would have less revenue generated from exports and fewer varieties of goods and services to choose from. Therefore, there is an expected positive relationship between exports and trade agreements (Ashby *et al*., 2016:96).

Breytenbach and Jordaan (2010:28), however, argue that trade agreements can have a positive or negative relationship with exports as it could lead to either trade creation or trade diversion. Trade creation can be defined as an increase in imports as a result of a reduction in the tariff imposed on goods from a country. If it is a preferential tariff reduction, imports of goods from the country in question will increase even more due to the substitution away from imports of the same goods from other countries as their goods become more expensive. The substitution away from the imports of other countries due to a preferential tariff reduction can be seen as trade diversion (Amjadi, Schuler, Kuwahara & Quadros., 2011:173). Carrère (2006:237) supports this view and established that most regional trade agreements (RTAs) result in increased intra-regional trade. However, the RTAs are often associated with a decrease in imports from non-member countries and sometimes even with a decrease in exports to non-member countries, thereby indicating trade diversion (Carrère, 2006:237).

Nevertheless, studies conducted by Woei, Chin and Ismail (2018:72,76), as well as Pomfret and Sourdin (2009:265), indicate that trade agreements reduce trade costs, mainly due to reduced tariffs. In this regard, after analysing the impact of RTAs on 43 countries (including South Africa), Korinek and Sourdin (2009a:13) estimated that if the average tariff rate increased by 1%, trade would decrease by approximately 1.5%.

Furthermore, Yi (2003:92) argues that there is an increase in the variety of goods exported by countries (which is linked to vertical specialisation), due to reductions in tariffs. By using NAFTA as an example; which involved eliminating tariffs among the USA, Canada and Mexico, (specifically those involving agriculture, textile and automobiles); Yi (2003:92) explains that the trading nature of the USA textiles and apparel sector changed significantly when NAFTA came

into force. Cotton is now sent to Mexico to be spun into fibres and then exported back to the USA where clothing pieces are made. These pieces are once again sent to Mexico to be transformed into clothes and finally exported to the USA again to be sold. This is also true for South African trade within the Southern African Development Community (SADC). Chauvin and Gaulier (2002:25) established that vertical specialisation plays an important role in enhancing trade between SADC member countries due to the fact that they have similar comparative advantages. For example, since other members of the SADC mainly focus on the export of primary goods, South Africa can import middle and low range quality food products from them at a reduced tariff. Being specialised in high quality food products, South Africa can then add value to the imported food products with the aim of exporting it again (Chauvin & Gaulier, 2002:25; Simwaka, 2011:26).

High tariffs also affect the economy and welfare of countries. Amiti, Redding and Weinstein (2019:22), for example, conducted a study on the effect of the 2018 trade war on USA welfare and prices. They estimated the cumulative deadweight welfare cost for the first 11 months of 2018, resulting from increased USA tariffs, to be approximately $6.9 billion, along with a cost of $12.3 billion to local importers and consumers in the form of tariff revenue paid to the government.

Nevertheless, Yalcin, Felbermayr and Kinzius (2017:1) indicated that average tariffs among WTO members have been declining over the past 15 years. Yet, global trade has slowed down, mainly due to an increase in trade protection in the form of alternative trade-restricting measures, such as NTBs (Yalcin *et al*., 2017:1). As NTBs have the potential to nullify trade liberalisation benefits, it is discussed in the following section (Fugazza & Mauir, 2008:476).

2.3.6 Non-tariff barriers

Movchan and Eremenko (2003:2) reviewed and combined several authors' definitions of NTBs in order to formulate their own. They define NTBs as measures, excluding tariffs, that governments implement to impact quantities, prices, resources for producing goods and services, as well as the direction and/or structure of the international movement of these goods and services. These measures/barriers include, but are not limited to quotas; embargoes; sanctions; domestic laws and regulations; quality measures; licensing; anti-dumping duties; subsidies; voluntary export restraints; technical barriers; as well as health, safety, sanitation and phytosanitary standards (Hillman, 1996:4; Hoekman & Nicita, 2008:3).

After analysing the effect of trade restrictions and trade facilitation on international trade for 104 importers and 115 exporters in 2006 (excluding South Africa), Hoekman and Nicita (2008:16) estimated that trade would increase by 1.8% if NTBs were reduced by 10%. Similarly, Evenett (2002:572) determined that US sanctions imposed against South Africa during the Apartheid-era,

resulted in South African exports being reduced by a third. Moreover, it has been established that South African exports to the US lagged significantly compared to other middle income developing economies for the first few years after the sanctions have been lifted. This can be due to the fact that previous export success contributes to export growth in the future (Evenett, 2002:572).

Furthermore, Melo, Engler, Nahuehual, Cofre and Barrena (2014:357,358) conducted a study, indicating that more stringent sanitary and phytosanitary regulations would have an overall negative effect on developing countries' exports. Otsuki, Wilson and Sewadeh (2001:508) had similar results in their study about the effect of one of the new EU standards of 2001 on EU-African trade. The standard in question entailed more stringent regulations imposed on the total aflatoxins acceptable in food products. They predicted that trade in cereals, for instance, would result in a loss of US$ 177 million, which was 59% lower than before the standard was implemented. In addition, Gebrehiwet, Ngqangweni and Kirsten (2007:33) established that a 1% increase in the level of the total aflatoxin imposed on South African food exports by five OECD countries (namely Germany, Ireland, Italy, Sweden and the USA), would result in a reduction of 0.41% in South African food trade. Otsuki *et al.* (2001:509) did, however, highlight the potential health benefits associated with stricter regulations. They found that the "new" standard would result in 0.9 less people dying from cancer related to the intake of aflatoxin per year.

It can, therefore, be said that NTBs have a significant negative effect on trade (Ferrantino, 2006:4; Melo *et al.*, 2014:358; among others). Melo *et al.* (2014:358), however, established that the negative effect of NTBs on trade would be larger if a developed country imposed the regulations. This is due to the fact that most developing and low-income countries' exports are more concentrated on agriculture, while developed or upper middle income countries generally export more manufactured goods or services. Therefore, when developed countries, for example, impose more stringent health and food safety regulations, developing countries find it more difficult to export their (agricultural) goods (Hoekman & Nicita, 2008:5-6,12).

2.3.7 Time and cost to trade

Trade time and costs can be defined as the time and costs of transportation and transactions associated with the international trading of goods (Jacks, Meissner & Novy, 2008:529). According to the OECD and WTO (2015:36), high trade costs and increased time to trade lead to countries being more isolated from world markets. The OECD and WTO (2015:36) elaborated that higher trade costs and increased trading time resulted in (i) consumers having to pay higher prices by not having access to the competitively priced goods and services from the rest of the world (and thereby negatively impacting consumer welfare), (ii) firms not being able to access high quality foreign inputs or being able to export their goods and finally, (iii) poverty increasing significantly.

There are several proxies for trade time and costs, such as geographical distance, being landlocked, sharing borders, the availability and quality of trade facilitation, as well as cultural differences. Due to trade facilitation and culture being more complex/multifaceted, it is discussed in more detail in sections 2.3.8 and 2.3.9.

Many authors have found a strong negative relationship between distance and bilateral trade (Braha *et al*., 2017:14; Breytenbach & Jordaan, 2010:31,32; among others). Feyrer (2009) established that trade would increase by five percent if the ocean distance between two trading countries were 10% shorter. However, a number of studies indicated that, although distance and bilateral trade was negatively correlated, partner countries with larger GDPs minimised the impact of distance on trade (Marimoutou, Peguin & Peguin-Feissolle, 2009:1152).

Nevertheless, the negative relationship is due to distance being associated with trade costs, such as transport cost and time. Marimoutou *et al.* (2009:1140) elaborate that intermodal transport is usually associated with greater distances, while monomodal transport is possible with shorter distances. Batra (2013:116) states that greater geographical distance can be linked to larger differences in culture (such as language) between countries (see section 2.3.9), which ultimately impacts trade negatively due to increased information and search costs. Therefore, greater distance results in higher trade costs, which makes it more expensive to import goods and services and hence reduces trade (Jordaan, 2015:356). The WTO (2018:64), however, established that the overall international trade costs decreased by approximately 15% from 1996 to 2014. This is mainly due to increased globalisation and the use of digital technologies, which may ultimately reduce the relevance of distance (WTO, 2018:64).

Furthermore, there is a positive relationship between export growth and countries sharing a border (Rahman & Ara, 2010:137; WTO, 2012:106). Limão and Venables (2001:453-454) established three reasons why a shared border impact trade positively. First, countries that share a border usually have integrated networks, thereby reducing transhipments. Secondly, countries with a common border typically have agreements regarding customs and transit, which contributes to faster export time and reduced trade/transport costs. Lastly, the likelihood of backhauling increases significantly when two bordering countries trade more, which allows for fixed costs to be split between two trips.

In addition, transport and information costs are higher for landlocked countries than for countries that have access to the ocean (WTO, 2012:106). Christ and Ferrantino (2011:1749) contribute to the discussion by stating that landlocked countries have significantly higher costs and more time to export (or import) goods and services. In a study conducted by Limão and Venables (2001:471), for example, it is estimated that countries that are landlocked and have a poor

infrastructure, typically trade approximately 60% less than countries with a coastline, due to transport costs being approximately 50% higher. Countries, therefore, tend to trade less with countries that are landlocked (Irwin & Terviö, 2002:8; WTO, 2012:41).

Furthermore, Korinek and Sourdin (2009b:17) have estimated that one less day of shipping on an average sea voyage of 20 days will not only result in lower costs, but also in an increase of 4.5% in trade. Alternatively, if maritime transport cost increases by 10%, trade will decrease by between six and eight percent, *ceteris paribus* (Moïsé & Le Bris, 2013:19). Djankov, Freund and Pham (2010:167) also established that each day that exported goods were delayed before shipment could cause a decline in exports of more than one percent. In addition, every day exports are delayed, countries distance themselves approximately 70 km from trading partners, thereby reducing trade (Djankov *et al.,* 2010:167). The WTO (2018:5) also predicts that trade growth can experience an annual increase of 1.8% to 2% until 2030 if trade costs continue to decrease over time.

In terms of African trade, it has been estimated by Daya, Ranoto and Letsoalo (2006:107) that Africa has the highest transport cost in the world, with sub-Saharan African countries taking the lead. In this regard, it has been estimated that industrialised countries' transport costs incurred in the export of a product is an average of 5.5% of the import value, while Africa's average is a significant 13% and sub-Saharan African countries' average is 14% (Daya *et al*., 2006:107). Since the burden of the higher transport costs is usually shifted onto freight customers, the costs of goods increase, thereby ultimately affecting competitiveness negatively (Daya *et al*., 2006:107). Nevertheless, it can ultimately be concluded that higher trade costs and increased time to trade will result in less trade taking place between countries, and vice versa.

2.3.8 Logistics service efficiency

According to Marti, Puertas and Garciá (2014:2982), as well as Bensassi, Márquez-Ramos, Martínez-Zarzoso and Suárez-Burguet (2015:47), logistics have become a vital component of international trade due to globalisation and increased competition. Logistics encompasses the ability to solve matters associated with logistical services, such as transportation, storage and packaging, in an efficient manner to increase the competitiveness of companies (Korinek & Sourdin, 2011:5; Marti *et al*., 2014:2982).

Hence, effective logistical services assist in facilitating the movement of goods, thereby contributing to ensuring that the customers receive the goods in question safely and on time (Marti *et al*., 2014:2982). Ultimately, effective logistical services help to reduce trade costs and time. De Souza, Goh and Gupta (2007:15) is of the opinion that the variation in trade costs and time

between countries, stemming from logistical services, is mainly due to the differences in the quality of infrastructure, policies, institutions and procedures. All of these have a significant impact on trade competitiveness and, therefore, the success of companies. Korinek and Sourdin (2011:18), hence, state that countries that improve their trade logistics will also increase their exports. Therefore, if logistical services are inefficient or not of a high quality, trade can be impeded (Korinek & Sourdin, 2011:5).

Logistical service efficiency (along with the time and cost associated with it) can be divided into three dimensions, namely at-the-border (for example, border procedures and efficiency), between-the-border (in other words, infrastructure for transport and communication) and behind-the-border (for instance, domestic regulations and product standards) (OECD & WTO, 2015:43; Portugal-Perez & Wilson, 2010:1,6). Each of these dimensions are discussed in sections 2.3.8.1 to 2.3.8.3.

2.3.8.1 Border efficiency

The aim of border efficiency is to quantify the customs efficiency levels, which are reflected in the cost, time and the number of documents associated with trade procedures (Portugal-Perez & Wilson, 2010:11). Korinek and Sourdin (2011:18) state that trade is positively affected by improvements in border administration. Portugal-Perez and Wilson (2010:26), for instance, established that if Kazakhstan improved its border (and transport) efficiency only halfway to the level of Romania's, it would experience an increase in its exports of 23.2%, which is equivalent to a 15.8% reduction in import tariffs. Korinek and Sourdin (2011:18) also established that trade would be affected worse if goods spent an additional day at a border compared to an extra day at sea. This is mainly due to the uncertainty regarding delays at borders as it is more difficult to predict and respond to such delays.

De Souza *et al*. (2007:23) contribute to the discussion that a lack of fully automated and integrated systems, such as electronic data interchange (EDI), is the main cause of inefficient documentation and administration. For this reason, a significant number of documentation must be completed, while there is no standard format for documentation across countries. Furthermore, although automated systems may be in place, the documentation review process can be time consuming and cause uncertainty. In Thailand, for instance, after the approval process has been completed by means of EDI, the documentation in question must be brought to the customs office for stamping (De Souza, 2007:24). The lack of transparency in regulations also results in documentation taking up a significant amount of the processing time at borders (De Souza, 2007:23). Nevertheless, viewed in its entirety, fully operational electronic systems reduce the time

traders spend at customs clearance significantly, thereby enhancing trade (The World Bank, 2017:80).

2.3.8.2 Infrastructure

In the context of international trade, infrastructure is the quality of countries' telecommunications and transport infrastructure (Marti *et al.,* 2014:8). Limão and Venables (2001:451), as well as Amjadi and Yeats (1995), indicate that weak policies and deteriorated communication, port and transport infrastructure lead to increased time and costs to export, thereby preventing countries from participating effectively in global production networks. A more recent trade report of the WTO (2018:5) supports this statement and indicates that the use of digital technologies can make the entry to a market easier, thereby enabling companies to distribute their goods at lower costs. A report of the USITC on the effects of infrastructure conditions on export competitiveness in Sub-Saharan Africa, also support this statement (Ferrantino, 2009:2-4). For instance, the shortest and most direct routes are not necessarily the most economical due to poor infrastructure and further destruction thereof from bad weather and civil unrest (Christ & Ferrantino, 2011:1 750). In the third annual report of the USITC in 2009, Whol (2009:3-5) uses Burundi as an example and states that,

> "Burundi's most direct route to the coast is through neighbouring Tanzania, but infrastructure along this route is so poor that the primary Burundian transit route to Mombasa is via Rwanda, Uganda and Kenya, an additional 600 km."

In addition, it has been estimated, for example, that Bosnia and Herzegovina, known for having some of the poorest infrastructure quality, can increase its exports by 53% if it improves its infrastructure to only half the level of Lithuania (Portugal-Perez & Wilson, 2010:26). Marti *et al*. (2014:20) contribute to the discussion that infrastructure improvements in emerging markets will have a greater effect on trade if improvements are made in developed countries. This is due to previous deficiencies that emerging markets have experienced.

Furthermore, Korinek and Sourdin (2011:7) acknowledged the important role of superior telecommunication technology in international trade. In recent years, information has increasingly been stored and processed electronically, for example, customs automation, tracking and tracing of goods, risk analysis, terminal operations, and so forth. Therefore, high quality information and telecommunications technology (ICT) is crucial for the reliable and timely flow of information. Korinek and Sourdin (2011:7) also established that the implementation of ICT may help to reduce transaction costs and delays, and enhance the efficient use of resources. Lui and Nath (2013:67-68) support this statement. Therefore, policies aimed at encouraging and facilitating the use of ICT will enhance trade significantly (Liu & Nath, 2013:67,84; Vemuri & Siddiqi, 2009:481).

2.3.8.3 Operating (trade) environment

According to the World Economic Forum (WEF) and Global Alliance for Trade Facilitation (2016:15), the quality of a country's operating environment has a significant effect on the capacity of companies to engage in international trade. The operating environment includes aspects such as the effectiveness of contract enforcement and the quality of institutions, among others (WEF & Global Alliance for Trade Facilitation, 2016:15).

Nunn (2007:594) describes a country's ability to enforce contracts as an important part of its comparative advantage. Measures of contract enforcement impact the volume of trade significantly, however, it has a larger effect on trade in exporting countries than it has in importing countries (Ranjan & Lee, 2007:216). For example, in the case where the quality of goods is concerned, imperfect contract enforcement leads to more expensive warranties, which, in turn, results in reduced profits for exporters. Exporters with lower quality goods, therefore, do not deem it profitable to export their goods, hence the volume of traded goods decrease (Ranjan & Lee, 2007:192). Furthermore, Egger (2001:5-6) established that the viability of contracts, as well as the rule of law (institutions) of importers and exporters, impacts the costs incurred in international trade. This is due to the fact that higher levels of contract viability decrease firms' risks. Moreover, Anderson and Marcouiller (2002:342,349) state that the enforcement of contracts across jurisdictional boundaries leads to increased hidden transaction costs (or "hidden taxes") related to the risk/uncertainty accompanying international trade, thereby reducing trade.

In addition, De Groot, Linders, Rietveld and Subramanian (2004:103) state that the aim of an institution is to lower the risk/uncertainty associated with exchange and to reduce transaction costs. Formal rules (institutions) impact behaviour and interpersonal trust, which affect the conventions of doing business. Ultimately, it can influence preferences and risk perceptions in international trade. Institutional effectiveness is, therefore, also an important determinant of trade costs in the protection and enforcement of intellectual property rights as many governance systems are involved in international trade (De Groot *et al*., 2004:104). This may create an opportunity for countries with similar levels of institutional quality to trade as they are familiar with each other's business practices, thereby reducing transaction costs. Countries with a significant divergence in institutional quality, therefore, experience higher adjustment costs and uncertainty when trading, hence leading to reduced trade (De Groot *et al.*, 2004:104,118-119).

Anderson and Marcouiller (2002:342,349) support the view that trade increases significantly if it is supported by strong institutions and estimate that Latin American countries will experience an increase of 30% in trade if they improved their institutional quality to the same levels as those of the EU. This increase in trade is approximately equal to what would be expected if those Latin

American countries were to reduce their tariffs to the levels of the USA (Anderson & Marcouiller, 2002:342,349).

2.3.9 Culture

Until a few years ago, cultural differences, such as language and colonial history, were considered to hinder trade (Eita & Jordaan, 2007:8; Rahman & Ara, 2010:137; Rose, 1999:17; WTO, 2012:106; among others). Language is, for example, associated with search and information costs. Therefore, it has been argued that countries that share a common language tend to trade more than countries that have no common language (Fejzić & Čovrk, 2016:79). Reuben, Barau and Akintunde (2014:138) contribute to the discussion by stating that countries with a common main language can exchange crucial information faster and are able to negotiate prices more swiftly. Ultimately, more "distance" exists between countries that do not share a common main language, which impedes trade (Drottz & Lantz, 2008:5).

Furthermore, it has been estimated that countries sharing a colonial history, trade approximately four times more than countries with no colonial history (De Sousa & Lochard, 2012:422). This can be due to the fact that countries with a colonial history know more about one another and may also understand each other's rule of law, business practises, competitiveness and delivery reliability better. Exporting companies would, therefore, rather supply goods or services to customers or use suppliers in countries that are familiar or similar to their own country. This ultimately leads to reduced search and information costs. Therefore, export growth is expected to be higher for countries with a shared colonial history (Rose, 1999:17; WTO, 2012:106).

The latest trade figures do, however, not back these statements up. In this regard, China has changed the so-called "playing field" as it was the largest exporter in 2019 (having a 13.3% share in world exports), as well as the second largest importer, with a 10.9% share in world imports (ITC, 2020). However, its main export destination is the USA, with whom China does not share a colonial history with nor a common official language (ITC, 2020). China is also South Africa's main trading partner, although these two countries do not share a colonial history or official main language (ITC, 2020). Nevertheless, cultural differences is still often used in the determination of export potential values to select international markets (Miečinskienė, Stasytytė & Kazlauskaitė, 2014:1174).

The determinants discussed in section 2.3 will form the basis of the methodologies of the three approaches under consideration in this study, which will be explained in the third chapter. The following section concludes this chapter.

2.4 Conclusion

The main aim of this study is to compare the rankings/priorities assigned to the export potential values calculated for South Africa by different approaches. This chapter, therefore, focused on contextualising this study into the literature.

The literature on the importance of exports, export promotion and international market selection indicated the crucial role that exports play in a country's economic growth and ultimate prosperity. Furthermore, the factors that generally influence exports were identified and discussed in sections 2.3.1 to 2.3.9. These factors are an essential part of this study as they are used in the methodologies of the different approaches, thereby ultimately contributing to the ranks/priorities assigned to the export potential values. Throughout this literature review, reference has also been made to South Africa (where applicable), as the empirical study will be carried out based on South Africa's export potential values.

The following chapter will explain the research methods of the gravity, ITC and DSM approaches. The characteristics of the data used in each method to estimate the export potential values of South Africa's top exported manufactured goods, will also be examined. Lastly, the tests used to compare the ranks of the estimated export potential values, such as the Spearman rank-order correlation test, will be explained.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter identified and explained the determinants of exports. It also provided a literature overview on the importance of exports, export promotion and international market selection.

The literature forms the basis of this chapter as it explains the methodologies of the respective approaches and data used in the estimation of export potential values. All the methods differ in their aims and approaches, however, all three estimate export potential values. Hence, the same concept is measured and a comparison can provide valuable insights into contributing to international market selection in general, and the application of each of the three methods specifically. In order to compare the ranks of the export potential values assigned by the gravity, ITC and DSM models, the correlation and frequency tests that are conducted in this study, are explained.

3.2 Product selection

As mentioned in Chapter 1, the National Treasury (2019:13) of South Africa acknowledged the strong competitive advantage of high-value exports of the manufacturing sector. Furthermore, the main aim of the DTI, as highlighted in the INES, is to double manufacturing exports by 2030 (Oliveira, 2017). By doing so, numerous employment opportunities can be created, which can ultimately enhance economic growth (Kotabe & Czinkota, 1992:638).

It is, however, necessary to select only a few manufactured goods for the purposes of this study as the gravity approach involves a different panel regression analysis for each product. For the product selection in this study, Sandrey's (2014:2) adaption of the definition of manufactured goods is applied. Sandrey (2014:2) defines such products as "being those excluding agriculture (as defined by the WTO Agreement on Agriculture), clothing as defined by HS Chapters 61, 62 and 63 and the mineral fuels, ores and precious metal and stone of HS Chapter 25, 26, 27 and 71." However, for this study, clothing is included as Sandrey (2014:2) acknowledges that it is a significantly important subset of manufactured goods for Africa. A selection of 15 of South Africa's main exported manufactured goods of 2015 is therefore used in this study, based on the above definition.[1] A list of these products, along with detailed product descriptions, can be found in Annexure 1.

1. Only those products with enough data and significant coefficients in the gravity model were included in the top 15 exported manufactured products. As a rule of thumb for this study, products must have had at least one significant supply or demand capacity variable and one significant trade cost variable to qualify. See Table 3-1 for a list or variables used in the gravity model.

Furthermore, the top 50 South African export destinations for each product are included in the analysis.[2] Various sources with trade statistics, as discussed in the following sections, are used to obtain the necessary data for all three approaches. Therefore, secondary data are used throughout the study. All export potential values of the three approaches have been estimated for 2015, based on data availability and comparability (see Annexure 2).

The methodology, variables, data and limitations of each of the approaches are discussed next.

3.3 Gravity model

Jan Tinbergen (1962) and Pentti Pöyhönen (1963) initiated the concept of using Newton's law of universal gravitation in order to explain bilateral trade flows. The main idea behind the gravity model is that bilateral trade flows between importing and exporting countries are determined based on the attraction and resistance between countries (Jordaan, 2015:355-356; Simwaka, 2006:6; among others). Potential trade flows are, therefore, analysed by means of two core factors, namely the size of countries and the distance between them. First, countries that have larger economies will have larger trade flows between them, thereby making it more attractive to trade with each other. Secondly, as mentioned in section 2.3.7 variables such as transport costs and transport time lead to trade resistance between countries. This is due to the fact that greater distances will result in higher transport costs and longer transport time (Breytenbach & Jordaan, 2010:5). The basic equation of the gravity model is, therefore, as follows:

$$T_{ij} = \beta_0 \frac{GDP_i^{\beta_1} GDP_j^{\beta_2}}{DIST_{ij}^{\beta_3}} \quad (1)$$

T_{ij} is considered to be the bilateral trade between the countries *i* and *j*, GDP_i and GDP_j signify countries *i* and *j*'s economic size and $DIST_{ij}$ signifies the distance between the countries in question. Furthermore, β_0 is the constant, while β_1, β_2 and β_3 represent the coefficients for each variable derived from an OLS analysis (Braha *et al.,* 2017:6).

However, the gravity model is not flawless. One of the criticisms against the gravity model is that it can cause bias estimates when the observations of countries with zero trade between them are disregarded (Helpman *et al*., 2007:2). It has also been argued that bias estimates can occur due to the standard specifications of the gravity equation imposing symmetry, which is inconsistent with the data (Helpman *et al*., 2007:2). Furthermore, Ciuriak and Kinjo (2006:189) state that the gravity model does not consider comparative advantage, which can affect policy recommendations such as the identification of markets for export promotion activities. Also, being based on both a Heckscher-Ohlin and increasing returns model, some is of the opinion that

2. A limited number of countries with missing values in the gravity and ITC approaches were omitted, as export potential values could not be calculated for them.

economies of scale is not taken into consideration (Helpman, 1999:139; Sohn, 2005:417; Kabir & Salim, 2010:155). Additionally, as mentioned in section 2.3.7, the WTO (2018:64) has established that the relevance of distance might be fading away due to globalisation and the use of digital technologies. The gravity model therefore fails to capture the effects of globalisation on international trade (WTO, 2012:45). A criticism with particular relevance to this study, has been indicated by Decreux and Spies (2016:4). They argue that estimating export potential values based on detailed product level data can be "computationally burdensome" as a vast number of coefficients and equations must be estimated. Moreover, most variables used in the gravity model is on country level, which makes product-specific analysis challenging. Nevertheless, as stated by Jordaan (2015:355), a gravity model can provide valuable insights into the relationship between the direction and the volume of bilateral trade.

At first, the gravity model was only applied on either time-series data or cross-sectional data (Breytenbach & Jordaan, 2010:25). Over time, it has, however, been adapted for panel analysis, which is used in this study. Panel data refer to a pooled model which incorporates cross-sectional data and time-series data (Breytenbach & Jordaan, 2010:25).

Panel data are beneficial in that (i) it allows for heterogeneity to take place; (ii) it can identify and measure effects that cannot be detected by time-series data or cross-sectional data, thereby allowing data to be more efficient; (iii) it allows for more degrees of freedom; and (iv) data delivered by panel data provide more variability, information and have less collinearity among the determinants (Baltagi, 2005:4-7). Conversely, panel data have limitations that include problems regarding design and data collection, such as coverage, non-responsiveness and dependence on cross-sectional data (Baltagi, 2005:4-7).

As panel data provides the possibility to allow for individual effects, either a random effects model or a fixed effects model must be used. The random effects model is usually better suited for the estimation of trade flows between arbitrarily drawn samples from a large population of trading partners (Breytenbach & Jordaan, 2010:25; Egger, 2000:2; Martinez-Zarzoso & Nowak-Lehmann, 2003:299). This model, however, captures all unobserved characteristics of the data, which are not captured in the explanatory variables, in the error term. Therefore, there may be correlation between the explanatory variables and the error term, which translates to endogeneity (WTO, 2012:124). Endogeneity is a violation of the OLS assumption of orthogonality between an error term and explanatory variables, and can, therefore, lead to significant bias in the estimation results (Shephard, 2016:30,46). This problem can be addressed by the fixed effects model.

The fixed effects model is usually more suitable for the estimation of trade flows between predetermined trading partners, based on forecasted trade statistics (Breytenbach & Jordaan,

2010:25; Egger, 2000:2). It allows for fixed estimates of individual-specific unobserved variables correlated with observed variables (Breytenbach & Jordaan, 2010:27; Egger, 2000:5). However, time-invariant variables, such as distance or being a landlocked country, cannot be included in the fixed effects model (Breytenbach & Jordaan, 2010:25; WTO, 2012:108). This is due to the fact that it causes multicollinearity between the independent variables (WTO, 2012:108).

The test of overidentifying restrictions, similar to the Hausman Test, is used to establish which model is suitable for the data (Polat & Yeşilyaprak, 2017:18). With this test, the random effects model is preferred if the null hypothesis (the error term is uncorrelated with the regressors) is not rejected. Conversely, if the null hypothesis is rejected, the fixed effects model is preferred (Park, 2011:13).

However, a gravity equation must first be estimated in order to calculate export potential values. Since the gravity equation (see Equation 1) is not in a linear form, a log-log model is necessary. Therefore, the dependent and independent variables (excluding dummy variables) take a log form. The basic log-log form of a gravity equation (as derived from Equation 1) is as follows:

$$ln(F_{ij}) = \beta_0 + \beta_1 ln(M_i) + \beta_2 ln(M_j) - \beta_3 ln(D_{ij}) + \varepsilon_{ij} \quad (2)$$

where

i signifies the exporter (South Africa);

j represents the importer;

F_{ij} is the dependent variable and considered to be the bilateral trade between the countries *i* and *j*;

M_i and M_j are the size (GDP) of the economies of countries *i* and *j*'s (the supply and demand capacities);

D_{ij} embodies the distance between the countries in question;

β_0 is the constant, while β_1, β_2 and β_3 represent coefficients of the independent variables; and

ε_{ij} is the error term.

By using the specified supply and demand, as well as trade time and cost determinants (as identified in the literature in Chapter 2), the primary gravity equation used for estimating the export potential values for each of the 15 South African exported manufactured goods in this study is as follows[3]:

3. The LPI, as a proxy for trade facilitation, was significant for only two products and was, therefore, only included in HS 330499 and HS 842139. Instead of trade facilitation, only the costs to import was taken into consideration for the other products, since weak trade facilitation, such as infrastructure and border administration, will ultimately increase the costs associated with importing and exporting goods and services (see section 2.3.8).

$$ln(tradeflow_{ijt}) = \beta_0 + \beta_1 ln(imports_d_{jt}) + \beta_2 ln(exports_o_{it}) - \beta_3 ln(distw_{ij}) + \beta_4(contig_{ij}) + \beta_5(comlang_off_{ij}) + \beta_6(colony_{ij}) + \beta_7(FTA_{ij}) - \beta_8(landlocked_{ij}) \pm \beta_9 ln(exchange_rate_o_d_{ijt}) - \beta_{10} ln(cost_d_{it}) + \varepsilon_{ij} \quad (3)$$

For each of the 15 products, a separate gravity equation is estimated over different destination countries, with South Africa as the exporting country. It should be noted that instead of using the traditional GDP of the importer and the exporter in this study, South Africa's total exports of each product to the world serves as a proxy for the supply capacity, while the destination countries' total imports from the world serves as the demand capacity.[4] This is due to the fact that this study focuses on specific products and not on total trade as it specifically sets out to compare export potential values on a product-country basis.

Furthermore, the 15 gravity datasets each contain data from 2007 to 2015. This is due to the data of the LPI only being available from 2007 onwards, while the method of collection for the cost data from the World Bank Doing Business report changed after 2015. Therefore, if data for the years before 2007 or after 2015 were used, it would have led to inconsistent and incomparable results.

The following table provides a summary of the descriptions and literature behind the variables included in the gravity equation for estimating the export potential values for each product-country combination. The table also provides the sources that were used to collect the data for the respective variables.

Table 3-1: Summary of variables used in the gravity model

Variable	Description	Proxy	Expected sign	Data source
$tradeflow_{ijt}$	Exports of 15 of South Africa's main manufactured products in US$ thousands from South Africa to country *j*	Dependent variable	N/A	UN Comtrade (Wits, 2019a)
$Imports_d_{jt}$	Total imports in US$ thousands in the destination country from the world	Total demand capacity for the specified products in the destination country	+	UN Comtrade (Wits, 2019a)

4. Five products' import and export values were, however, not significant, and the importer and exporter's GDPs (extracted from the World Bank) were used instead. These products are: HS 290129 (unsaturated acyclic hydrocarbons), HS 720241 (ferro-silico-manganese in granular/powder form), HS 732690 (articles of iron/steel), HS 870410 (dumpers designed for off-highway use) and HS 880330 (parts of aeroplanes/helicopters).

Variable	Description	Proxy	Expected sign	Data source
exports_o$_{it}$	Total exports in US$ thousands from the origin country (South Africa) to the world	South Africa's total supply capacity	+	UN Comtrade (Wits, 2019a)
Distw$_{ij}$	Weighted distance from South Africa to country *j*	Trade cost (transportation cost)	-	CEPII (2019a)
Contig$_{ij}$	Dummy for the common border between South Africa and country *j*	Trade costs (transportation costs)	+	CEPII (2019a)
comlang_off$_{ij}$	Dummy for the common language shared between South Africa and country *j*	Trade costs (search/information costs)	+	CEPII (2019a)
Colony$_{ij}$	Dummy for the shared colonial history between South Africa and country *j*	Trade costs (search/information costs)	+	CEPII (2019a)
FTA$_{ij}$	Dummy for any free trade agreements or shared customs unions between South Africa and country *j*	Trade costs (tariff barriers)	+	CEPII (2019a)
landlocked$_{ij}$	Dummy for landlocked countries	Trade costs (transportation costs)	-	CEPII (2019a)
exchange_rate_o_d$_{ijt}$	Exchange rate between South African Rand and the currency of country *j,* expressed in Rand	Exchange rate risk	±	The World Bank (2019a)
cost_d$_{it}$	Total costs to import in the destination country per container in US$	Trade costs	-	The World Bank (2019b) Doing Business Report

Source: Researcher's own compilation.

The following section includes a more detailed description of the variables in Table 3-1 and data sources.

3.3.1 Description of variables and data sources

A description of the various data sources used to obtain data for the variables of the gravity model follows.

3.3.1.1 Trade flow, supply and demand capacities

As mentioned, the dependent variable ($tradeflow_{ijt}$) reflects the exports of each of the 15 South African manufactured products to its top 50 destination countries. The first two independent variables represent the total number of South African exports of the product to the world ($imports_d_{jt}$) and the total number of imports of the product in the destination countries from the world ($exports_o_{it}$) respectively. These independent variables act as the size measures of the typical gravity equation (see section 2.3.1). Each destination country's total number of imports of the product ($imports_d_{jt}$) captures the total size of the import demand for the product in each destination country. On the other hand, South Africa's total number of exports of the product ($export_o_{it}$) takes South Africa's export supply into consideration.

The data for the dependent variable, as well as the two independent variables for size, were obtained from the UN Comtrade database. This database consists of merchandise trade exports and imports on a detailed product and country level for more than 170 countries (WITS, 2019b). In this study, the data were collected for each year from 2007 to 2015 for all the destination countries.

3.3.1.2 Trade costs

Data for the trade costs variables were extracted from two sources, namely the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII) and the World Bank.

3.3.1.2.1 CEPII geographical trade cost dataset

The data for distance, common borders, language and colonial history, landlocked countries, as well as free trade agreements, were obtained from the *GeoDist* dataset on CEPII, which contains data for 225 countries. The sources used by CEPII in order to build the *GeoDist* database mainly include the CIA World Factbook and the Correlates of War Project (Mayer & Zignago, 2011:8).

The distance between South Africa and each destination country ($distw_{ij}$) was based on weighted distance. This means that city-level data were used to evaluate the geographical distribution of

the population in each nation. The bilateral distances between the largest cities of the two countries in question were, therefore, estimated, with the inter-city distances being weighted by the share that the city had in the overall country's population. Therefore, a generalised mean of the city-to-city bilateral distances were used to establish the weighted distance between two countries (Mayer & Zignago, 2011:10). As mentioned in section 2.3.7, globalisation has reduced the effect and relevance of distance on international trade, however, it is expected that greater distance results in higher trade costs due to increased transport costs and time. Intermodal transport is also usually associated with greater distances (Marimoutou *et al*., 2009:1140).

Furthermore, the variables for common border ($contig_{ij}$), common language ($comlang_off_{ij}$) and colonial history ($colony_{ij}$) are dummies, indicating whether South Africa shares a border, language or colonial history with the destination country in question (1) or not (0). As mentioned in sections 2.3.7 and 2.3.9, a common border, language or colonial history is expected to increase trade mainly due to search and information costs being lower (De Sousa & Lochard, 2012:422; Fejzić & Čovrk, 2016:79; Rahman & Ara, 2010:137). Shared borders usually mean integrated networks, which reduces transhipments, and countries with a common border typically have agreements regarding customs and transit, thereby reducing export time and costs (Limão & Venables, 2001:453-454). On the other hand, a common language can assist in exchanging crucial information faster and enabling a swifter negotiation of prices (Reuben *et al.,* 2014:138). Similarly, a colonial history between countries most likely mean that the countries in question know more about each other and understand the other's rule of law, business practices, competitiveness and delivery reliability better (Rose, 1999:17; WTO, 2012:106).

The landlocked variable is also a dummy which either indicates that the destination country is landlocked (1) or not (0). Landlocked countries experience higher transport costs and information costs, as well as a longer time to export or import goods (Christ & Ferrantino, 2011:1749; WTO, 2012:106) (see section 2.3.7). Finally, the data for free trade agreements are used to indicate whether or not South Africa and the destination country have an agreement regarding the free trade of goods. From the theory in section 2.3.5, it is clear that trade agreements are intended to reduce trade barriers between countries, thereby improving the probability of exporting/importing higher trade volumes (Ashby *et al*., 2016:96). Moreover, the reduced tariffs associated with trade agreements result in reduced trade costs (Pomfret & Sourdin, 2009:265; Woei *et al*., 2018:72,76).

3.3.1.2.2 The World Bank's costs to import data

The data for the costs (per container in US$) to import for each destination country included in the analyses was obtained from The World Bank Doing Business reports. It provides quantitative indicators on the regulations of businesses and the enforcement thereof, and can be compared

across 190 countries over time (The World Bank, 2019c). In addition, Doing Business considers 11 areas affecting business, which includes starting a business, handling construction permits, obtaining electricity, registering property, obtaining credit, tax payments, trading across borders, protecting minority investors, enforcing contracts, resolving insolvency and labour market regulations (The World Bank, 2014:22). The costs (excluding tariffs) to import containerised cargo forms part of the trading across borders section. The indicators used to measure the costs to import include documentation requirements, port and terminal handling, procedures at customs and logistical aspects, such as inland transit between the largest capital city and the main port used by traders (The World Bank, 2014:105).

3.3.1.2.3 Exchange rates

The World Development Indicators (WDI) of the World Bank provided the data for the exchange rates used in this study. The WDI consists of the most accurate and current global development data, as compiled from various acknowledged international sources (The World Bank, 2019d).

In the case of exchange rates, data were obtained from the IMF and International Financial Statistics. Furthermore, the WDI captures annual data for 217 countries and has data available from 1960 (The World Bank, 2019d). Exchange rates are determined by the World Bank as an annual average based on monthly averages and are expressed in USA Dollars (The World Bank, 2019e). For this study, the exchange rates obtained from the World Bank were converted to and expressed in South African Rand.

The ITC's approach for estimating export potential values follows.

3.4 Export Potential Map of the International Trade Centre[5]

With the aim of increasing transparency when investigating export markets, sectors and/or products, the ITC developed the Export Potential Map in 2016, which is an online tool that enables trade advisors, policymakers and private companies to assess the export potential of existing products, based on detailed market access and trade information (Decreux & Spies, 2016:2; ITC, 2019a). The tool consists of two indicators, namely the export potential indicator (EPI) and the product diversification indicator (PDI). In short, the EPI provides information on the export potential for established export products to existing and/or new markets, while the PDI provides information on new export products that face favourable demand conditions in either existing or new markets (Decreux & Spies, 2016:2). For the purpose of this study, only data captured by the EPI[6] is used.

5. This section relies heavily on Decreux and Spies (2016), who wrote the methodology of the Export Potential Map on behalf of the ITC.
6. Any exporter-product combination is considered to have export potential if it either has a total export potential value of US$ 200 000 or more to the world, or if it is partially covered by the 95% cumulative export potential of products which is ranked for the exporting country in descending order. If a product is below the specified threshold, it is seen as currently having inadequate export potential (Decreux & Spies, 2016:6).

The Export Potential Assessment of the ITC have a number of limitations. First, export potential assessments abstain from reporting any potential dollar value that may be related to identified diversification opportunities and, therefore, only within-market ranks of products are provided. This is due to the fact that the PDI is based on the descriptive and outcome-based principle of product space, while the EPI is based on a structural decomposition of trade into supply, demand and bilateral linkages (Decreux & Spies, 2016:3). Furthermore, there are several, mostly intangible, aspects that are not considered by the Export Potential Map. These aspects may have an influence on the feasibility of exporting more of certain products. Examples of these aspects include the presence of synergic development plans or sector strategies, opportunities of branding and marketing, as well as the opportunity and willingness to entice foreign direct investments (Decreux & Spies, 2016:3-4). Moreover, the costs related to export promotion activities are not considered in the Export Potential Map, which may also influence the feasibility of exporting products. The ITC also recommends that trade advisors look at the results of the Export Potential Map with a critical eye and follow up with additional consultations with the relative stakeholders and desk research, as it is difficult to capture most social, developmental and environmental aspects with quantitative trade data (Decreux & Spies, 2016:3-4). This recommendation is, however, applicable when using any of the three approaches to estimate export potential values.

As mentioned, the EPI is built on a structural model that estimates export potential values from demand conditions in the importing country, supply capacities in the exporting country and bilateral connections between them. As mentioned, the gravity model can be computationally burdensome when export potential values are estimated on an HS 6-level. The ITC, therefore, used the gravity model as inspiration to develop the EPI, which can be specified on an HS 6-digit level. It resembles an empirical specification that takes into account the exporter and the product, the importer and the product, as well as the fixed effects of the exporting and importing country. The basic theoretical equation is as follows (Decreux & Spies, 2016:6):

$$v_{ijk} = \alpha_{ik}\beta_{ij}y_{jk} \quad (4)$$

where

v_{ijk} represents the exports of product *k* from exporter *i* to importer *j*;

α_{ik} is a parameter describing the performance of exporter *i* in exporting product *k* (supply);

β_{ij} reflects the easiness to export any product from *i* to *j* (easiness to trade); and

y_{jk} corresponds to the demand of importer *j* for product *k* (demand).

Sections 3.4.1 to 3.4.3 describe the methodology of the supply, easiness to trade and demand components of the equation. The methodology of the supply side of Equation 4 is discussed next.

3.4.1 Supply

A dynamic adaption of the exporter's market share in the target country forms the basis of the supply side, which is modified for some of the elements that interfere with the measurement of true export performance. The equation is as follows (Decreux & Spies, 2016:7):

$$Supply_{ik}^{EP} = Projected\ MS_{ik} \times TB_{ik} \times GTA_{ik} \quad (5)$$

The respective components are discussed below.

3.4.1.1 Augmented exporter's capacity (projected MS_{ik})

Projected MS_{ik} accounts for the augmentation of the exporter's capacity to export due to economic growth. The expected growth in GDP is calculated for five years with the most recent year used as the starting point[7]. It can be formulated as follows (Decreux & Spies, 2016:7):

$$Projected\ MS_{ik} = \frac{v_{ik} \times \Delta GDP_i}{\sum_i (v_{ik} \times \Delta GDP_i)} \quad (6)$$

with

v_{ik} representing country *i*'s exports of product *k*.

GDP growth projections from 2017 to 2023 were obtained from the World Economic Outlook (WEO) database of the IMF (ITC, 2019c). If the data are incomplete or unavailable for a country, projections are only made for the following two years (IMF, 2019a). Furthermore, projections are estimated by means of a "bottom-up" approach, which means that they are generated for individual countries and then accumulated. A series of repetitions then allow for the aggregates to be fed back into the forecasts of the individual countries and these forecasts merge for the final projections (IMF, 2019b).

3.4.1.2 Export-import ratio (TB_{ik})

The export-import ratio is measured by this component and is formulated as follows (Decreux & Spies, 2016:7):

7. ΔGDP_i is calculated as the ratio of country *i*'s expected GDP over the current GDP.

$$TB_{ik} = \min\left(1, \frac{x_{ik}}{m_{ik}}\right) \quad (7)$$

Export potential values are often used as guidance to select products/sectors with an extensive production base in a country for export promotion activities. Comparative advantage often has asignificant influence on the trade balance, which can be measured by the revealed comparative advantage (RCA) of a country. However, as re-exporting is usually included in declared exports and, therefore, has no influence on the production capacity of a country in producing the goods, RCA has been corrected by the ratio at which exports are exceeded by imports. In essence, a product is downgraded if it seems to be competitively exported by a country, even though the trade balance of that country is negative. The opposite, however, is not true (and the correction factor is not applied), meaning that if exports are higher than imports, the product will not be upgraded (Decreux & Spies, 2016:7-8).

3.4.1.3 Global margin of preference (GTA_{ik})

GTA_{ik} signifies the global margin of preference a country faces when it exports product *k* and is formulated as follows (Decreux & Spies, 2016:8)[8]:

$$GTA_{ik} = \left(\frac{1 + av.\ tariff_{ik}}{1 + av.\ tariff_{k}}\right)^{\sigma_k} \quad (8)$$

The numerator is calculated as the weighted average tariff applied to product *k,* with the weights being the imports of product *k* into market *j,* supplied by exporter *i.* On the other hand, the denominator resembles the weighted average tariff charged on market *i*'s exports of product *k.* A tariff advantage for market *i* occurs when the numerator is larger than the denominator, with the decrease in the market share of product *k* being higher if the advantage is higher. Furthermore, the sensitivity of trade to prices, measured by σ_k , influences the effect of tariffs. The substitution elasticity between suppliers of product *k* is, therefore, represented by $\sigma_k > 0$.

3.4.2. Easiness to trade

This component is based on the actual trade of products with potential between importer *j* and exporter *i* relative to the hypothetical trade if exporter *i*'s share in world markets and in market *j* are the same. It is expressed as follows (Decreux & Spies, 2016:9):

$$Easiness_{ij} = \frac{v_{ij}}{\sum_k \left(Supply_{ik}^{EP,Static} \times Demand_{ijk}^{Static}\right)} \quad (9)$$

8. The calculation of average tariffs does not include any tariff above 80% It has been established that tariff peaks related to large trade flows usually do not resemble the actual applied tariff, which could, therefore, result in wrong inference regarding actual supply capacities. The removed tariffs represented 0.213% of the entire sample (Decreux & Spies, 2016:8).

On average, exporter *i* will find it easier to trade with market *j* than it will with world markets when $Easiness_{ij} > 0$. This can be due to the two countries sharing the same language or culture, being located close to each other or the countries having a business history. This will ultimately enlarge exporter *i*'s trade potential with market *j*, irrespective of the product. Conversely, exporter *i* will most likely find trade with market *j* more difficult if $Easiness_{ij} < 0$, thereby lowering potential trade (Decreux & Spies, 2016:8).

3.4.3 Demand

The demand side is measured by combining projected import values along with factors related to the target market's openness to products imported from the exporting country. It is formulated as follows (Decreux & Spies, 2016:8):

$$Demand_{ijk} = Projected\ M_{jk} \times MTA_{ijk} \times Distance\ factor_{ijk} \quad (10)$$

The respective components are discussed below.

3.4.3.1 Projected imports (M_{jk})

Current imports, amplified by the expected growth of GDP per capita[9] and expected growth in population (with a unitary elasticity), is the basis of projected imports. As the population grows, demand for all goods increases, however, demand for superior goods will increase even more when it is expected that GDP per capita will grow. Projected M_{jk} is expressed as follows (Decreux & Spies, 2016:8):

$$Projected\ M_{jk} = y_{jk} \times \left(\frac{\Delta GDP_j}{\Delta Pop_j}\right)^{E_{M_{dc},GDP_j}} \times \Delta Pop_j \quad (11)$$

with

y_{jk} signifying country *j*'s imports of product *k*; and

E_{M_{dc},GDP_j} representing the revenue-elasticity of import demand per capita, which is calculated individually by development level *d* and HS 2-digit chapter *c* (Decreux & Spies, 2016:9).

The ILOStat database was used to acquire data for population projections from 2017 to 2023, as it is currently the world's largest source of internationally comparable global, national and regional estimates of key labour indicators (ILO, 2019a; ITC, 2019c). The UN World Population Prospects forms the basis of the International Labour Organisation's (ILO) modelled estimates, which

9. Data for GDP per capita growth projections were obtained from the IMF's World Economic Outlook database. See section 3.4.1.1.

provides projections and estimates of the total population by means of five-ear age groups. All the data for these methods are obtained from administrative sources, household surveys, official estimates, national accounts and establishment surveys (ILO, 2019b).

3.4.3.2 Exporter's margin of preference (MTA_{ijk})

The margin of preference which the exporter has in the importing country is captured by the MTA_{ijk}. It is formulated as follows (Decreux & Spies, 2016:9):

$$MTA_{ijk} = \left(\frac{1 + ad.\ tariff_{jk}}{1 + ad.\ tariff_{ijk}}\right)^{\sigma_k} \quad (12)$$

The exporting country will enjoy a tariff advantage in the importing country if the tariffs applied to the exporter are lower than tariffs faced by other suppliers of product *k*. This is an indication of higher import potential. The extent thereof is dependent on the price sensitivity of trade, which is represented by σ_k (Decreux & Spies, 2016:9).[10]

The Market Access Map of the ITC is used to obtain data for ad-valorem tariffs as it gives a full overview of all the trade protection policies in the world (ITC, 2019c; ITC, 2019d). Data are acquired from key institutions such as Foreign Affairs, Finance and Trade Ministries, legislative bodies, regional institutions, revenue authorities, tax directions, customs services and permanent missions to the WTO and the UN. Customs duties are extracted and then cleared, formatted and compiled before being made available by the Market Access Map (ITC, 2019d).

3.4.3.3 Distance advantage indicator (distance $factor_{ijk}$)

The product-specific distance advantage indicator is expressed as (Decreux & Spies, 2016:9):

$$Distance\ factor_{ijk} = e^{-|av.\ log\ distance_{jk} - log\ distance_{ij}|} \quad (13)$$

It compares the distance from the importing country to the exporting country with the distance between the importer and the other suppliers of product *k*. The best products to export to certain markets can be identified by the information captured in the average distance faced when a product is traded. As an example, an exporter located close to an importer will favour goods where there is a high sensitivity of trade to distance, such as perishable goods. The average distance to trade such products will, therefore, be shorter. Conversely, the average distance to trade durable goods will be longer. Therefore, the lower the absolute difference between the average distance and the exporter's distance to the importing country, the higher the export potential for exporter *i* will be to export product *k* to importer *j* (Decreux & Spies, 2016:9).[11]

10. Outliers was removed, as discussed in Footnote 8.
11. Data for distances were obtained from the CEPII database. See section 3.3.1.2.1 for the discussion thereof.

3.4.4 Final calculation of export potential values

Finally, by combining the supply, easiness to trade and demand components, as discussed in sections 3.4.1 to 3.4.3, export potential values can be estimated with the following formula, as derived from Equation 4 (Decreux & Spies, 2016:10):

$$EP_{ijk} = Supply_{ik}^{EP} \times Easiness_{ij} \times Demand_{ijk} \quad (14)$$

It should be noted that, for the purposes of this study, the export potential values were obtained from the online Export Potential Map tool of the ITC. The data coverage is discussed next.

3.4.5 Data coverage

The ITC used trade data, obtained from UNCTAD, to compile the Export Potential Indicators (EPI) for 222 countries and regions on an HS 6-digit level. Certain products, however, are not included as they are either not compatible with international conventions, have a significant dependence on natural resources or are not consistent with the work programme of the ITC. Furthermore, to ensure consistency across countries and years regarding revision changes made to the HS, product groups have been introduced that contain all the goods that have ever been classified under a redefined HS code. This rule has one exception, namely that product groups which are spread across different HS 2 chapters, have been split into subgroups in order to ensure that each group “fits” in a single chapter. As manual checks have revealed that trade misallocations are insignificant in such cases, the Export Potential Map ultimately includes4 034 products on an HS 6-digit level, instead of 5 205 HS 6 products, which comprises the HS 2012 revision (Decreux & Spies, 2016:14).

To ensure that misreported data (“false positives”) does not impact the robustness of results, a set of different measures is used. First, the sum of imports and exports over a period of the most recent five years is used to calculate indicators, thereby neutralising any bad data reports in single years (Decreux & Spies, 2016:14).

Furthermore, products should have been exported in the past three years, while also imported over the past five years to be included. In addition, a repetitive reliability check is used to compare countries’ reports of imports and exports every year with those of trustworthy trade partners. Any reporters deemed to be unreliable are not included in the following iteration. This process repeats itself up to the point where a set of reliable reporters remains stable. Lastly, a geometric average of mirror and direct data is used, thereby mitigating the effect of any misreported trade (Decreux & Spies, 2016:14).

The methodology, limitations and data sources of the DSM approach are discussed in the following section.

3.5 Decision Support Model[12]

The DSM was initially developed by Cuyvers *et al*. (1995:173-186). It is based on the idea of Walvoord (1983:83), which, in principle, uses a screening process to evaluate international market opportunities. The purpose of developing the model was to assist export promotion organisations, with limited resources and many options for potential export opportunities to support, in identifying a selection of country-product combinations for which a certain country has realistic export potential (Viviers *et al*., 2014:10).

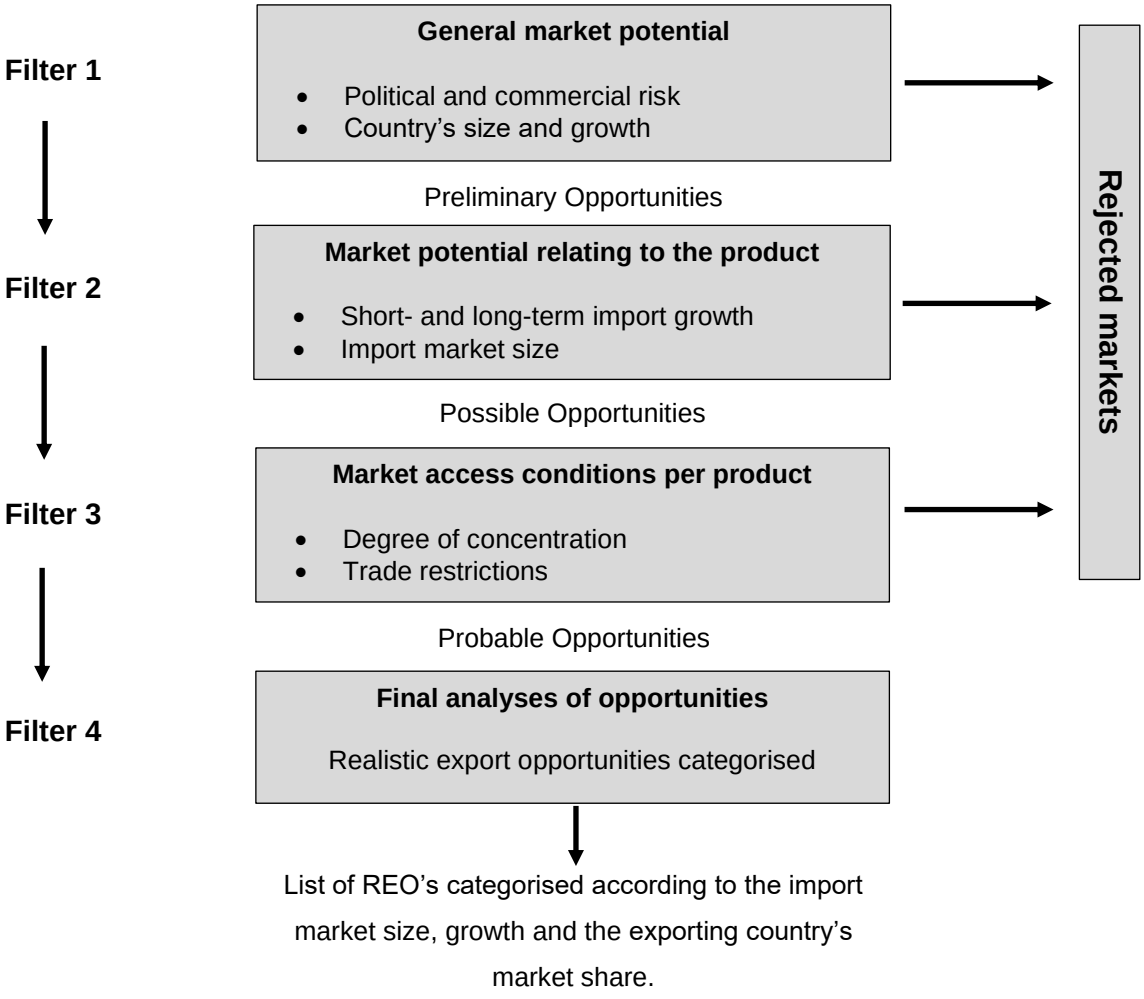
The DSM approach assumes, as a starting point, that all the markets in the world are potential markets for exporters and, hence, all markets should be included in the screening process (Cuyvers, 2004:256). It, therefore, evaluates all possible product and country combinations in the world, which are screened by using four consecutive "filters" in order to eliminate potentially unviable export opportunities. REOs are then categorised and prioritised for the exporting country and an export potential value are estimated for each of these REOs (Steenkamp, 2011:59; Viviers *et al*., 2014:10).[13]

Cuyvers *et al*. (1995:174), however, advise users of the DSM not to make decisions regarding export promotion activities solely based on the results of the model. Other factors should also be considered, such as feedback from export councils and foreign trade offices (Steenkamp, 2011:17). Governments can also support exports to a certain country due to political and diplomatic reasons, even if the DSM did not identify it as a REO. Furthermore, since the DSM is based on historical data and covers a five-year term, it can be argued that even though some of the current export activities are suboptimal according to the DSM, it could still be worthwhile to follow through with them in the longer run if these export decisions are based on other qualitative information (Cuyvers *et al*., 1995:174; Steenkamp, 2011:17).

Nevertheless, the DSM serves as a tool to support governments in export promotion decisions regarding the allocation of scarce resources (Cuyvers *et al*., 1995:174). Figure 3-1 offers a summary of the filters used in the DSM approach.

12. This section relies heavily on the methodology, as explained by Viviers *et al.* (2014:33-42).
13. For the purposes of this study, export potential values were only estimated with the gravity model and the Export Potential Map of the ITC for those countries that the DSM identified as having export potential.

Figure 3-1: Consecutive filters used in the DSM



Source: Cuyvers *et al*. (2012a:57).

As illustrated in Figure 3-1, the first filter of the DSM eliminates countries based on their political and/or commercial risk to the exporter (Filter 1.1) and whether or not countries indicate acceptable macro-economic size and growth (Filter 1.2). This filter, therefore, eliminates all countries that show a lack of potential on country level, thereby only allowing a limited set of product-country combinations to enter the, more detailed, following filters (Cuyvers *et al*., 2012a:56). Ultimately, small countries with high risk and inadequate general potential are eliminated in the first filter (Viviers *et al*., 2014:34).

In the second filter, the remaining product categories are assessed in order to identify which markets (in other words, product-country combinations) indicate sizable and growing import demand. The criteria used for this filter include import market size, short-term import growth and long-term import growth (Cuyvers *et al*., 1995:179). The selection criteria are based on specified shares of world imports and world averages in import growth per product (Cuyvers *et al*., 2017:8). Filter 2 is described in more detail in section 3.5.1.1.

If a product-country combination is selected based on its size and growth, it is not necessarily an indication that it would be easy to enter this market (Cuyvers *et al*., 1995:180). Therefore, the third filter analyses the remaining markets' accessibility by examining the degree of market concentration (Filter 3.1) and market entry barriers (Filter 3.2) (Viviers *et al*., 2014:33).

The degree of market concentration is measured by the Herfindahl-Hirshmann Index (HHI). As mentioned in section 2.3.4, an import market can be considered concentrated when only a few competitors have a substantial market share and thereby a strong competitive edge. Cuyvers *et al*. (1995:180) established that there is a negative relationship between market concentration and export performance. Market concentration is also considered less of a concern in a relatively large and growing market than in a non-growing market (Cuyvers *et al*., 1995:180). Therefore, different degrees of market concentration are allowed depending on the size and growth of import demand categorised in Filter 2 (Viviers *et al.,* 2014:39). More detail on Filter 3.1 follows in section 3.5.1.2.

The second part of the third filter considers barriers to market entry. Examples include import duties, NTBs, costs and time resulting from transit or import procedures. Since this information is time consuming to collect and update from each exporting country's point of view on such a large scale (the model considers all possible world-wide product-country combinations as a starting point and base cut-off values on the entire dataset), a proxy for "the revealed absence of trade barriers" was used in the original DSM developed by Cuyvers *et al.* (1995:181). It was argued that if neighbours with similar market structures, facing similar market access conditions, could enter a market successfully and establish a collective comparative advantage in a particular import market, the exporter in question should also not experience too many difficulties (Cuyvers *et al.*, 1995:181).

No markets are eliminated in the fourth and final filter. Instead, the REOs identified in the previous filters are categorised and prioritised. The exporter's market share in each product-country combination that entered the fourth filter is compared to the market shares of the six largest competitors.

This leads to the matrix presented in Table 3-2, where the REOs identified throughout the first three filters are categorised according to demand size and growth, as well as the relative market share that the exporter has in each of the markets in question (Viviers *et al*., 2014:41). The classification of the rows in Table 3-2 was obtained from the second filter, while the exporter's relative market share (as determined in the fourth filter) form the basis of the columns (Viviers *et al*., 2014:41).

Table 3-2: Final categorisation of REOs

	Market share of country *n* (filter 4)			
Size and growth of importing market	**Fairly small**	**Intermediately small**	**Intermediately large**	**Fairly large**
Large product market	Cell 1	Cell 6	Cell 11	Cell 16
Growing (short-term and long-term) product market	Cell 2	Cell 7	Cell 12	Cell 17
Large product market with short-term growth	Cell 3	Cell 8	Cell 13	Cell 18
Large product market with long-term growth	Cell 4	Cell 9	Cell 14	Cell 19
Large product market with short-term and long-term growth	Cell 5	Cell 10	Cell 15	Cell 20

Source: Cuyvers (2004:269).

From Table 3-2, it is clear that 20 unique kinds of markets are recognised. Every product-country combination that was selected to enter the fourth filter have been allocated to one of the unique cells (Cuyvers *et al*., 1995:182; Cuyvers, 2004:269). By doing so, export promotion organisations will know what the size and growth of the demand potential is in comparison to the exporting country's relative market share. This can help formulate export promotion strategies for REOs with similar characteristics. Cell 5 would, for instance, be an example of a large and growing market opportunity that the exporter has not yet used (Viviers, *et al.*, 2014:41). The export promotion strategy that Cuyvers, Viviers, Sithole-Pisa and Kühn (2012b:188-189) recommends for this kind of market, as an example, is an offensive strategy of "jumping the bandwagon". This may involve a combination of elements that will enable potential exporters to either enter the market in question or increase their presence in the market, including the distribution of market information, participation of potential exporters in high-profile trade missions, media campaigns in the target country, matchmaking with exporters of complementary products and inviting major importers or distributors in the target country for site visits (Cuyvers *et al*., 2012b:189).

The above description briefly explains the four filters of the DSM. However, all the filters were not applied for the purposes of this study. As the starting point of the DSM is to consider all possible worldwide product-country combinations, the original intention of Filter 1 was to eliminate, early in the process, small and stagnant countries posing high political/commercial risk. The purpose of Filter 1 was not necessarily to apply, as this study only focuses on specific products and countries for comparison to other methods.

Furthermore, the original Filter 3.2 is a proxy for "the absence of trade barriers". This filter can, however, not be applied in the case of South Africa since the country does not have many similar characteristics to its neighbours (Steenkamp, 2011). The export specialisation of South Africa's neighbours in a market can, therefore, not be used as a proxy for its market access. Later applications of the DSM for South Africa included an alternative analysis of trade barriers in Filter 3.2 (Steenkamp, 2011). Trade costs (including, among others, transportation, customs clearance and documentation costs, as well as tariffs) were collected for each potential worldwide market. As cut-off values are based on world averages and South Africa's transportation costs data are not readily available in an updated dataset, this would have involved an extensive and time-consuming data collection exercise. For the purposes of this study, in which the focus is on the potential value calculation for a selection of 15 products, an update of this filter was, therefore, not included. Moreover, the potential value calculation of the DSM did not include market access variables.

Lastly, Filter 4 involves a categorisation of REOs for export promotion purposes, which is not of specific interest to compare potential export values in this study. The categorisation in Filter 4, however, makes the DSM unique in its purpose to inform export promotion and help formulate export promotion strategies.

Therefore, Filters 2 and 3.1 were applied for the purposes of this study and are explained thoroughly in the following sections.

3.5.1 Explanation of filters applicable in this study

As mentioned, two filters of the DSM have been applied for the purposes of this study. The methodology of Filters 2 and 3.1 is, therefore, discussed more comprehensively in the following two sections.

3.5.1.1 Filter 2: The identification of probable opportunities

As mentioned, Filter 2 evaluates different countries' import demand on an HS 6-digit product level. This is done through an analysis of import size and growth (Viviers *et al*., 2014:33).

The second filter uses three indicators for the evaluation of import demand, namely short-term and long-term import growth, as well as import market size. First, short-term import growth is represented by the newest available simple annual import growth. On the other hand, the long-term import growth rate is the compounded annual percentage of import growth, which is calculated over a five-year period. Lastly, in order to calculate the import market size, the total number of imports of country *i* for product *j* as a share of the world's total imports of product *j* is

used (Cuyvers *et al*., 1995:178). Data was obtained from world trade database of CEPII-BACI.[14] CEPII reconciles FOB export values and CIF import values, with CIF costs excluded for every bilateral trade flow and, therefore, there is no difference in import and export figures for the same trade flow in this dataset (CEPII, 2019b).

Cut-off values for each of the indictors are determined by the RCA index, as developed by Balassa (1964). It is defined as follows:

$$RCA_{n,j} = \left(\frac{X_{n,j}}{X_{W,j}}\right) \div \left(\frac{X_{n,tot}}{X_{W,tot}}\right) \quad (15)$$

with

$X_{n,j}$ representing country *n*'s exports (in other words, the exporter in question) of product *j*;

$X_{W,j}$ reflecting product *j*'s worldwide exports;

$X_{n,tot}$ indicating country *n*'s total exports of all products; and

$X_{W,tot}$ is the worldwide exports of all product categories.

If the RCA index is near 0, country *n* is exporting a relatively small amount of product *j*. If the RCA index is equal to or larger than 1, country *n* is specialised in the exportation of product *j* (Cuyvers *et al*., 1995:179).

Regarding the cut-off points of the short-term and long-term import growth, a scaling factor S_j is introduced to ensure that the degree of specialisation that country *n* has in the export of product *j* is considered (Cuyvers, 2004:259-260). The scaling factor is defined as follows (Cuyvers, 2004:260):

$$S_j = 0.8 + \frac{1}{(RCA_j + 0.85)e^{(RCA_j - 0.01)}} \quad (16)$$

The cut-off values are, therefore, established as:

$$g_{i,j} \geq G_j \quad (17)$$

where

$g_{i,j}$ is product *j*'s import growth rate in country *i;* and

$G_j = g_{w,j}.S_j\,, if\ g_{w,j} \geq 0$; or $G_j = g_{w,j} \div S_j\,, if\ g_{w,j} < 0$;

14. See section 3.3.1.2.1.

with $g_{w,j}$ representing the total number of world imports of product *j* by country.

This process is applicable to short-term and long-term growth rates (Cuyvers, 2004:260). If a country meets the requirements for a specific product, as indicated in Table 3-3, it is allocated a "1". If a country does not meet the requirements, it is allocated a "0". An example of this allocation can be seen in Table 3-5.

Table 3-3: Cut-off values of short-term and long-term growth

	$0 \leq RCA_{n,j} < 1$ (The exporting country is not specialised in exporting product *j*)	**$RCA_{n,j} \geq 1$ (The exporting country is specialised in exporting product *j*)**
$g_{w,j} > 0$ The world's short-term or long-term growth rate is positive for product *j*	Country *i*'s short-term or long-term import growth rate of product *j* (g_{ij}) should be between one and two times the world growth rate for product *j*.	Country *i*'s short-term or long-term import growth rate of product *j* (g_{ij}) can be equal to, or a bit lower than the world growth rate for product *j*.
$g_{w,j} < 0$ The world's short-term or long-term growth rate is negative for profuct *j*	Country *i*'s short-term or long-term import growth rate of product *j* (g_{ij}) should be higher than the world growth rate for product *j*.	Country *i*'s short-term or long-term import growth rate of product *j* (g_{ij}) can be equal to, or a bit lower than the world growth rate of product *j*.

Source: Viviers *et al*. (2014:36).

Furthermore, if the following condition is true, country *i* has a large relative import market size for product *j* (Cuyvers, 2004:260):

$$Z_{i,j} \geq S_j \tag{18}$$

with

$Z_{i,j}$ reflecting country *i*'s total number of imports of product *j*; and

$$S_j = 0.02Z_{w,j}, if\ RCA_{n,j} \geq 1;\ or\ S_j = [(3 - RCA_{n,j})/100]Z_{w,j}, if\ RCA_{n,j} < 1$$

Once again, a "1" or "0" is allocated to each product-country combination, depending on whether or not the requirements, as indicated in Table 3-4, have been met (Viviers *et al*., 2014:37). Markets are then selected by means of their categorisation, as indicated in Table 3-5.

Table 3-4: Cut-off values of import market size

$0 \leq RCA_{n,j} < 1$ **(The exporting country is not specialised in exporting product *j*)**	$RCA_{n,j} \geq 1$ **(The exporting country is specialised in exporting product *j*)**
Country *i*'s imports of product *j* (Z_{ij}) should be between 2% and 3% of the total world imports of product *j*.	Country *i*'s imports of product j (Z_{ij}) should be equal to, or greater than 2% of the total world imports of product *j*.

Source: Viviers *et al*. (2014:37).

Table 3-5: Example of the categorisation of product-country combinations

Category	Short-term market growth	Long-term market growth	Relative market size
0	0	0	0
1	1	0	0
2	0	1	0
3	0	0	1
4	1	1	0
5	1	0	1
6	0	1	1
7	1	1	1

Source: Cuyvers (2004:261).

If a product-country combination falls under any category from three to seven, it will be selected as a sufficiently large and/or growing import market (Cuyvers, 2004:261). The selected countries will then enter Filter 3.1.

3.5.1.2 Filter 3.1: The degree of market concentration

A country selected based on its import size and growth is not necessarily an indication of easy market access (Cuyvers *et al*., 1995:180). It is also necessary to analyse the remaining markets' accessibility by examining the degree of market concentration. As indicated in section 2.3.4., a highly concentrated market is difficult to enter as only a few exporting countries have a substantial market share in the importing country, resulting in a strong competitive edge. In the DSM, the degree of market concentration is measured by the HHI, which is formulated as follows (Viviers *et al*., 2014:38):

$$HHI_{i,j} = \sum \left(\frac{Z_{k,i,j}}{Z_{tot,i,j}} \right)^2 \quad (19)$$

with

$Z_{k,i,j}$ representing country *i*'s imports of product *j* from country *k*; and

$Z_{tot,i,j}$ reflecting the total number of imports of product *j* into country *i*.

If the HHI is 1, it is an indication that there is only one international supplier of product *j* in the importing country, while an HHI closer to 0 is an indication that there are many international suppliers (in other words, lower market concentration in the importing country). Hence, an exporter will find it more difficult to enter a market if the HHI is fairly high (Cuyvers, 2004:261).

As mentioned in section 2.3.4, market concentration may be less of a concern in a relatively large and growing market than in a non-growing market (Cuyvers *et al*., 1995:180). The cut-off value for market concentration is, therefore, determined in such a way that it is reliant on the category of markets, as allocated in the second filter (see Table 3-5). Cut-off values are, therefore, defined as follows (Viviers *et al*., 2014:38):

$$h_k = HHI_{i,j} \tag{20}$$

where

h_k = 0.4 for the third category;

h_k = 0.5 for the fourth and sixth categories; and

h_k = 0.6 for the seventh category.

Therefore, in fairly large markets, the degree of market concentration may not be higher than 40% and in fairly large and growing markets, the level of market concentration may not exceed 50% In addition, no more than 60% of market concentration is allowed for fairly large markets that are growing in the short and the long term (Viviers *et al*., 2014:39).

3.5.2 Estimating export potential values

The original DSM did not include a calculation of export potential values as it is not the main aim of the model. It was, therefore, only introduced in later versions of the model in an attempt to rank the identified REOs in terms of the relative size of the markets.

Hence, export potential values are determined for each product-country combination that was identified as a REO. It is calculated as follows (Viviers *et al*., 2014:42):

$$Pot_exp_{i,j} = average\left(Z_{six1,i,j}, Z_{six2,i,j}, \ldots, Z_{six6,i,j}\right) \quad (21)$$

with

$Z_{six1,i,j}$ representing the imports of product *j* by country *i* from each of the exporter's top six competitors.

Export potential values are, therefore, estimated by taking the average market share of the top six competitors in each market. This allows for an indication of the relative size of export opportunities. It also corresponds with Filter 4, where the top six competitors' market shares are compared to that of the exporter.

This concludes the discussion of the methodology of the gravity, ITC and DSM approaches toward calculating export potential values. A short comparison and summary are given in the following section.

3.6 Summary and comparison of the gravity, ITC and DSM approaches

To summarise, the Export Potential Assessment of the ITC primarily sets out to measure export potential values and includes demand, supply and accessibility dimensions into these values. On the other hand, the gravity model's main purpose is to analyse the determinants of bilateral trade and the estimated gravity regression equation is often used to calculate potential export values.

Lastly, the DSM was specifically designed to crystallise, among all possible worldwide product-country combinations, those with realistic export potential for export promotion purposes of a particular country. Although the original DSM did not include a potential export value calculation, authors have added it in later versions/applications in order to rank the identified REOs. Furthermore, the DSM and gravity model run the export potential analysis from one exporting country's perspective at a time, while the approach of the ITC covers a wide range of exporters in the form of visualised illustrations of untapped export potential.

The DSM initially included all products in the analysis and one can distinguish afterwards which products the exporting country specialises in. Therefore, current export products are included, as well as products for diversification purposes. Conversely, the ITC has two different approaches for current export products and diversification products. The ITC, however, does not calculate potential values for diversification products since the calculation of export potential values include supply variables (current export values).

The following table provides a summary and comparison of the variables included in the gravity, ITC and DSM approaches.

Table 3-6: Comparison of variables included in the different methods

Variables / Indicators	Gravity**	ITC Export Potential Map	DSM
Import demand	GDP (size) of importer* (see section 3.3)[15]	Projected imports* (based on current import values per product, the GDP and population growth projections of the importing country) (see section 3.4.3.1).	Import size per product-country combination* Short-term import growth per product-country combination. Long-term import growth per product-country combination (see section 3.5.1.1).
Barriers to trade	Distance* Common border* Common language* Colonial history* Landlockedness* Trade agreements* Exchange rates* (see section 3.3.1.2.1 and 3.3.1.2.3)	Tariff (dis)advantage in total exports of the product* (see section 3.4.1.3).[16] Tariff (dis)advantage in the specific import market* (see section 3.4.3.2). Distance factor* (distance between exporter and importer compared to other suppliers of the product in the import market) (see section 3.4.3.3).[17]	Market concentration per product-country combination (HHI) (see section 3.5.1.2). Proxy for revealed absence of trade barriers (see section 3.5.). Some versions of the model included a trade cost analysis, which encompasses tariffs, transportation costs and logistical aspects (Steenkamp, 2011).
Export supply	GDP (size) of exporter* (see section 3.3)	Projected exports* (based on current export values per product and GDP growth projections) (see section 3.4.1.1). Export-import ratio* (see section 3.4.1.2).	After the filtering process, later versions of the model included a categorisation of the exporter's supply capacity: RCA/RTA indices (see Viviers *et al.* 2014).

*Used in export potential calculation.
**Note that most gravity variables are on country level

Source: Researcher's own compilation

15. In order to increase the product specificity in this study, the import- and export values of each product were used instead of GDP (see section 3.3). The import values therefore represent demand and the export values represent the supply capacity of the concerned countries.
16. The variables such as distance and the tariff (dis)advantage in the import market / export of the product also forms part of the calculation of import demand and export supply (see sections 3.4.3 and 3.4.1 respectively).
17. The ITC's easiness to trade ratio can have a positive value due to the exporting and importing country having a common language / culture, a business history or being located close to one another (see section 3.4.2).

From Table 3.6, it is clear that the methods differ in approach, however, all three can be used to calculate “potential export values”. The same concept is, therefore, measured and a comparison of estimated export potential values could provide valuable insights for all three methods. One would not expect these to be exactly the same in value, but it is of interest whether or not the relative ranking among product-country combinations are similar.

Therefore, in this study, the ranks of the potential export values emanating from the three approaches for 15 of South Africa’s main manufactured export products are compared.

3.7 Statistical comparison of the ranks assigned to product-country combinations

The statistical analysis for the comparison of the ranks assigned to the product-country combinations by the gravity, ITC and DSM approaches are carried out by means of three tests. These tests entail correlation distributions and frequency distributions, as well as a comparison of the ranks of each product’s top 10 countries, as assigned by each of the above approaches. The discussion of the respective tests follows.

3.7.1 Spearman rank-order correlation test

The Spearman rank-order correlation test is a nonparametric technique used to evaluate how the rankings of the results between two independent variables compare and correlate (Bon-Gang, 2018:19; Gauthier, 2001:359). Since the correlation test is a nonparametric technique, it is not affected by the population’s distribution. In addition, it is insensitive to outliers as it operates on the ranks of the data (Gauthier, 2001:359).After the estimated export potential values of the respective approaches have been ranked, the correlation coefficient (r_s) is calculated with the following formula (Touran & Suphot, 1997:300):[18]

$$r_s = \frac{\sum(U-\overline{U})(V-\overline{V})}{\sum(U-\overline{U})^2 \sum(V-\overline{V})^2} \quad (22)$$

with

U, V representing the ranks of variables X and Y respectively; and

$\overline{U}, \overline{V}$ indicating the means of variables X and Y respectively.

The correlation coefficient can take any value between -1 and 1. The closer r_s is to ± 1, the stronger the correlation between the ranks (Gauthier, 2001:359). For this study, a correlation of ± 0.7 is considered relatively high and a correlation lower than ± 0.5, relatively low. Therefore, a correlation between ± 0.5 and ± 0.7 is considered to be moderate for the purposes of this study.

18. Any tied ranks are replaced by average ranks (Touran & Suphot, 1997:300).

The Spearman rank-order correlation test is carried out first in order to get an overall idea of how the ranks assigned to the export potential values compare between the approaches. Moreover, the correlation test establishes whether there are relationships between the ranks assigned to the export potential values by the respective approaches.

For more in-depth comparisons of the ranks, further tests were conducted in this study. Frequency distributions were, therefore, compared for the different permutations of two approaches (see section 3.7.2). Moreover, a comparison was made of the ranks of every product's top 10 countries according to the three approaches (see section 3.7.3).

3.7.2 Comparison of frequency distributions

Frequency distributions of two approaches were compared for each product-country combination in order to do a more detailed comparison of the ranks assigned to the export potential values. The differences in ranks (X) between the estimated export potential values of every product-country combination of the two approaches were, therefore, categorised into units of five. The allocation of categories was as follows:

Category 0: $0 \leq X \leq |5|$; indicating that rankings differed minimally,

Category 1: $|5| < X \leq |10|$;

Category 2: $|10| < X \leq |15|$;

Category 3: $|15| < X \leq |20|$;

Category 4: $|20| < X \leq |25|$; and

Category 5: $X > |25|$, indicating that rankings differed substantially.

For example, Category 3 would apply if there were a difference of 19 places (or ranks) between the ITC and DSM approaches (or similarly, between the ITC and gravity approaches or DSM and gravity approaches) for the product-country combination *ki*.

The frequency distributions (in other words, how many product-country combinations fall into each category) provide a measure to determine how much the ranks of the export potential values differ between the three approaches. The lower the differences in ranks, the better the approaches' estimated export potential values compare.

3.7.3 Comparison of each product's top 10 countries

The top 10 country comparison of each product is the final technique/test used to compare the ranks of the export potential values estimated by the gravity, ITC and DSM approaches. This technique shows whether or not the three approaches identified more or less the same top 10 countries with the most export potential for each product.

First, every product's top 10 countries are determined under each approach. Thereafter, a comparison is drawn between the ranks of the identified top 10 countries emanating from the three approaches. The closer the ranks are, and the more countries included in all three approaches' top 10, the better the export potential values compare.

In conclusion, the above three correlation and frequency tests will be used to determine how the estimated export potential values and the ranks thereof compare. From the discussion in section 3.7, it is clear that the final conclusion regarding how the three approaches' export potential values compare will be based on different perspectives and levels of comparison. The following section will conclude this chapter.

3.8 Conclusion

Chapter 3 provided an in-depth explanation of the methodology of the gravity, ITC and DSM approaches and how export potential values were estimated/obtained. Moreover, it was indicated that, although the approaches and their estimated export potential values differed, a comparison of the allocated ranks could provide valuable insights for the respective models. Furthermore, the limitations, variables and data sources used by each approach were discussed. This description of the respective approaches' methodology and data will allow for a better understanding of the results in the next chapter.

In addition, the tests used to compare the estimated export potential values were explained. These include the Spearman rank-order correlation test, a comparison of frequency distributions and a comparison of the top 10 countries of each product. As the tests focus on different levels of comparison, a sound conclusion can be made regarding how the export potential values of the three approaches compare.

In the following chapter, the export potential values obtained from the respective approaches will be analysed. Thereafter, the results will be compared by using the abovementioned three correlation and frequency tests. By doing so, a conclusion can ultimately be made regarding the export potential values' comparability.

CHAPTER 4 RESULTS

4.1 Introduction

Chapter 3 provided a comprehensive explanation of the methods and data used in the gravity, ITC and DSM approaches. The tests used to compare the ranks/priorities assigned to the estimated export potential values were also explained in depth.

In this chapter, the gravity, ITC and DSM approaches are applied to compare the results (rankings/priorities) of the respective export potential values. Section 4.2 will discuss the outcomes of this comparison.[19]

4.2 Comparison of the ranks assigned to export potential values

As discussed in section 3.7 three tests were used to compare the ranks (based on the estimated export potential values of each approach) of the different product-country combinations. These tests consisted of the Spearman rank-order correlation test, a comparison of frequency distributions and a comparison of each product's top 10 countries. The results of the respective tests are discussed from sections 4.2.1 to 4.2.3.

4.2.1 Spearman rank-order correlation test

As mentioned in section 3.7.1, the Spearman rank-order correlation test is conducted to establish how the ranks of the export potential values estimated by the different approaches compared and whether there were relationships between them. The following table provides a summary of each product's correlation coefficient (between the respective approaches), as determined by the Spearman rank-order correlation test.

Table 4-1: Correlation coefficients between approaches

		Correlation coefficient		
Product	**Approach**	**Gravity**	**ITC**	**DSM**
Overall[20]	Gravity	1	0.650**	0.377**
	ITC	0.650**	1	0.694**
	DSM	0.377**	0.694**	1
HS 290129 (unsaturated acyclic hydrocarbons)	Gravity	1	0.723**	0.692**
	ITC	0.723**	1	0.878**
	DSM	0.692**	0.878**	1

19. The estimated export potential values of each approach can be found in Appendix 2.
20. The overall correlation coefficient was also estimated by means of the Spearman rank-order correlation test.

		Correlation coefficient		
Product	**Approach**	**Gravity**	**ITC**	**DSM**
HS 330499 (beauty/make-up and skincare preparations)	Gravity	1	0.677**	0.640**
	ITC	0.677**	1	0.860**
	DSM	0.640**	0.860**	1
HS 480419 (uncoated kraftliner in rolls/sheets)	Gravity	1	0.548**	0.817**
	ITC	0.548**	1	0.705**
	DSM	0.817**	0.705**	1
HS 720230 (ferro-silico-manganese in granular/powder form)	Gravity	1	0.648**	0.611**
	ITC	0.648**	1	0.785**
	DSM	0.611**	0.785**	1
HS 720241 (ferro-chromium in granular/powder form)	Gravity	1	0.599**	0.620**
	ITC	0.599**	1	0.981**
	DSM	0.620**	0.981**	1
HS 721049 (flat-rolled products of iron or non-alloy steel)	Gravity	1	0.714**	0.685**
	ITC	0.714**	1	0.802**
	DSM	0.685**	0.802**	1
HS 732690 (articles of iron/steel)	Gravity	1	0.880**	0.730**
	ITC	0.880**	1	0.882**
	DSM	0.730**	0.882**	1
HS 840999 (parts used solely with certain engines of HS 84)	Gravity	1	0.793**	0.469**
	ITC	0.793**	1	0.690**
	DSM	0.469**	0.690**	1
HS 841391 (parts of specified pumps)	Gravity	1	0.701**	0.372*
	ITC	0.701**	1	0.729**
	DSM	0.372*	0.729**	1
HS 842139 (purifying machinery and apparatuses for gases)	Gravity	1	0.755**	0.701**
	ITC	0.755**	1	0.837**
	DSM	0.701**	0.837**	1
HS 843149 (parts used solely with certain machinery of HS 84)	Gravity	1	0.748**	0.503**
	ITC	0.748**	1	0.743**
	DSM	0.503**	0.743**	1
HS 847490 (parts of the machinery of HS 8474)	Gravity	1	0.622**	0.510**
	ITC	0.622**	1	0.625**
	DSM	0.510**	0.625**	1
HS 870410 (dumpers designed for off-highway use)	Gravity	1	0.447**	0.414**
	ITC	0.447**	1	0.667**
	DSM	0.414**	0.667**	1
HS 870421 (motor vehicles for the transportation of goods)	Gravity	1	0.703**	0.541**
	ITC	0.703**	1	0.775**
	DSM	0.541**	0.775**	1
HS 880330 (parts of aeroplanes/ helicopters)	Gravity	1	0.761**	0.851**
	ITC	0.761**	1	0.852**
	DSM	0.851**	0.852**	1

** Correlation is significant at 1%
* Correlation is significant at 5%
Source: Researcher's own estimates.

In Table 4-1, it is evident that the rankings assigned to the export potential values by the ITC and DSM approaches had the highest overall correlation (0.694), followed by the ITC and gravity approaches (0.650). The correlation between the DSM and gravity methods were significantly lower (0.377), meaning that the rankings of the approaches in question were less comparable.

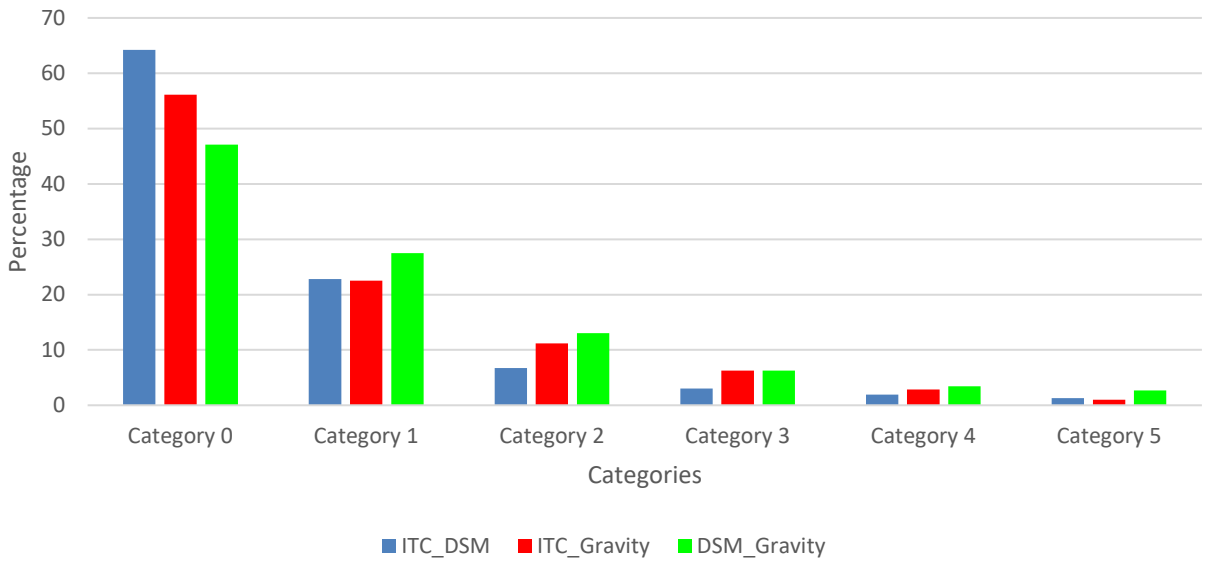
Furthermore, by analysing each product's correlation between the different methods, it was clear that the ITC and DSM had the most products (in other words, 12 of the 15 products) with a correlation above 0.7, with one product (HS 720241: ferro-chromium, in granular/powder form) even having a correlation above 0.9. The other three products showed a moderate correlation between 0.5 and 0.7. In terms of the ITC and gravity approaches, nine of the 15 products had a correlation higher than 0.7, five products had a correlation between 0.5 and 0.7, and one product had a low correlation of under 0.5 (HS 870410: dumpers designed for off-highway use). Finally, the DSM and gravity methods only had four products with a correlation above 0.7, of which two products showed a correlation higher than 0.8. Moreover, eight products had a moderate correlation between 0.5 and 0.7, while three products had a correlation less than 0.5.

The Spearman rank-order correlation test, therefore, indicated that the ITC and DSM approaches had the strongest relationship, with the relationship between the ITC and gravity methods following closely. However, since the Spearman rank-order correlation coefficient did not provide an exact comparison of specific ranks, a comparison of frequency distributions is reported for each of the products in section 4.2.2.

4.2.2 Comparison of frequency distributions

Section 3.7.2 explained the categorisation of the differences in ranks between the estimated export potential values of every product-country combination (labelled from Categories 0 to 5), with the difference interval being five ranks. In this section, bar charts are used to illustrate, in terms of percentage, which two approaches had the most export potential values with differences in ranks that "fit" into each category. By doing so, a conclusion can be drawn as to how much the ranks (of the export potential values estimated by the different approaches) differed. Figure 4-1 illustrates an overall comparison between the respective approaches over the six categories.

Figure 4-1: Comparison of the ranks of the gravity, ITC and DSM approaches over the six categories



Source: Researcher's own estimates

In Figure 4-1, it is clear that the ITC and DSM approaches (ITC_DSM) compared the best as they had the highest percentage (64%) of product-country combinations with five or less differences in ranks between their estimated export potential values (Category 0). When adding Category 1 to this number, 87% of the product-country combinations showed differences in ranks below 10 places when the potential values of the ITC and DSM approaches were compared. This implies that the ITC_DSM comparison had a very low percentage (13%) in the remaining categories (Categories 2 to 5) with differences in ranks of more than 10 places.

Conversely, the DSM and gravity approaches (DSM_Gravity) had the lowest percentage (47%) of product-country combinations in Category 0. This means that less than half of the product-country combinations of DSM_Gravity had fewer than five differences in ranks. However, when adding Category 1, almost 75% of the product-countries combinations differed with less than 10 places between the DSM and gravity approaches. Therefore, a total of 25% of the product-country combinations had differences in ranks in Categories 2 to 5 (a difference of more than 10 places), which can be seen as relatively large differences in ranks.

The ITC and gravity approaches (ITC_Gravity) also show a relatively fair comparison, with 56% of product-country combinations' export potential values having five or less differences in ranks (Category 0). Almost 79% of the product-country combinations considered showed a difference of lower than 10 places in ranking when the export potential values of the ITC and gravity models were compared, leaving around 21% with relatively large differences in ranks.

Overall, the differences in ranks were the smallest between the ITC and DSM approaches. Although the ITC and DSM ranks compared fairly to that of the gravity approach, the DSM and gravity approaches had the lowest percentage of product-country combinations with a difference of fewer than five places in rank (Category 0) and the highest percentage with large differences in ranks (Categories 2 to 5). These results support the findings of the Spearman rank-order correlation test (see section 4.2.1).

As mentioned, Figure 4-1 provides an overall picture of the differences in the ranks of the gravity, ITC and DSM approaches over the six categories. The frequency distributions per category on a product level can be found in Annexure 3.

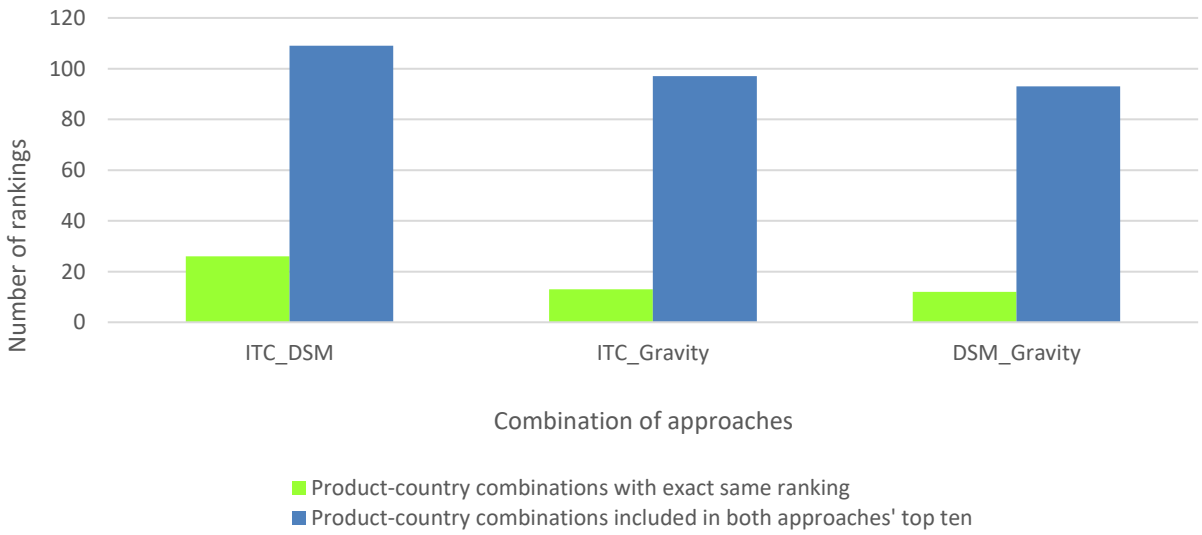
In order to give yet another perspective on the ranks, a comparison of each product's top 10 countries is carried out in section 4.2.3.

4.2.3 Comparison of each product's top 10 countries

The final technique/test allows for a detailed comparison of ranks as it indicates whether the three approaches assigned the same rank(s) to any of the top 10 countries of each product. Furthermore, it will show whether or not the top 10 countries of each product are similar for the respective approaches.

The following figure illustrates a summary of the overall comparison of each product's top 10 countries.

Figure 4-2: Overall comparison of product-country combinations included in the top 10 of each approach



Source: Researcher's own estimates

From Figure 4-2, it is clear that the ITC and DSM approaches had by far the most product-country combinations with the exact same ranking (26 product-country combinations), as well as the most product-country combinations included in both approaches' top 10 countries (109 product-country combinations). The ITC and gravity models had the second most product-country combinations with the exact same ranking assigned by the models in question (13 product-country combinations), along with the second most product-country combinations that both models included in the top 10 countries (97 product-country combinations). The DSM and gravity approaches, on the other hand, had only slightly less product-country combinations with the exact same rank (12 product-country combinations) than the ITC and gravity models. The number of product-country combinations included in the DSM and gravity approaches' top 10 countries were also only slightly less (93 product-country combinations) than those included in the ITC and gravity approaches' top 10 countries.

The results for each product are summarised in Table 4-2. The top 10 countries identified by each approach are highlighted in shades of blue. Medium blue represents those countries where at least two approaches were identified as being in the top 10, while dark blue represents those countries where only one approach was identified as being part of the top 10. Lastly, light blue refers to those countries where at least two approaches assigned the exact same rank to the export potential values in the top 10. The table has been arranged in such a manner that those products where at least one country's ranking is the same across all three methods, are presented first. Thereafter, products are presented in a descending manner, according to the number of countries highlighted in green.

Table 4-2: Comparison of the top 10 countries per product exported from South Africa

		Rankings		
Product code	**Import country**	**ITC**	**DSM**	**Gravity**
HS 480419 (uncoated kraftliner in rolls/sheets)	Germany	1	1	1
	Italy	2	2	3
	Belgium-Luxembourg	3	5	2
	Spain	4	3	5
	India	5	12	10
	United Rep. of Tanzania	6	33	26
	Saudi Arabia	7	7	19
	Turkey	8	8	22
	Kenya	9	22	36
	United Arab Emirates	9	13	27
	Zambia	9	26	23
	France	12	4	4
	Australia	14	11	7
	Austria	15	6	6
	New Zealand	17	20	9
	Poland	26	9	8
	Guatemala	31	10	13

		Rankings		
Product code	**Country**	**ITC**	**DSM**	**Gravity**
HS 290129 (unsaturated acyclic hydrocarbons)	USA	1	1	1
	Belgium-Luxembourg	2	2	10
	Thailand	3	4	16
	India	4	8	6
	China	5	10	3
	Germany	6	12	4
	France	7	3	5
	Singapore	8	5	15
	Rep. of Korea	9	9	11
	Spain	10	13	7
	Netherlands	11	6	17
	Brazil	12	11	8
	Canada	13	7	2
	Switzerland	14	14	9
HS 842139 (purifying machinery and apparatuses for Gases)	Germany	1	2	1
	USA	2	1	3
	China	3	4	13
	United Kingdom	4	5	2
	Turkey	5	8	5
	Spain	6	3	4
	Japan	7	11	8
	Australia	8	9	11
	Rep. of Korea	9	12	9
	France	10	7	6
	Czech Rep.	11	6	7
	Italy	13	10	10
HS 880330 (parts of aeroplanes/ helicopters)	USA	1	2	2
	Germany	2	3	3
	France	3	1	4
	United Kingdom	4	4	1
	Japan	5	10	11
	Netherlands	6	14	6
	Singapore	7	5	10
	Spain	8	9	7
	United Arab Emirates	9	11	12
	Italy	10	7	5
	Canada	12	6	8
	Saudi Arabia	13	8	9
HS 720241 (ferro-chromium in granular/powder form)	China	1	1	6
	Japan	2	2	8
	USA	3	5	4
	Rep. of Korea	4	4	11
	Mozambique	5	3	28
	Belgium-Luxembourg	6	7	10
	Germany	7	8	1
	Netherlands	8	10	22
	Spain	9	9	7
	India	10	13	13
	Italy	11	6	3
	France	12	12	2
	Sweden	13	11	5
	Ireland	27	27	9

		Rankings		
Product code	**Country**	**ITC**	**DSM**	**Gravity**
HS 732690 (articles of iron/ steel)	USA	1	1	4
	Germany	2	4	6
	China	3	7	7
	Thailand	4	2	20
	United Kingdom	5	9	1
	Japan	6	6	12
	France	7	8	8
	India	8	13	3
	Nigeria	9	17	2
	Mexico	10	3	25
	Rep. of Korea	12	5	17
	Turkey	13	15	10
	Kenya	14	32	5
	Saudi Arabia	15	16	9
	Viet Nam	15	10	23
HS 330499 Beauty/make-up and skincare preparations)	China	1	2	13
	USA	2	3	2
	Hong Kong, China	3	1	16
	Japan	4	11	3
	Germany	5	4	5
	Canada	12	8	4
	Singapore	7	6	8
	Thailand	8	15	22
	Rep. of Korea	9	9	14
	France	10	12	9
	Belgium-Luxembourg	14	7	6
	Netherlands	15	14	7
	Italy	16	10	11
	Djibouti	24	29	10
HS 843149 (parts used solely with certain machinery of HS 84)	Zambia	1	26	1
	USA	2	1	3
	Mozambique	3	30	2
	China	4	6	7
	Germany	5	4	5
	United Kingdom	6	8	9
	India	7	11	19
	Australia	8	10	4
	Belgium-Luxembourg	9	9	6
	Canada	10	3	8
	Japan	11	2	21
	Singapore	12	7	15
	Netherlands	13	13	10
	France	14	5	12

		Rankings		
Product code	**Country**	**ITC**	**DSM**	**Gravity**
HS 870421 (motor vehicles for the transportation of goods)	Germany	1	4	3
	Australia	2	2	36
	United Kingdom	3	1	1
	Belgium-Luxembourg	4	5	4
	France	5	3	2
	Turkey	6	10	19
	Uganda	7	30	10
	Spain	8	7	5
	Netherlands	9	9	25
	Malawi	10	36	11
	Saudi Arabia	11	8	7
	Italy	12	6	13
	Ethiopia	14	18	8
	Hungary	22	13	6
	Estonia	23	29	9
HS 847490 (parts of the machinery of HS 8474)	USA	1	1	4
	Australia	2	3	5
	China	3	13	33
	Germany	4	5	9
	United Rep. of Tanzania	5	23	1
	Indonesia	6	6	22
	Canada	7	2	6
	United Kingdom	8	4	3
	Burkina Faso	9	29	39
	Saudi Arabia	10	10	8
	Kenya	11	33	2
	Chile	15	9	21
	Algeria	16	8	13
	France	18	11	10
	Mexico	18	7	25
	Eritrea	24	36	7
HS 870410 (dumpers designed for off-highway use)	USA	1	1	3
	Mozambique	2	14	1
	Germany	3	7	5
	Indonesia	4	5	34
	Canada	5	2	10
	Guinea	6	37	45
	Kenya	6	33	28
	Mali	6	28	18
	United Kingdom	6	6	2
	Angola	10	25	15
	Netherlands	10	10	9
	Russian Federation	12	4	6
	Belgium-Luxembourg	13	12	4
	Viet Nam	20	9	44
	Poland	24	8	17
	Myanmar	27	3	46
	Italy	30	27	7
	Austria	31	22	8

		Rankings		
Product code	**Country**	**ITC**	**DSM**	**Gravity**
HS 721049 (flat-rolled products of iron or non-alloy steel)	Belgium-Luxembourg	1	9	3
	USA	2	1	1
	Thailand	3	4	23
	Germany	4	2	6
	Spain	5	6	2
	China	6	3	22
	Turkey	7	11	15
	Mexico	8	5	14
	United Kingdom	8	8	5
	Italy	10	12	7
	Malawi	11	25	8
	Poland	16	10	9
	France	19	7	4
HS 720230 (ferro-silico-manganese in granular/powder form)	USA	1	1	2
	Japan	2	3	5
	Germany	3	5	12
	Netherlands	4	6	3
	Italy	5	7	16
	Turkey	6	4	4
	Rep. of Korea	7	9	10
	Canada	8	13	6
	France	9	10	18
	Brazil	10	14	7
	Russian Federation	11	2	1
	Poland	13	8	19
	Colombia	16	19	9
	Belarus	24	11	8
HS 841391 (parts of specified pumps)	Zambia	1	24	1
	USA	2	1	8
	Germany	3	2	14
	China	4	4	23
	Mozambique	5	30	2
	Saudi Arabia	6	11	5
	United Kingdom	6	8	4
	Japan	8	7	26
	Thailand	9	14	17
	Italy	10	5	15
	France	11	6	16
	Mexico	11	3	27
	Netherlands	11	10	6
	Rep. of Korea	14	9	25
	Madagascar	16	34	3
	Kuwait	17	21	10
	Côte d'Ivoire	18	37	7
	Israel	32	27	9

		Rankings		
Product code	**Country**	**ITC**	**DSM**	**Gravity**
HS 840999 (parts used solely with certain engines of HS 84	Germany	1	2	1
	USA	2	1	2
	China	3	11	16
	Thailand	4	9	5
	United Kingdom	5	4	3
	India	6	19	22
	Japan	7	17	19
	Zambia	8	41	4
	Spain	9	15	11
	France	10	3	15
	Nigeria	11	26	10
	Rep. of Korea	12	14	6
	Turkey	13	18	8
	Belgium-Luxembourg	14	16	9
	Italy	15	5	14
	Mexico	17	8	28
	Netherlands	18	12	7
	Hungary	20	6	37
	Poland	22	10	27
	Austria	31	7	35

Source: Researcher's own estimates.

In Table 4-2, it is clear that 11 of the 15 products had five or more countries which all three approaches identified as being part of the top 10 countries. In addition, for nine of the products, at least two methods identified five or more of the countries in the top 10. Following this, the ITC had the lowest number of product-country rankings that were not identified by the other approaches as being part of the respective top 10 countries. On the other hand, the gravity approach had the most product-country rankings that had not been included in the other approaches' top 10. Furthermore, the ITC had seven products where only one country's ranking was not in the top 10 of either of the other approaches, while the DSM had five products and the gravity approach had two products. The DSM and gravity approaches, therefore, had more countries that do not form part of the other methods' top 10. Ultimately, this means that the ITC were more comparable in relation to the DSM and gravity approaches, while the gravity model did not compare that well to either of the other two approaches.

Additionally, the ITC and DSM methods had four products where all the countries identified in the respective top 10 corresponded with at least one other approach, while the gravity model only had two products where this was the case. Moreover, only two products (HS 290129 and HS 480419) had a country with the exact same rank assigned to the export potential values by all three approaches. On the other hand, for 10 products, two of the approaches assigned identical ranks to at least three countries.

After comparing each product's top 10 countries, as estimated by the different approaches, it can be said that the results were similar to that of the Spearman rank-order correlation tests (see

section 4.2.1) and frequency distributions (section 4.2.2). A brief discussion of the results of section 4.2 is provided in the following section.

4.2.4 Discussion of results

From all three frequency and distribution tests comparing the ranks/priorities assigned to the export potential values of the gravity, ITC and DSM approaches, it was clear that the ITC and DSM approaches were the most comparable among the three approaches. Conversely, although it compared moderately, the ranks assigned by means of the DSM and gravity approaches had the lowest level of similarity among the respective approaches. As mentioned in section 3.6, the ITC's main purpose is to determine export potential values on a detailed product level, while the gravity model mainly aim to analyse the determinants of bilateral trade on a country level. Furthermore, the DSM was specifically developed to crystallise, among all possible worldwide product-country combinations, those with realistic export potential for a country.

Since the rankings overall clearly differed between the approaches, it is necessary to consider possible reasons for the differences.

One of the reasons for the DSM and gravity, as well as the ITC and gravity approaches, not comparing that well might be the fact that most variables used in the gravity approach are on a country level, which makes product-specific analysis challenging (see section 3.3). Furthermore, the gravity model was not specifically developed to estimate export potential values on a large and detailed scale. Therefore, the gravity approach can be "computationally burdensome" when estimating export potential values on such a scale since it requires a panel regression analysis for each individual product, which is the case in this study (Decreux & Spies, 2016:4). A vast number of coefficients and equations must thus be estimated (Decreux & Spies, 2016:4).

As mentioned, the ITC and DSM approaches were the most comparable among the three methods. Besides both these approaches incorporating more relevant variables, they were also both designed to analyse export potential on a large scale and detailed product level. Although the DSM was not initially intended to estimate export potential values (which was added in later applications of the model), both approaches included variables that were country specific and product specific, and could be used on a large scale (see section 3.6).

The purpose, benefits and limitations of each of the three models, which will further explain the differences in rankings found in this chapter, will be summarised in section 5.3.

4.3 Conclusion

This chapter entailed a practical application of the methods and data used in this study, as explained in the third chapter, along with an analysis of the estimated results.

Although the frequency and distribution tests focused on different aspects in the comparison of the rankings/priorities assigned to the different approaches' estimated export potential values, all three tests indicated that the ITC and DSM approaches compared the best. This is evident in the fact that these two approaches had the highest correlation (0.694), fewest differences in ranks and most product-country combinations with the exact same rank. On the other hand, although there were similarities between them, the rankings assigned to the export potential values of the DSM and gravity approaches had the lowest comparability among the three methods. The results indicated that they had the lowest correlation (0.377), the most differences in ranks and the least top 10 product-country rankings that corresponded. The ITC and gravity approaches compared moderately, as they had a correlation of 0.655 (which was just below the correlation of the ITC and DSM approaches) and had fair differences in ranks. The approaches in question, however, only had one identical product-country ranking more than the DSM and gravity approaches.

The results of this study, therefore, support the statement of Decreux and Spies (2016:4), which suggests that the gravity model was not developed to estimate export potential values on a large and detailed scale. The rankings based on the export potential values of the ITC and DSM approaches, which were developed with the intention of working on a detailed product-level, were, therefore, more comparable on an HS 6-digit level.

The following chapter will provide a summary and conclusion to the study along with recommendations based on the results in this chapter.

CHAPTER 5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

It is challenging to put a specific value to export potential since it is difficult to evaluate the accuracy thereof owing to the potential not always being actively pursued and realised in actual trade (ITC, 2017). Important market selection and prioritisation decisions are, however, often based on estimated export potential. Resources for export promotion strategies are also scarce and incorrect market selection can lead to large losses (Papadopoulos & Denis, 1988:38; Shankarmahesh *et al*., 2005:204). This study, therefore, aimed to compare the rankings/priorities assigned to the export potential values estimated for South Africa by three different approaches. The three IMS approaches used for this comparison included the gravity model, the ITC's Export Potential Map and the Decision Support Model. Although the approaches differed in aim and method, the same concept, export potential, is measured and a comparison can contribute to the literature on IMS and provide insight to refine and enhance each approach.

Chapter 2 contextualised this study into the literature by investigating the importance of exports, export promotion and international market selection, as well as identifying the factors that generally affect exports, with a specific focus on South Africa. A detailed explanation of the methodologies of international market selection approaches and data were provided in Chapter 3, along with a description of the tests used to ultimately compare the rankings assigned to the export potential values of South Africa's top exported manufactured products. Finally, Chapter 4 reported the main findings of the comparison in question.

A summary of the objectives (as stated in section 1.4) of the study is provided in Table 5.1, along with the chapters in which these objectives were met.

Table 5-1: Objectives addressed in each chapter

	Objective	Addressed
1 (general)	Determine whether the gravity, ITC and DSM approaches give similar rankings/priorities to the same product-country combinations based on their estimated export potential values.	Chapter 4
2	Provide an overview of the literature on the importance of export promotion and IMS, and specifically identify the determinants of export potential.	Chapter 2

	Objective	Addressed
3	Compare the rank/priority based on the export potential values calculated for South Africa by means of the three methods for the same products and countries by using the Spearman rank-order correlation test, frequency distributions and a comparison of each products' top 10 countries.	Chapter 4
4	Identify the benefits and limitations of each export potential value calculation method based on the literature and empirical analyses and make recommendations on how the approaches can be refined/enhanced.	Chapter 5

Source: Researcher's own compilation

The following section provides a summary of the study along with conclusions drawn.

5.2 Summary and conclusions of the study

Numerous studies have explained the vital role exports play in the ultimate prosperity of a country, as there is a positive relationship between exports and economic growth. Export promotion strategies pursued by governments, therefore, also influence the economic growth of countries positively as such strategies aim to increase exports.

In South Africa in particular, the NDP highlighted the fact that the country would experience increased income if the volume of exports increased, as there would be significantly more foreign exchange earnings. These earnings would encourage industrialisation, infrastructure investment and productivity, thereby contributing to reducing unemployment and reaching the growth target of 5.4% by 2030 (NPC, 2012:120). National Treasury indicated that the high-value exports of the manufacturing sector had a strong competitive advantage, which should be used as a means to encourage exports, which complements the DTI's Integrated National Export Strategy of doubling manufacturing exports by 2030 (Oliviera, 2017). It is, therefore, crucial to encourage manufacturing exports as it can increase employment in various industries.

Resources for export promotion are, however, limited as it is impossible to export all products to all countries profitably and successfully. Furthermore, the selection of "incorrect markets" could result in market failures, which usually leads to significant losses. Therefore, markets with the highest export potential need to be selected and prioritised to ensure that scarce resources are not wasted but used in a way that contributes to economic growth. As mentioned, it is challenging to put a specific value to export potential. Three approaches are found in the IMS literature that calculate export potential values. A comparison of the rankings/priorities assigned to the export potential values estimated by the gravity, ITC and DSM approaches was, therefore, attempted in this study.

In Chapter 2, the importance of exports, export promotion and international market selection were elaborated in the literature, while the determinants of exports were also identified. The literature indicated that increased exports and export promotion strategies could contribute to the economy in several ways. These included a spillover of knowledge, enhanced innovation, production expansion, increased productivity and efficiency, specialisation, improvement of skills, better use of production capacity, economies of scale, growth in employment, income and outputs, reduced poverty, improved trade balance, acquisition of foreign exchange, diversification of export markets, as well as increased competitiveness. Ultimately, economic growth could be enhanced through export and a country could experience better prosperity. Furthermore, it was found that selecting the correct markets for export promotion are crucial, as market failures could occur if the wrong markets were selected, which could lead to significant losses. Companies may also struggle financially if poor market selection occurred, as IMS forms the foundation for companies' future export developments and success.

Furthermore, the determinants of export potential were identified in the IMS literature and their effect on exports, whether positive or negative, were discussed. These determinants included proxies for the size and growth of import demand and export supply, political and exchange rate risk, market concentration, trade agreements, tariffs, NTBs and the operating environment. Several trade cost estimators also influence export potential, such as the time and costs to import, the availability and quality of trade facilitation, distance/proximity and cultural differences. The factors in question were an important part of this study, as they formed part of the foundation of the methodologies and analysis of the estimated export potential values.

Chapter 3 provided an explanation of the methodology and data used, which included a comprehensive description of the methodologies of the gravity, ITC and DSM approaches. A limited number of manufactured goods could be selected for this study due to the gravity model involving a panel regression analysis for each individual product. Therefore, 15 of South Africa's main exported manufactured goods of 2015 were selected, based on the definition of manufactured goods by Sandrey (2014:2). Each product's top 50 destination countries were included in the analysis.

In brief, the gravity model analyses potential trade flows by means of a panel regression analysis based on historic bilateral trade data. It takes into account the size of markets (which serves as an attraction for trade) and the distance and/or trade costs between markets (which serves as resistances to trade) (Jordaan, 2015:355). The Export Potential Map of the ITC estimates export potential values based on an economic model, which combines the supply of the exporter with the importing country's demand and market access conditions (ITC, 2019a). Finally, the DSM was

developed for export promotion purposes and involve four sequential filters, which aim to eliminate less-promising markets in order to produce a list of product-country combinations of REOs. Once the REOs have been identified, export potential values are estimated by taking the top six competing countries' average market shares in each market, as this provides an indication of the size of the potential of each market relative to the others.

Once the export potential values had been estimated for all three approaches, the values were compared for the same product-country combinations. The Spearman rank-order correlation test, along with frequency distributions and a comparison of each product's top 10 countries, were used to compare the export potential values. These three tests each provided a different overall level of depth and perspective in comparing the ranks assigned to the export potential values.

In the fourth chapter, the export potential values emanating from the gravity, ITC and DSM approaches were calculated. Thereafter, the correlation and frequency tests were applied to the estimated export potential values in order to draw a conclusion on how the rankings/priorities of the values in question compared. The results of the Spearman rank-order correlation test, frequency distributions and comparison of each products top 10 countries are summarised in Table 5-2 below.

Table 5-2: Summary of results

Spearman rank-order correlation test (see section 4.2.1)	• ITC Export Potential Assessment and DSM had the highest correlation between the ranks of product-country combinations (equal to +-0.7, considered relatively high, see section 3.7.1). • ITC and gravity model had a moderate to high correlation (approximately 0.65, also considered relatively high, see section 3.7.1). • DSM and gravity model had the lowest correlation between the ranks of product-country combinations (roughly 0.38, considered relatively low, see section 3.7.1).
Frequency distributions (see section 4.2.2 and Figure 4-1).	• ITC and DSM had the fewest differences in product-country combinations' ranks (only 13% of product-country combinations had differences in ranks of more than 10 places). • The differences in ranks between the ITC and gravity models were slightly more with approximately 21% of product-country combinations having differences in ranks of more than 10 places). • The DSM and Gravity Model had 25% of product-country combinations with differences in ranks of more than 10 places.

Comparison of each product's top 10 countries (see section 4.2.3 and Figure 4-2).	• The ITC and DSM had by far had the most product-country combinations with the exact same rank (26), as well as the most product-country combinations included in both approaches' top 10 (109). • The ITC and gravity model had the second most product-country combinations with the exact same rank (13), along with the second most product-country combinations included in the top 10 of both approaches (97). • The DSM and gravity approaches only had slightly less product-country rankings than the ITC and gravity model that corresponded (12), as well as slightly less product-country combinations that were included in the top 10 of both approaches (93).

Source: Researcher's own estimates.

All three tests, therefore, confirmed that, among the three methods, the ITC and DSM approaches compared the best, while the DSM and gravity approaches were the least comparable. A possible reason for this is the fact that the gravity model could be "computationally burdensome" when estimating export potential values on an HS6-digit product level for many products (see section 3.3). As mentioned, the gravity model involves a panel regression analysis for each individual product and, therefore, a vast number of coefficients and equations must be estimated (Decreux & Spies, 2016:4). , The gravity model also mostly incorporates variables that are on a country level (see Table 3-6), which makes the results less product-specific.

It is also important to keep in mind the purpose of and the differences between each specific IMS analysis (see section 3.6). Among the three approaches, the export potential analysis of the ITC was the only one that was designed with the purpose of estimating export potential values on a detailed product level (see section 3.4). The main aim of the gravity model is to estimate the determinants of bilateral trade on a country level and the estimated regression equation is sometimes used to calculate potential export values (see section 3.3). The DSM was originally developed with the purpose of assisting export promotion organisations in identifying REOs. It starts with all possible world-wide product-country combinations and filters out a selection of priorities for country-level export promotion. The calculation of export potential values was added in later revisions of the model, in order to compare the relative size among the identified export opportunities (see section 3.5).

Based on the literature and empirical analysis of this study, it can be concluded that the Export Potential Assessment of the ITC is the most comprehensive for the purpose of determining export potential values on a detailed product level. The export potential method of the ITC was inspired by the gravity model to incorporate market attractiveness and barriers to trade into the analysis. Although the approaches differ and the variables are not exactly the same, the assessment of the

ITC also includes all aspects of trade potential that the DSM covers namely market size, market growth and market accessibility. Unlike the DSM, which only considers market size in the calculation of the export potential value, the Export Potential Assessment of the ITC incorporates demand, supply and easiness to trade into the calculation. It, however, has the limitation of calculating potential values only for a country's current export basket.

Recommendations are provided in the following section, which will conclude this study.

5.3 Recommendations

The benefits and limitations of each of the methods analysed are important to consider when making recommendations.

First, the gravity model has been applied since 1962 and is often referred to as the "work horse" of international trade analyses. It is best suited to estimate the determinants of trade between countries and the relative importance of these determinants. For the purposes of estimating export potential values for a large amount of markets on a detailed product level, it, however, poses challenges, especially considering that most variables included in the model are on country level and, therefore, lacks product specificity. Furthermore, with the gravity model being the oldest of the models considered, the relevance of some of the variables used in this model might be fading due to globalisation and the use of digital technologies.

The DSM was originally developed in the early 1990s with the intention of identifying REOs for export promotion organisations to best use their scarce resources and formulate effective export promotion strategies. For the purpose of picking the winners, the DSM uses specified cut-off criteria to filter out less-promising markets and handpick REOs. As mentioned, it has the benefit of starting with all possible world-wide product-country combinations and filtering it down to a more manageable number for export promotion purposes. It, therefore, does not exclude new opportunities based on current exports (although current export specialisation is taken into consideration when determining cut-off values). In later versions of the model, criteria were added after the filtering process to differentiate between products that the exporting country exported competitively and those it did not (Viviers *et al*., 2014). As mentioned, the original DSM also did not include a calculation of export potential values. It was only introduced in later revisions when the need arose to compare the relative size of the REOs identified. A limitation of the export potential values, which are based on the average market share of the top six competitors in each market, is that it only considers the relative size of the markets (demand) and does not incorporate market access and the exporter's supply capacity into the values.

The ITC developed an Export Potential Assessment in 2016 to provide developing countries with practical trade information in the form of visualised illustrations of untapped export potential on a detailed product level. The export potential values are based on the supply capacity of the exporting country, the easiness to trade and the demand conditions in the target market. The ITC also includes modern and more relevant variables in the calculation of export potential values, such as business history. This study therefore found that the export potential values of the ITC compared relatively well with both the other methods and that it was the most comprehensive in terms of the variables included in the calculation and the level of product specification. However, the ITC calculates potential export values only for the exporting country's current export products. A different approach, which is not covered in this study, is taken for products that the exporting country does not export yet, but that fall within the product space (supply capabilities) of its current export basket. It does not calculate an export potential value for these products, but rather provides ranks of products within different markets.

Against this background and summary of the main benefits and limitations of each of the models applicable to this study, the following recommendations can be made for practical application and future research:

- Depending on the problem that needs to be addressed, the different approaches should be used for their intended purposes.
- Since the motivation behind calculating export potential values in the DSM is to rank among the identified REOs, it can be considered to rather calculate a composite index to incorporate all the different aspects the model includes, including export supply (RCA). This can be done for all products, regardless of whether or not the exporting country has a competitive advantage in exporting the product.
- A product space analysis can be added to the supply capacity analysis at the end of the filtering process of the DSM to classify products in more detail.
- To address the limitation that the ITC calculates export potential values only for products that the supplying country exports competitively, using averages for the export supply variables of the closest related products within the product space as a proxy to calculate export potential values for product diversification opportunities might be considered.
- In order to confirm whether some model combinations work better for specific countries only, or whether in a fixed approach one or two models work better overall, the analysis can be repeated for other countries for comparative purposes.

However, it is important that other immeasurable components of export potential are added to the analysis. Export promotion decisions should, therefore, not be based on export potential values/untapped export potential alone (see section 3.5).

Ultimately, the different export potential approaches can be used to enhance and complement one another. For example, if the purpose is to pick winners among a large number of potential export markets, the DSM filtering process can be used as a starting point. The ITC's more comprehensive export potential assessment, which was inspired by a gravity-type framework, can then be used to attach export potential values to REOs that the DSM identifies. Moreover, the product diversification information from the ITC can be used to differentiate between different types of export opportunities (intensive or extensive product margin) and prioritise among different opportunities.

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ANNEXURE 1: LIST OF PRODUCTS

The 15 manufactured goods used in this study to compare export potential values consist of the following:

Table A1-1: List of manufactured products used in this study

HS Code	Description
HS 290129	Unsaturated acyclic hydrocarbons (excluding those of HS 290121 – HS 290124).
HS 330499	Beauty/make-up preparations and preparations for skincare (excluding medications; excluding those of HS 330410 – HS 330491), including sunscreen/suntan preparations.
HS 480419	Kraftliner, uncoated, other than unbleached, in rolls/sheets (excluding those of HS 4802 or HS 4803).
HS 720230	Ferro-silico-manganese, in granular/powder form.
HS 720241	Ferro-chromium, containing by weight >4% of carbon, in granular/powder form.
HS 721049	Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, otherwise plated or coated with zinc (excluding electrolytically), other than corrugated.
HS 732690	Articles of iron/steel, not specified elsewhere.
HS 840999	Parts suitable for use solely/principally with the engines of HS 8407 or HS 8408 (excluding those of HS 840910 and HS 840991).
HS 841391	Parts of the pumps of HS 841311 - HS 841381.
HS 842139	Filtering/purifying machinery and apparatuses for gases, other than intake air filters for internal combustion engines.
HS 843149	Parts suitable for use solely/principally with the machinery of HS 8426 or HS 8429 or HS 8430 (excluding those of HS 843141 – HS 8431.43).

HS Code	Description
HS 847490	Parts of the machinery of HS 8474.
HS 870410	Dumpers designed for off-highway use.
HS 870421	Motor vehicles for the transportation of goods (excluding those of HS 870410), with C-I internal combustion piston engines (diesel/semi-diesel), gross vehicle weight not greater than 5 t.
HS 880330	Parts of aeroplanes/helicopters, other than propellers, rotors, undercarriages and parts thereof.

Source: WITS (2019a)

ANNEXURE 2: ESTIMATED EXPORT POTENTIAL VALUES

The following table contains the estimated export potential values of the gravity, ITC and DSM approaches for 15 of South Africa's main exported manufactured goods in 2015:

Table A2-2: Export potential values estimated by the gravity, ITC and DSM approaches

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
290129	Belgium-Luxembourg	90 400.46	61 164.17	1 068.12
290129	Bosnia Herzegovina	62.10	137.87	10.03
290129	Brazil	10 800.00	10 922.91	1 980.55
290129	Canada	4 700.00	19 138.96	9 924.13
290129	China	41 200.00	13 666.42	8 862.09
290129	Croatia	26.60	67.75	57.36
290129	Denmark	83.20	50.92	311.91
290129	Egypt	669.00	318.55	110.56
290129	Estonia	43.40	121.43	25.58
290129	France	31 800.00	26 942.20	5 709.14
290129	Germany	38 400.00	10 670.22	6 306.78
290129	Greece	22.50	26.62	244.06
290129	India	41 800.00	17 680.62	3 225.90
290129	Maldives	178.10	27.99	1.69
290129	Mauritius	66.40	16.79	4.03
290129	Mozambique	279.30	74.84	98.74
290129	Myanmar	4.70	119.99	14.60
290129	Netherlands	12 000.00	23 459.54	117.73
290129	Poland	128.40	140.37	665.21
290129	Republic of Korea	16 600.00	15 864.60	785.24
290129	Singapore	20 500.00	23 558.11	242.25
290129	Spain	13 200.00	7 357.70	2 383.50
290129	Sri Lanka	6.40	6.58	18.43
290129	Switzerland	1 300.00	1 443.43	1 184.80
290129	Thailand	65 800.00	24 468.33	188.54
290129	USA	93 300.00	66 671.64	116 004.24
290129	Vietnam	48.60	24.19	44.58
330499	United Kingdom	8 900.00	168 113.24	53 241.12
330499	USA	26 000.00	264 466.83	44 225.70
330499	Japan	11 300.00	90 409.08	10 590.07
330499	Canada	2 700.00	118 119.05	8 572.42
330499	Germany	10 300.00	174 414.65	7 057.64
330499	Belgium-Luxembourg	1 922.80	125 868.26	7 015.56
330499	Netherlands	1 800.00	80 630.98	4 682.65
330499	Singapore	8 200.00	137 860.16	2 279.56

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
330499	France	6 200.00	87 826.86	2 254.79
330499	Djibouti	155.30	674.84	1 742.03
330499	Italy	1 100.00	91 168.30	1 719.67
330499	Saudi Arabia	2 900.00	42 586.17	1 552.92
330499	China	43 500.00	302 672.71	1 204.56
330499	Republic of Korea	6 800.00	100 371.54	1 191.57
330499	Pakistan	285.20	2 845.50	813.13
330499	Hong Kong, China	23 300.00	310 436.47	574.65
330499	Qatar	456.20	5 728.79	200.46
330499	Kuwait	922.70	10 192.11	169.96
330499	Benin	132.20	1 674.25	131.37
330499	Spain	2 200.00	85 644.97	103.73
330499	Dominican Republic	19.20	3 914.85	63.67
330499	Thailand	6 900.00	47 821.68	58.34
330499	Senegal	187.20	1 399.39	33.45
330499	Myanmar	37.50	10 397.13	33.08
330499	Côte d'Ivoire	209.80	763.31	26.99
330499	Bahrain	193.80	2 603.56	23.53
330499	Vietnam	578.40	13 286.91	14.48
330499	Peru	150.00	6 372.56	11.77
330499	Egypt	40.50	7 308.41	10.22
720241	Germany	146 700.00	30 940.13	268 549.10
720241	France	39 800.00	12 941.25	139 436.87
720241	Italy	71 200.00	47 423.86	118 381.40
720241	USA	296 500.00	65 574.62	71 297.36
720241	Sweden	16 900.00	13 273.12	69 860.16
720241	China	2 500 000.00	223 250.05	65 486.20
720241	Spain	96 400.00	23 768.43	63 421.42
720241	Japan	353 900.00	118 149.11	26 741.29
720241	Ireland	298.00	192.82	26 496.13
720241	Belgium-Luxembourg	163 565.90	44 822.72	23 968.67
720241	Republic of Korea	284 700.00	77 064.35	16 001.94
720241	Portugal	627.60	198.42	12 833.83
720241	India	78 600.00	11 513.54	9 861.87
720241	Hungary	51.90	55.61	4 659.76
720241	Austria	7 000.00	5 150.82	4 297.89
720241	Canada	12 600.00	5 094.52	4 004.87
720241	Croatia	8.60	20.77	3 207.49
720241	Mexico	7 900.00	2 215.68	2 991.20
720241	Slovenia	7 800.00	4 986.24	2 624.74
720241	Brazil	14 100.00	2 252.89	2 215.87
720241	Bulgaria	148.20	124.90	2 206.84

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
720241	Netherlands	129 300.00	23 554.37	2 076.20
720241	Chile	2 200.00	1 159.26	1 432.47
720241	Turkey	1 700.00	1 154.06	1 427.24
720241	Colombia	182.70	98.26	1 081.96
720241	Malaysia	1 900.00	241.47	1 032.84
720241	United Arab Emirates	6 400.00	1 359.73	948.83
720241	Mozambique	165 800.00	110 290.05	936.61
720241	Egypt	706.90	723.05	805.70
720241	Peru	793.00	307.51	413.11
720241	Morocco	32.50	13.52	213.82
720241	Jordan	27.10	34.88	33.82
720241	Zambia	1 300.00	613.70	30.65
720241	Bolivia	101.10	31.79	8.19
732690	United Kingdom	5 500.00	124 231.30	6 922.30
732690	Nigeria	4 300.00	19 919.03	2 852.54
732690	India	4 500.00	54 210.05	1 770.94
732690	USA	28 100.00	498 432.40	1 288.69
732690	Kenya	1 500.00	3 165.45	1 281.97
732690	Germany	22 000.00	329 238.09	635.12
732690	China	19 200.00	187 053.57	588.29
732690	France	4 800.00	178 891.32	543.11
732690	Saudi Arabia	1 400.00	32 643.84	365.00
732690	Turkey	2 000.00	33 352.10	212.04
732690	Pakistan	274.50	4 615.99	195.17
732690	Japan	5 000.00	195 862.12	190.69
732690	Ghana	2 900.00	6 292.88	159.79
732690	Congo	611.80	3 969.73	145.51
732690	Singapore	762.20	51 640.84	100.06
732690	Iraq	54.40	15 944.26	98.59
732690	Republic of Korea	2 200.00	230 029.43	82.33
732690	Qatar	446.50	8 648.89	65.28
732690	Côte d'Ivoire	829.60	4 937.24	61.65
732690	Thailand	7 100.00	364 146.80	56.57
732690	Romania	562.60	54 789.56	50.74
732690	Chile	182.00	8 485.24	49.80
732690	Vietnam	1 400.00	86 433.27	35.09
732690	Kuwait	320.80	5 963.95	32.96
732690	Mexico	3 000.00	336 896.61	32.74
732690	Sri Lanka	115.00	3 226.79	32.59
732690	Lebanon	19.30	2 867.48	25.90
732690	Morocco	106.10	12 787.75	23.48
732690	Hungary	905.60	55 480.22	22.97

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
732690	Oman	169.40	9 731.23	20.66
732690	Benin	51.80	537.61	14.67
732690	Jordan	74.80	2 705.37	11.28
732690	Liberia	83.90	771.55	7.77
732690	Lithuania	84.00	6 555.21	5.93
732690	Azerbaijan	123.80	10 222.82	5.88
732690	Trinidad and Tobago	67.20	3 986.85	5.39
732690	Georgia	34.90	2 526.97	2.55
732690	Nepal	2.30	500.72	2.34
732690	Bolivia	59.10	1 999.39	2.28
732690	Maldives	51.30	937.40	2.27
732690	Guatemala	6.80	1 308.21	2.11
732690	Iceland	35.00	1 579.32	2.10
732690	TFYR of Macedonia	2.80	1 207.27	1.41
732690	Guyana	15.10	570.19	1.00
732690	Honduras	17.80	1 320.95	0.81
732690	Kyrgyzstan	1.20	530.51	0.63
732690	Nicaragua	5.00	1 106.65	0.51
840999	Australia	2 800.00	34 197.72	175.50
840999	Austria	338.00	133 105.59	2.47
840999	Bahamas	74.30	3 019.88	0.23
840999	Belgium-Luxembourg	3 618.50	79 846.20	293.33
840999	Bulgaria	33.40	1 738.91	0.55
840999	Chile	461.10	12 783.24	34.56
840999	China	15 500.00	119 551.45	59.20
840999	Côte d'Ivoire	708.80	2 102.20	54.18
840999	Ecuador	143.20	7 172.05	2.66
840999	Egypt	214.40	10 068.72	14.27
840999	France	4 800.00	212 696.33	64.24
840999	Germany	43 900.00	314 679.99	40 567.79
840999	Greece	618.00	9 099.51	39.43
840999	Hungary	1 900.00	144 025.63	1.62
840999	India	11 000.00	61 934.21	30.45
840999	Ireland	118.80	2 738.49	7.50
840999	Italy	3 200.00	149 017.53	73.36
840999	Japan	8 400.00	78 588.85	38.15
840999	Kuwait	156.70	2 775.18	10.75
840999	Lebanon	32.70	4 908.26	2.41
840999	Mexico	2 400.00	130 532.10	5.48
840999	Netherlands	2 300.00	118 538.82	410.18
840999	New Zealand	299.30	2 970.23	12.51
840999	Nigeria	4 200.00	10 832.11	283.83

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
840999	Pakistan	1 200.00	11 393.09	0.93
840999	Panama	553.70	5 943.33	1.09
840999	Peru	343.20	10 068.71	4.67
840999	Poland	1 100.00	122 100.95	6.06
840999	Portugal	496.70	22 112.69	3.60
840999	Qatar	212.30	2 207.66	4.19
840999	Republic of Korea	4 000.00	86 663.60	1 111.76
840999	Romania	290.60	21 791.38	2.59
840999	Senegal	833.80	3 905.89	37.75
840999	Spain	4 900.00	83 304.10	238.39
840999	Sweden	2 200.00	94 782.80	100.27
840999	Thailand	14 900.00	123 562.40	2 196.79
840999	Trinidad and Tobago	79.70	1 523.91	1.54
840999	Turkey	3 800.00	66 076.50	371.69
840999	United Kingdom	13 600.00	165 817.91	12 886.35
840999	USA	31 200.00	415 198.46	39 864.27
840999	Vietnam	558.00	12 521.58	4.82
840999	Zambia	6 000.00	1 660.43	6 758.57
842139	Germany	363 300.00	287 030.47	596 222.10
842139	United Kingdom	54 100.00	93 567.92	211 342.93
842139	USA	190 000.00	407 014.68	195 090.78
842139	Spain	46 200.00	124 378.15	183 564.09
842139	Turkey	49 700.00	66 105.30	52 783.10
842139	France	15 000.00	67 943.41	46 196.86
842139	Czech Republic	13 800.00	88 192.69	39 744.21
842139	Japan	40 200.00	58 103.21	28 260.47
842139	Republic of Korea	20 100.00	38 166.11	15 893.80
842139	Italy	7 900.00	58 771.31	9 014.25
842139	Australia	27 600.00	61 363.46	7 334.19
842139	Mozambique	3 300.00	856.16	1 195.95
842139	China	141 600.00	121 318.72	493.58
842139	Bahamas	89.20	1 386.66	224.88
842139	Georgia	178.60	875.81	151.94
842139	Kenya	3 500.00	1 080.81	90.18
842139	El Salvador	13.90	372.48	54.20
842139	Vietnam	11 300.00	30 764.69	48.80
842139	TFYR of Macedonia	31.70	720.58	40.80
842139	Egypt	2 000.00	12 319.84	9.12
842139	Côte d'Ivoire	3 000.00	414.53	4.82
842139	Cameroon	3 300.00	418.41	3.04
842139	New Zealand	1 400.00	4 698.04	2.71
842139	Ecuador	292.10	2 042.15	2.40

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
842139	Chile	1 800.00	8 554.65	0.56
842139	Denmark	2 600.00	11 158.29	0.47
842139	Pakistan	4 300.00	4 068.44	0.44
842139	Panama	507.20	779.33	0.17
842139	Lebanon	116.30	953.56	0.14
842139	Latvia	111.70	1 985.80	0.08
843149	USA	22 400.00	380 934.98	14 804.16
843149	Japan	3 200.00	168 220.70	81.33
843149	Canada	3 400.00	137 576.28	1 044.69
843149	Germany	8 200.00	127 297.90	2 235.84
843149	France	2 100.00	94 743.85	509.93
843149	China	10 500.00	90 402.36	1 173.83
843149	Singapore	2 800.00	88 149.92	352.09
843149	United Kingdom	5 400.00	86 645.70	918.16
843149	Belgium-Luxembourg	3 613.20	71 760.66	1 700.20
843149	Australia	5 100.00	68 492.08	3 367.88
843149	India	5 300.00	63 520.16	172.29
843149	Republic of Korea	1 300.00	57 940.72	11.95
843149	Netherlands	2 500.00	55 136.94	823.61
843149	Italy	1 700.00	48 496.22	52.41
843149	Austria	191.60	47 216.47	46.09
843149	Saudi Arabia	1 700.00	44 648.09	134.42
843149	Mexico	483.60	38 652.95	46.25
843149	Chile	635.20	31 730.88	310.10
843149	Finland	264.00	22 275.20	38.30
843149	Spain	863.40	22 093.83	10.12
843149	Poland	271.50	19 688.99	67.11
843149	Hong Kong, China	413.20	16 101.84	25.14
843149	Ireland	361.80	15 426.41	56.67
843149	Vietnam	350.20	14 465.85	17.32
843149	Peru	393.60	14 033.50	461.53
843149	Zambia	24 800.00	11 903.44	41 304.45
843149	Algeria	388.70	8 589.44	2.16
843149	Egypt	116.80	7 965.01	226.62
843149	Kuwait	291.20	7 381.31	16.51
843149	Mozambique	17 000.00	6 853.40	33 528.47
843149	Qatar	413.30	6 400.69	69.03
843149	Bulgaria	72.40	5 032.25	24.60
843149	Argentina	460.90	4 899.52	18.91
843149	Israel	75.00	4 277.66	26.40
843149	Greece	79.20	4 272.18	11.27
843149	Romania	42.10	4 106.98	11.30

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
843149	Burkina Faso	1 400.00	3 812.76	563.95
843149	Cameroon	389.90	3 456.90	69.28
843149	Azerbaijan	40.60	3 082.55	13.16
843149	Estonia	85.20	3 075.16	425.97
843149	Guinea	554.90	2 935.18	240.40
843149	Guatemala	13.30	2 872.51	60.80
843149	Guyana	145.90	2 323.31	42.70
843149	Trinidad and Tobago	34.70	2 305.97	1.32
843149	Bolivia	81.90	2 297.09	3.30
847490	USA	23 500.00	65 956.44	1 243.42
847490	Canada	6 100.00	52 531.88	1 136.39
847490	Australia	11 100.00	32 358.97	1 204.88
847490	United Kingdom	5 900.00	23 685.96	2 542.37
847490	Germany	9 800.00	21 757.26	783.36
847490	Indonesia	6 300.00	21 518.50	363.35
847490	Mexico	2 000.00	21 051.75	258.93
847490	Algeria	2 400.00	19 980.60	546.46
847490	Chile	2 500.00	19 935.50	386.83
847490	Saudi Arabia	5 000.00	19 541.01	898.69
847490	France	2 000.00	17 182.24	744.46
847490	Russian Federation	3 400.00	16 395.27	540.08
847490	China	10 500.00	15 634.95	167.60
847490	Netherlands	1 600.00	14 913.64	708.66
847490	Japan	1 600.00	11 440.67	159.93
847490	Guatemala	67.50	11 366.32	190.03
847490	Egypt	421.90	9 512.93	238.76
847490	Qatar	1 600.00	8 043.43	475.26
847490	Malaysia	2 400.00	6 645.32	169.06
847490	Denmark	605.50	6 511.32	295.93
847490	Mongolia	146.70	5 603.06	32.42
847490	Oman	398.00	5 347.11	257.92
847490	United Republic of Tanzania	7 200.00	4 357.73	5 964.69
847490	Philippines	1 000.00	4 214.28	470.21
847490	Iraq	53.80	3 186.04	459.17
847490	Panama	1 500.00	2 829.75	31.03
847490	Lao People’s Democratic Republic	21.50	2 743.48	45.52
847490	Ireland	243.80	2 554.43	595.12
847490	Burkina Faso	5 600.00	2 375.26	96.13
847490	Israel	216.30	2 310.68	440.11
847490	Kuwait	686.50	2 186.80	234.22
847490	Kyrgyzstan	31.20	2 161.84	42.53
847490	Kenya	4 800.00	2 161.45	2 755.53

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
847490	Pakistan	1 200.00	2 104.08	414.76
847490	Bangladesh	985.30	1 960.48	153.46
847490	Eritrea	1 200.00	1 886.47	990.99
847490	Greece	181.70	1 689.53	254.06
847490	Georgia	95.40	1 426.29	157.31
847490	Côte d'Ivoire	4 600.00	1 346.87	407.81
847490	Uzbekistan	10.40	1 301.91	36.54
847490	Armenia	194.30	1 203.81	26.00
847490	New Zealand	308.90	1 155.32	175.62
847490	Slovenia	31.50	1 123.87	129.43
847490	Uganda	2 700.00	1 049.26	309.99
847490	Lithuania	67.00	1 016.83	104.34
870421	United Kingdom	92 300.00	701 952.24	183 364.27
870421	Australia	135 200.00	604 029.89	470.27
870421	France	47 400.00	513 992.95	161 802.57
870421	Germany	143 800.00	374 352.55	111 988.87
870421	Belgium-Luxembourg	80 592.90	361 675.28	85 359.68
870421	Italy	19 500.00	201 044.54	10 138.83
870421	Spain	23 500.00	196 381.00	55 951.61
870421	Saudi Arabia	20 900.00	167 904.03	19 119.98
870421	Netherlands	22 400.00	166 422.56	1 605.24
870421	Turkey	35 900.00	152 476.51	4 716.14
870421	Chile	17 900.00	139 986.31	1 868.79
870421	Denmark	5 300.00	65 397.24	5 111.04
870421	Hungary	4 600.00	56 670.15	19 730.64
870421	Ireland	11 500.00	50 383.51	7 805.29
870421	Czech Republic	5 000.00	49 800.58	7 071.22
870421	Slovenia	3 400.00	48 901.18	2 295.26
870421	Israel	5 100.00	40 496.30	262.42
870421	Ethiopia	15 100.00	35 641.80	16 821.98
870421	Romania	2 000.00	29 227.81	8 833.98
870421	Jordan	5 300.00	28 523.59	1 139.00
870421	Guatemala	1 700.00	27 786.98	1 066.08
870421	Costa Rica	1 600.00	22 439.36	1 281.42
870421	Panama	5 900.00	18 631.62	1 587.17
870421	Dominican Republic	1 600.00	15 530.07	1 053.41
870421	Bangladesh	3 400.00	14 517.19	4 715.01
870421	El Salvador	476.90	12 723.14	703.64
870421	Cambodia	148.50	11 882.46	197.34
870421	Djibouti	4 000.00	11 858.64	12 257.95
870421	Estonia	4 200.00	10 658.44	14 148.33
870421	Uganda	24 600.00	9 979.31	14 038.08

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
870421	Côte d'Ivoire	8 700.00	8 829.21	6 670.37
870421	Cameroon	3 300.00	4 746.25	2 981.32
870421	Lebanon	192.60	4 086.20	757.12
870421	Iceland	1 300.00	3 642.68	1 807.16
870421	Malta	456.40	3 493.81	6.22
870421	Malawi	21 300.00	3 408.53	12 575.84
870421	Niger	427.00	3 334.83	419.49
870421	Jamaica	703.00	3 274.33	512.13
870421	Bahrain	604.10	1 890.51	581.57
870421	Burkina Faso	1 200.00	1 838.40	1 540.17
870421	Belize	154.60	1 656.91	324.99
880330	Argentina	30.10	1 727.38	119.91
880330	Burkina Faso	15.10	911.06	16.62
880330	Cameroon	14.00	880.44	26.95
880330	Canada	1 700.00	377 430.87	396.53
880330	Central African Republic	1.10	254.52	4.90
880330	Egypt	0.09	17 672.91	130.60
880330	El Salvador	0.06	1 009.43	4.16
880330	Estonia	16.40	1 008.32	13.05
880330	France	13 300.00	2 003 394.04	1 121.81
880330	Germany	13 700.00	1 158 392.45	1 526.77
880330	Guyana	0.59	374.33	1.09
880330	Iceland	36.10	5 977.27	2.76
880330	Italy	2 000.00	287 822.22	1 034.07
880330	Japan	4 700.00	252 592.89	225.71
880330	Lao People's Democratic Republic	0.79	597.96	6.06
880330	Latvia	6.40	2 013.65	15.92
880330	Lithuania	31.00	2 881.16	24.70
880330	Malaysia	1 900.00	127 917.24	81.91
880330	Maldives	47.00	3 198.82	1.80
880330	Malta	25.70	21 029.23	24.30
880330	Mexico	12.80	31 042.71	72.50
880330	Morocco	83.50	46 997.11	28.85
880330	Mozambique	16.30	2 427.26	114.86
880330	Myanmar	5.30	4 827.35	6.23
880330	Netherlands	3 300.00	120 660.91	988.25
880330	Peru	5.30	8 117.72	36.12
880330	Portugal	188.20	24 888.32	125.65
880330	Qatar	238.30	149 434.41	71.27
880330	Romania	44.60	14 095.58	80.42
880330	Saudi Arabia	1 400.00	283 569.79	284.10
880330	Senegal	15.60	396.13	3.00

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
880330	Singapore	2 700.00	467 445.64	262.66
880330	Spain	2 500.00	256 896.11	643.13
880330	United Arab Emirates	2 100.00	244 531.23	161.70
880330	United Kingdom	8 500.00	479 385.55	8 241.99
880330	USA	29 600.00	1 693 146.09	4 220.46
880330	Vietnam	431.50	17 572.88	9.69
721049	Albania	3.40	655.26	12.16
721049	Bahrain	70.90	2 864.83	63.54
721049	Bangladesh	1 100.00	7 191.02	69.61
721049	Belgium-Luxembourg	11 206.00	97 297.68	886.82
721049	Benin	48.00	1 057.77	24.24
721049	China	4 900.00	156 560.46	102.71
721049	Egypt	311.80	10 859.78	67.88
721049	El Salvador	24.60	4 734.14	73.55
721049	Estonia	165.10	7 274.66	174.32
721049	Fiji	15.10	467.30	65.62
721049	France	832.40	102 822.40	833.87
721049	Germany	5 500.00	226 453.41	767.28
721049	Greece	119.80	8 361.10	284.05
721049	Guyana	12.40	118.79	9.90
721049	Indonesia	1 200.00	36 554.48	19.63
721049	Iraq	30.80	10 761.88	129.61
721049	Italy	2 300.00	68 340.50	605.70
721049	Kazakhstan	99.80	9 204.34	95.13
721049	Kuwait	224.80	6 738.42	134.12
721049	Madagascar	890.90	2 118.31	72.76
721049	Malawi	2 200.00	4 258.85	465.33
721049	Maldives	4.50	954.10	48.97
721049	Mexico	2 900.00	122 984.79	262.24
721049	New Zealand	58.40	1 373.94	150.70
721049	Nicaragua	11.30	2 652.06	42.52
721049	Oman	41.90	3 925.85	55.05
721049	Poland	939.00	82 410.79	438.81
721049	Romania	213.30	23 705.15	433.28
721049	Rwanda	1 100.00	3 851.00	281.07
721049	Saudi Arabia	846.90	34 066.29	161.49
721049	Singapore	123.90	11 624.05	165.21
721049	Spain	5 100.00	118 112.99	895.38
721049	Sri Lanka	123.30	3 934.32	21.38
721049	TFYR of Macedonia	1.90	341.07	9.89
721049	Thailand	7 200.00	143 077.05	95.40
721049	Turkey	3 800.00	69 821.35	205.00

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
721049	United Kingdom	2 900.00	97 757.53	826.48
721049	United Republic of Tanzania	1 900.00	2 179.58	333.34
721049	USA	9 600.00	251 428.80	1 652.90
480419	Angola	534.40	408.45	173.25
480419	Australia	2 100.00	3 543.35	878.21
480419	Austria	1 600.00	7 591.77	1 075.60
480419	Belgium-Luxembourg	7 701.50	8 610.94	1 619.19
480419	Bolivia	34.10	191.92	193.39
480419	Bulgaria	57.00	146.64	315.42
480419	Burkina Faso	1.50	19.54	47.52
480419	Cambodia	23.30	324.42	155.74
480419	Cameroon	525.60	482.03	225.80
480419	Cyprus	43.60	108.82	248.63
480419	Czech Republic	371.20	2 534.63	658.33
480419	Ecuador	113.90	1 057.18	238.72
480419	Egypt	252.80	1 643.31	201.63
480419	Ethiopia	330.20	446.28	497.22
480419	Fiji	77.50	343.64	534.45
480419	France	3 200.00	11 934.11	1 506.83
480419	Georgia	0.85	20.34	68.15
480419	Germany	16 300.00	29 976.59	1 772.87
480419	Greece	641.20	1 477.72	616.32
480419	Guatemala	107.30	3 653.41	635.47
480419	Hungary	243.90	1 203.43	387.09
480419	India	5 000.00	3 314.76	806.26
480419	Italy	8 700.00	20 806.99	1 524.59
480419	Jordan	45.60	151.52	131.46
480419	Kenya	3 500.00	1 196.27	152.76
480419	Madagascar	1 300.00	184.91	87.57
480419	Myanmar	6.30	472.11	129.48
480419	New Zealand	1 100.00	1 318.39	838.79
480419	Pakistan	2 200.00	1 448.35	460.42
480419	Paraguay	57.60	169.45	116.67
480419	Poland	263.20	3 884.71	862.29
480419	Portugal	792.80	1 803.09	664.32
480419	Saudi Arabia	4 100.00	7 483.71	480.21
480419	Singapore	119.40	1 369.04	524.61
480419	Slovakia	10.10	863.10	525.90
480419	Slovenia	64.00	686.74	468.73
480419	Spain	7 100.00	12 925.74	1 386.34
480419	Togo	465.10	270.54	36.87
480419	Turkey	3 700.00	5 567.99	447.79

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
480419	United Arab Emirates	3 500.00	3 192.13	251.02
480419	United Republic of Tanzania	4 500.00	332.35	270.66
480419	Uruguay	495.10	522.62	172.30
480419	Zambia	3 500.00	645.03	390.90
870410	Angola	1 300.00	3 099.98	1 007.99
870410	Antigua and Barbuda	3.40	333.52	70.87
870410	Argentina	281.30	5 557.09	1 076.06
870410	Austria	85.20	4 586.69	1 496.30
870410	Bangladesh	225.60	238.15	422.40
870410	Belgium-Luxembourg	831.90	9 580.19	2 140.10
870410	Bulgaria	54.10	1 703.82	493.46
870410	Cambodia	16.30	715.40	80.22
870410	Cameroon	37.10	244.21	257.68
870410	Canada	1 500.00	77 106.74	1 405.72
870410	Hong Kong, China	40.30	2 293.59	185.67
870410	Costa Rica	4.00	1 893.41	167.59
870410	Czech Republic	61.00	1 479.16	1 021.33
870410	Denmark	38.70	2 221.21	497.23
870410	Djibouti	62.20	793.44	28.26
870410	Gabon	256.50	947.32	174.03
870410	Germany	4 500.00	20 771.64	2 024.73
870410	Guinea	1 400.00	952.08	90.73
870410	Iceland	8.10	327.71	375.29
870410	Indonesia	2 800.00	29 999.61	234.72
870410	Ireland	36.80	2 958.97	895.17
870410	Israel	102.20	3 395.67	166.70
870410	Italy	94.10	2 938.52	1 708.38
870410	Japan	555.10	9 860.75	1 054.05
870410	Jordan	154.40	6 586.29	180.93
870410	Kenya	1 400.00	1 809.51	355.68
870410	Lithuania	14.30	417.29	261.64
870410	Malaysia	438.80	5 756.89	165.46
870410	Mali	1 400.00	2 721.22	631.14
870410	Mozambique	4 600.00	9 198.91	2 897.96
870410	Myanmar	126.20	34 733.93	81.16
870410	Netherlands	1 300.00	10 544.23	1 449.90
870410	Oman	17.20	2 027.57	120.38
870410	Paraguay	9.10	420.23	425.49
870410	Poland	243.50	17 190.11	865.91
870410	Qatar	70.30	5 687.99	250.78
870410	Russian Federation	1 000.00	33 203.16	1 928.16
870410	Rwanda	395.10	364.78	523.69

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
870410	Saudi Arabia	311.40	4 739.77	552.45
870410	Slovakia	1.90	1 555.02	1 074.86
870410	Slovenia	7.70	370.78	269.94
870410	Sweden	251.40	9 424.38	595.89
870410	Thailand	528.00	3 276.13	249.88
870410	Trinidad and Tobago	3.90	555.47	171.77
870410	Tunisia	98.10	5 495.91	132.46
870410	Turkey	549.90	6 158.23	613.89
870410	United Kingdom	1 400.00	29 948.16	2 884.32
870410	USA	15 600.00	203 267.07	2 836.05
870410	Vietnam	305.20	16 632.32	117.54
720230	Algeria	617.20	2 097.61	497.27
720230	Austria	192.70	2 886.08	122.76
720230	Bahrain	130.30	1 616.08	198.95
720230	Belarus	73.60	6 813.45	1 585.33
720230	Brazil	798.80	5 671.03	1 653.74
720230	Bulgaria	64.10	853.65	92.72
720230	Canada	2 100.00	6 531.80	2 299.48
720230	Colombia	519.80	2 224.96	912.85
720230	Czech Republic	392.40	6 720.25	151.83
720230	Ecuador	142.40	1 384.40	649.21
720230	France	1 600.00	7 358.80	342.26
720230	Germany	13 600.00	28 539.20	587.01
720230	Iraq	9.30	631.68	522.95
720230	Italy	5 200.00	20 230.63	458.11
720230	Japan	13 900.00	33 317.99	2 412.17
720230	Morocco	193.60	1 176.93	379.34
720230	Netherlands	9 600.00	21 740.56	4 383.07
720230	New Zealand	246.70	691.46	307.82
720230	Peru	609.60	2 332.28	572.08
720230	Poland	611.60	15 122.61	326.23
720230	Portugal	549.70	2 107.89	106.13
720230	Republic of Korea	2 300.00	13 269.59	831.13
720230	Russian Federation	762.90	35 167.45	5 925.49
720230	Slovakia	9.70	3 768.67	167.16
720230	Slovenia	59.30	1 156.30	51.20
720230	Sweden	141.20	3 849.15	90.89
720230	Turkey	3 700.00	31 578.30	2 890.91
720230	USA	16 800.00	52 876.86	5 449.87
841391	Austria	120.80	31 303.38	7.85
841391	Azerbaijan	67.60	2 878.69	12.47
841391	Bahrain	174.10	1 707.42	78.72

HS Code	Country	ITC US$ 1 000	DSM US$ 1 000	Gravity US$ 1 000
841391	Bangladesh	165.20	1 182.24	45.53
841391	Bulgaria	160.60	7 363.46	43.10
841391	Chile	375.80	10 116.08	125.71
841391	China	12 800.00	75 927.42	69.11
841391	Côte d'Ivoire	425.80	1 286.56	383.86
841391	Dominican Republic	19.50	2 257.81	18.30
841391	Egypt	188.20	8 641.59	136.50
841391	El Salvador	3.70	718.51	4.87
841391	France	1 500.00	57 254.47	105.06
841391	Germany	13 800.00	100 607.49	121.00
841391	Hungary	947.60	28 438.80	10.35
841391	Iceland	12.70	457.25	5.30
841391	Ireland	371.30	7 684.37	82.85
841391	Israel	89.60	2 875.22	311.72
841391	Italy	1 800.00	58 835.84	109.79
841391	Japan	2 900.00	55 976.78	60.53
841391	Kuwait	535.80	7 473.02	175.72
841391	Lao People's Democratic Republic	3.90	799.38	4.25
841391	Lebanon	11.90	1 378.37	75.71
841391	Madagascar	909.70	1 555.51	2 138.70
841391	Mauritania	165.10	618.47	33.38
841391	Mexico	1 500.00	77 819.22	57.15
841391	Mongolia	9.90	862.78	2.95
841391	Mozambique	7 000.00	2 099.35	2 219.04
841391	Myanmar	6.50	1 477.96	47.12
841391	Netherlands	1 500.00	40 851.46	516.43
841391	Oman	249.90	8 025.32	138.14
841391	Panama	89.90	1 616.26	4.31
841391	Peru	238.00	6 270.16	37.06
841391	Republic of Korea	1 100.00	41 642.39	60.74
841391	Romania	204.90	19 952.98	71.33
841391	Saudi Arabia	3 000.00	31 799.44	702.67
841391	Slovakia	14.00	11 769.49	7.72
841391	Slovenia	25.60	1 916.99	12.31
841391	Sri Lanka	39.20	652.99	55.90
841391	Thailand	2 400.00	20 794.16	89.91
841391	Trinidad and Tobago	56.50	2 187.13	87.54
841391	United Kingdom	3 000.00	52 996.64	1 785.13
841391	USA	25 500.00	348 963.40	357.92
841391	Vietnam	314.30	5 065.49	62.75
841391	Zambia	31 300.00	6 216.72	8 224.90

Source: Researcher's own estimates

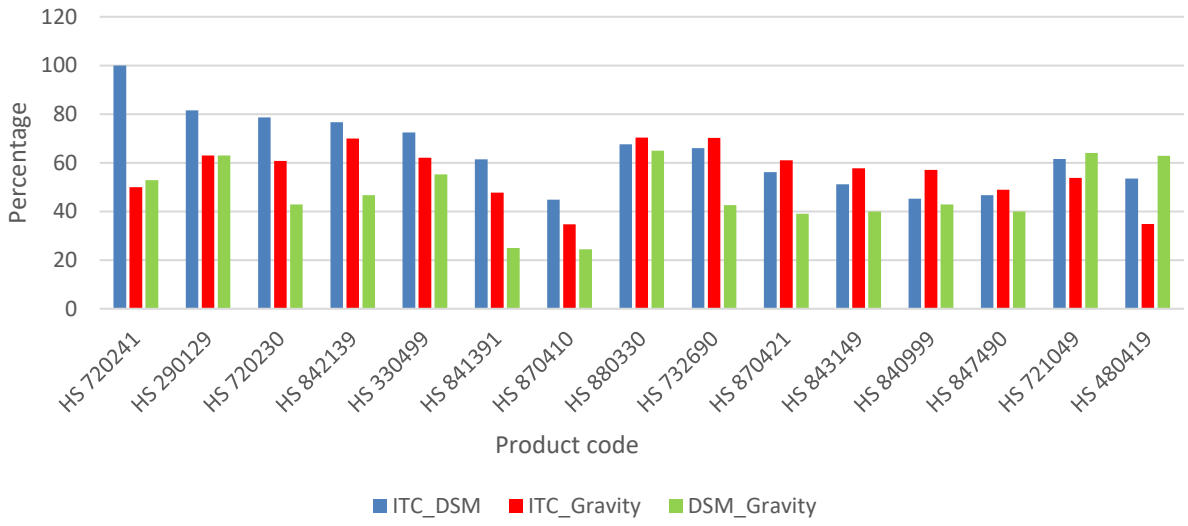
ANNEXURE 3: COMPARISON OF FREQUENCY DISTRIBUTIONS PER PRODUCT

In Figure 4-1, an overall picture was provided of the differences in the ranks of the gravity, ITC and DSM approaches across the six categories. The following sections provide a brief discussion on the frequency distributions per category at a product level[21].

A3.1 Category 0: 0 ≤ X ≤ |5|

This category indicates the percentage of countries having five or fewer differences in the ranks of export potential values between two approaches. Figure A3-1 illustrates the results of Category 0, indicating which approaches have the fewest differences in ranks per product.

Figure A3-1: Differences in ranks - Category 0



Source: Researcher's own estimates

As an example, the ITC_DSM frequency percentage of 100% for export destinations of HS 720241 (ferro-chromium in granular/powder form) signifies that the ranks assigned to this product, based on the ITC and DSM approaches, differ with five or less places for all (100%) the countries. Considering the same product, the ITC_Gravity frequency ratio of 50% means that for 50% of the countries, the ranks assigned by the ITC and gravity approaches differ with five or

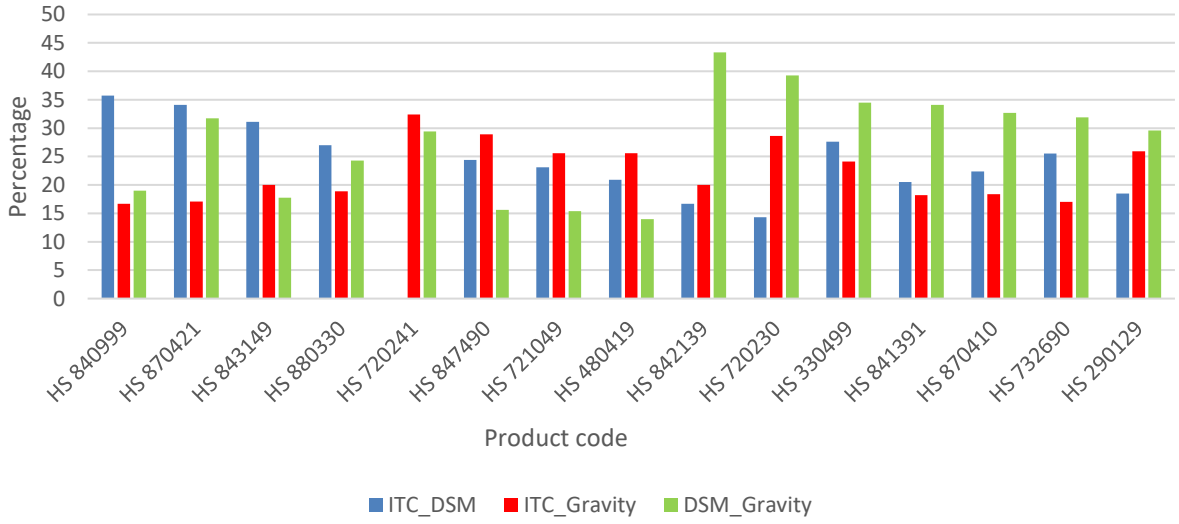
21. It should be noted that the products in each of the following bar charts are presented in such a manner that those products for which the ITC and DSM approaches (ITC_DSM) have the highest frequency percentages are illustrated first, followed by the products for which the ITC and gravity approaches (ITC_Gravity) have the highest frequency percentages. Those products for which the DSM and gravity approaches (DSM_Gravity) have the highest frequency percentages are thus presented last in each of the charts.

less places. Similarly, for 52.5% of the countries, the ranks assigned by the DSM and the gravity model differ with five or less places.

A3.2 Category 1: |5| < X ≤ |10|

Category 1 indicates for how many product-country combinations the ranks assigned by the different approaches differ with more than five and up to 10 places. This number of differences can still mean that the approaches in question compare relatively well (compared to Categories 2 to 5). Figure A3-2 illustrates the frequencies recorded in Category 1 for each product.

Figure A3-2: Differences in ranks - Category 1



Source: Researcher's own estimates

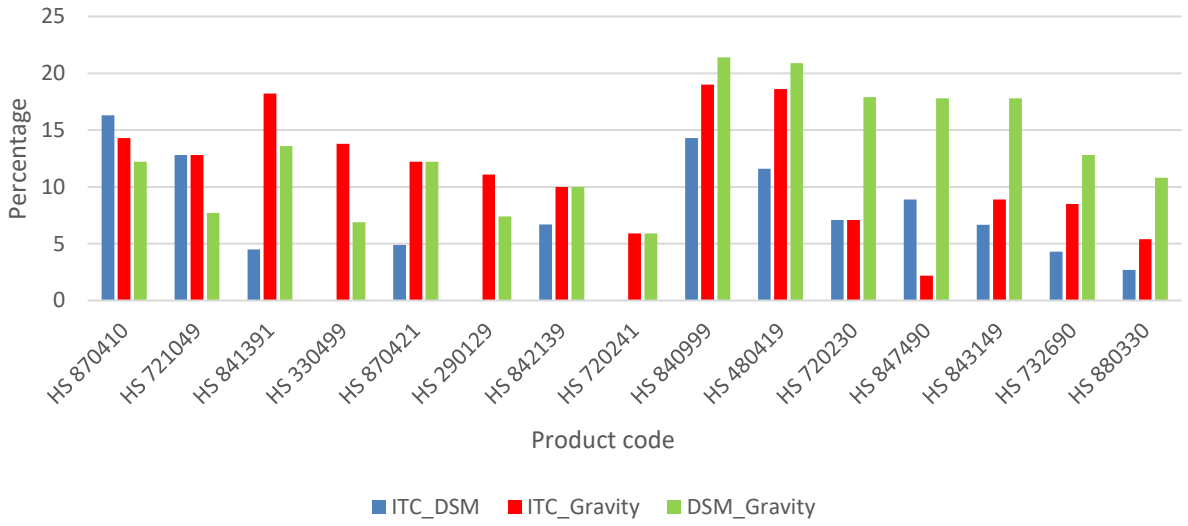
The ITC_Gravity frequency percentage of 25.6% for the export destinations of HS 480419 (articles of iron/steel, not elsewhere specified), for example, indicates that the ranks assigned to the product based on the ITC and gravity approaches, differ with more than five and up to 10 places for 25.6% of the countries. Similarly, the ITC_DSM ratio of 20.9% means that the ranks assigned by the ITC and DSM models differ with between five and 10 places for 20.9% of the countries. This is also applicable to the DSM_Gravity comparison, where 14% of the countries' ranks assigned by the DSM and gravity model differs with more than five and up to 10 places.

A3.3 Category 2: |10| < X ≤ |15|

This category indicates how many products have a difference of between 10 and up to 15 places in the ranks assigned to export potential values between two approaches. It is a relatively large

number of differences in ranks, which means that the ranks assigned by the approaches in question do not compare well. The results for this category are demonstrated in Figure A3-3.

Figure A3-3: Differences in ranks - Category 2



Source: Researcher's own estimates

The ITC_DSM percentage of 16.3% for export destinations of HS 870410 (dumpers designed for off-highway use), for instance, indicates that the ranks assigned to this product based on the ITC and DSM approaches differ with more than 10 and up to 15 places for 16.3% of the countries. Similarly, the ITC_Gravity ratio of 14.3% means that for 14.3% of the countries, the ranks assigned by the ITC and gravity approaches differ with between 10 and 15 places. The same applies to DSM_Gravity, where 12.2% of the countries' ranks assigned by the DSM and gravity model differs with more than 10 and up to 15 places. Moreover, there are no countries for HS 841391, HS 290129 and HS 720241 for which the differences in ranks of export potential values between the ITC and DSM approaches are more than 10 places.

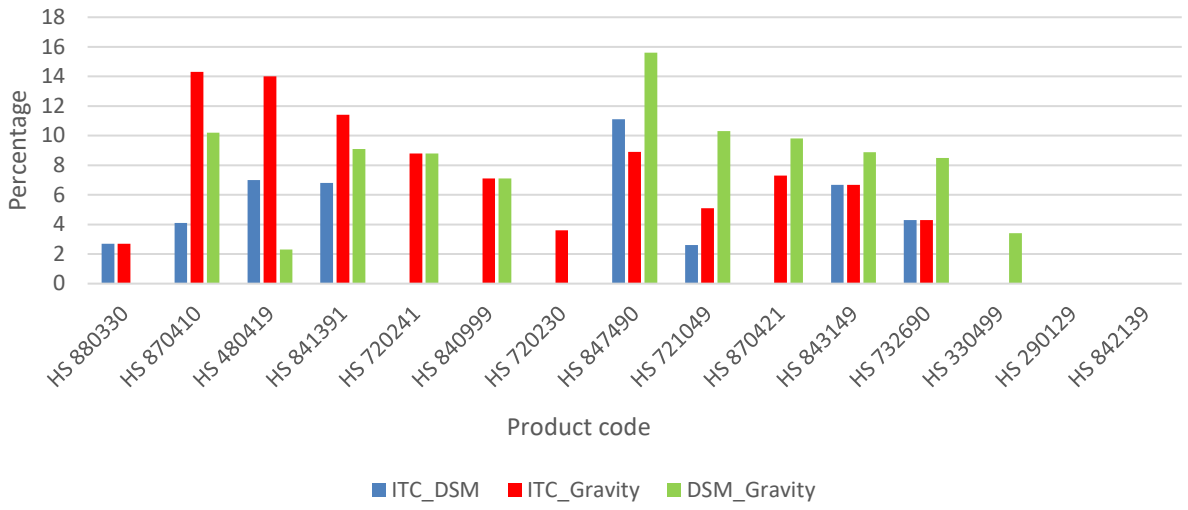
A3.4 Category 3: |15| < X ≤ |20|

Category 3 indicates the number of products that have more than 15 differences in ranks, but less than or equal to 20 differences. The results of the fourth category can be seen in Figure A3-4.

In the case of HS 847490 (parts of the machinery of HS 8474), for example, the DSM_Gravity frequency percentage of 15.6% signifies that the ranks assigned to this product based on the DSM and gravity approaches, differ with more than 15 and up to 20 places for 15.6% of the countries. Similarly, the ranks assigned by the ITC and DSM methods differ between 15 and 20 places for 11.1% of the countries. This is also the case for ITC_Gravity, where 8.9% of the

countries' ranks assigned by the ITC and gravity approaches differs with more than 15 and up to 20 places. Moreover, when comparing ITC and DSM rankings, seven products have no countries in this category. Similarly, the ITC_Gravity comparison has three products and the DSM_Gravity four products for which the differences in ranks of export potential values are between 15 and up to 20 places.

Figure A3-4: Differences in ranks - Category 3



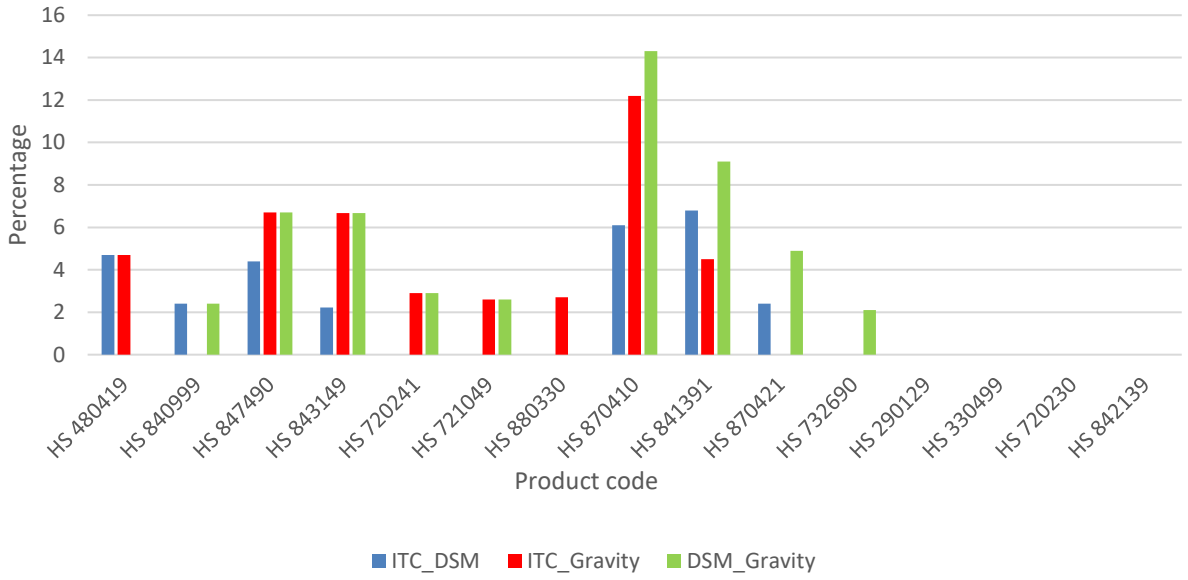
Source: Researcher's own estimates

A3.5 Category 4: |20| < X ≤ |25|

The frequencies recorded in this category for each product are illustrated in Figure A3-5. This category records those products for which two approaches have more than 20 differences in rankings assigned to export potential values, but have less than or equal to 25 differences in rankings.

For instance, the ITC_Gravity and DSM_Gravity percentage of 6.7%, respectively, for export destinations of HS 843149 (parts suitable for use solely/principally with the machinery of HS 8426, HS 8429 or HS 8430), signifies that the ranks assigned for this product, based on the ITC_Gravity/DSM_Gravity approaches, differ with more than 20 and up to 25 places for 6.7% of the countries. Similarly, the ITC_DSM ratio of 2.2% means that the ranks assigned by the ITC and DSM approaches differ with between 20 and 25 places for 2.2% of the countries. In addition, eight products have no countries for which the differences in ranks of export potential values between the ITC and DSM are between 20 and 25 places. Similarly, this is the case for seven products in the ITC and gravity comparison, and six products when comparing the DSM and gravity ranks.

Figure A3-5: Differences in ranks - category 4

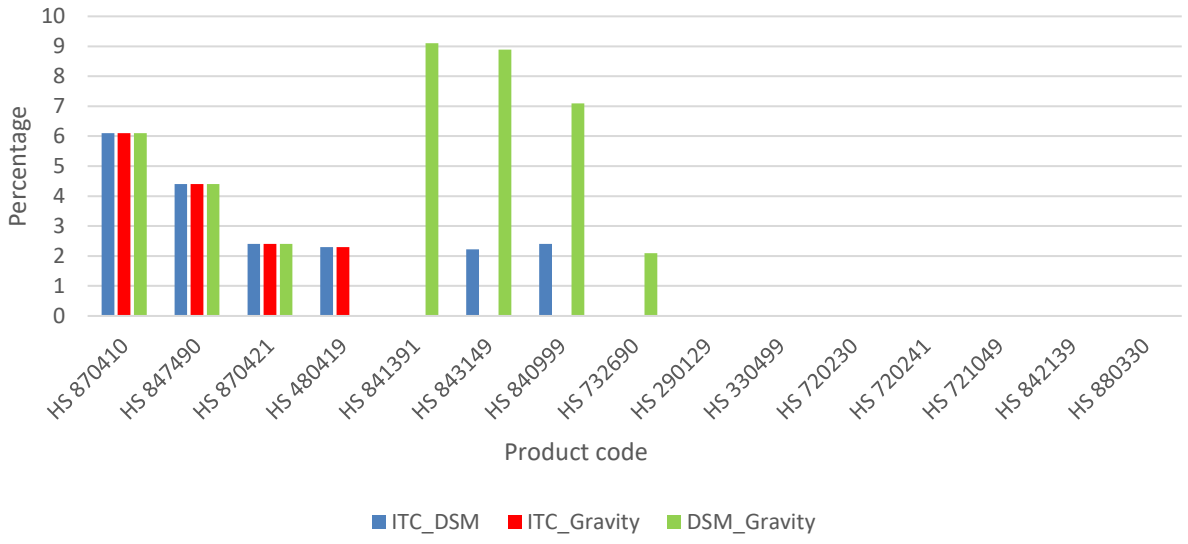


Source: Researcher's own estimates

A3.6 Category 5: X > |25|

The results of the last category are illustrated in Figure A3-6. This category represents products that have more than 25 differences in ranks between two methods. If this is the case, the method rankings in question differ significantly.

Figure A3-6: Differences in ranks - category 5



Source: Researcher's own estimates

As an example, the DSM_Gravity percentage of 9.1% for export destinations of HS 841391 (parts of the pumps of HS 841311 - HS 841381) signifies that the ranks assigned to this product by the DSM and gravity approaches differ with more than 25 places for 9.1% of the countries. In the case of the ranks for HS 841391, compared between the ITC_DSM and ITC_Gravity approaches, no country indicated differences of more than 25 places. Moreover, the ITC_DSM comparison has nine products, the ITC_Gravity 11 products and the DSM_Gravity eight products with no countries indicating differences in ranks of export potential values of more than 25 places.